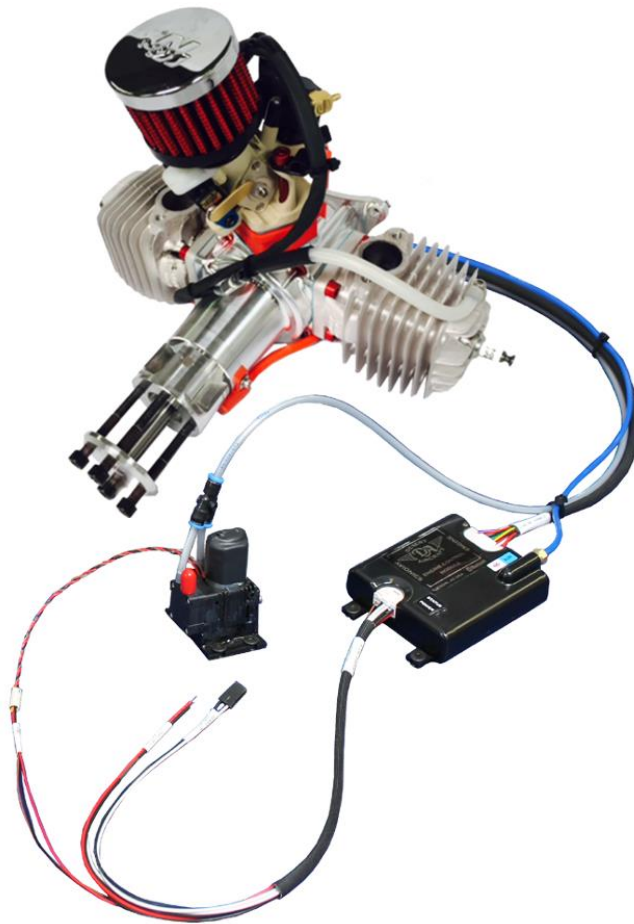




DA70 EFI

Electronic Fuel Injected Engine



OWNER'S MANUAL



Document Revision Table					
Rev	Description of change	Revised by	Revision Date	Approved By	Approved Date
A	Initial Release	DMcClain	03/28/17	TWest	03/28/17
B	Changed the engine Picture	DMcClain	04/24/17	TWest	04/25/17
C	Added technical information	DMcClain	06/16/17	TWest	06/16/17
D	Updated with Revision Table	DMcClain	12/11/17	TWest	12/11/17
E	Adjusted the maintenance chart	DMcClain	03/05/19	TWest	5/10/19
F	Changed Spark Plug callouts	DMcClain	07/29/19	DRB	7/31/19
G	Format Update	RShoemaker	10/22/19	DRB	10/30/19
H	Format Update	R.Shoemaker	2/10/20	DRB	2/12/20
I	Updated Maintenance Hrs	A.Sanchez	1/12/21	K.Gratien	1/12/21



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1. General Safety

Read and understand this Owner's Manual before operating your engine. You can help prevent accidents by being familiar with the controls and observing safe operating procedures.

Operator's Responsibility:

1. The operator should know how to stop the engine quickly in case of an emergency.
2. A safety zone around the propeller should be established in which no person or object is allowed to enter. Install a guard around the propeller when appropriate.



WARNING

1. Observe all safety precautions when working around the propeller.
2. Exhaust contains poisonous carbon monoxide, a colorless and odorless gas. Breathing carbon monoxide can cause loss of consciousness and may lead to death.
3. Never run your engine in an enclosed space. Always allow for appropriate ventilation.
4. Observe precaution around the muffler. The exhaust system gets hot enough to ignite some materials.
5. Keep flammable materials away from the engine.
6. Gasoline is extremely flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks where the engine is operating.

2. Un-Packing Your Engine

Caution

Your Engine comes with wire harnesses attached to the intake assembly. Handle the engine with care when removing the assembly from the box.

Package Contents

1. Engine with Throttle Body Assembly
2. Engine Control Module (ECM)
3. Engine Wire Harness
4. ECM Input Harness
5. Owner's Manual
6. Mufflers (If Ordered)
7. Installation hardware
8. Fuel Pump
9. Air Filter
10. Ignition and ECM mounting kit



ATTENTION

Observe Precautions for Handling Electrostatic Sensitive Devices (ESD).

The ECM and Throttle servo on this engine contain sensitive electronic hardware. As a result, this engine is packaged in electrostatic dissipative foam and contained in electrostatic dissipative bags. Any handling of these devices should be contained in an ESD safe area.

EFI Components and Descriptions

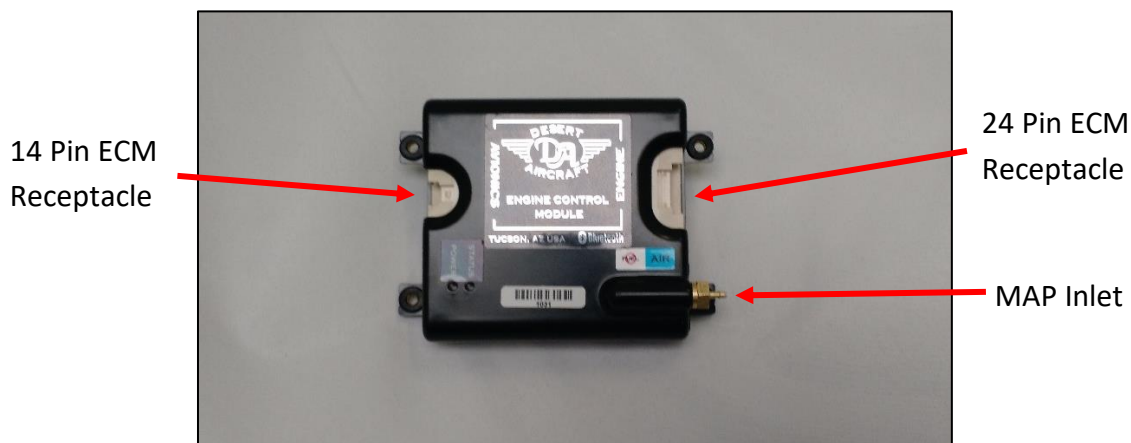


Figure 1: Engine Control Module (ECM)

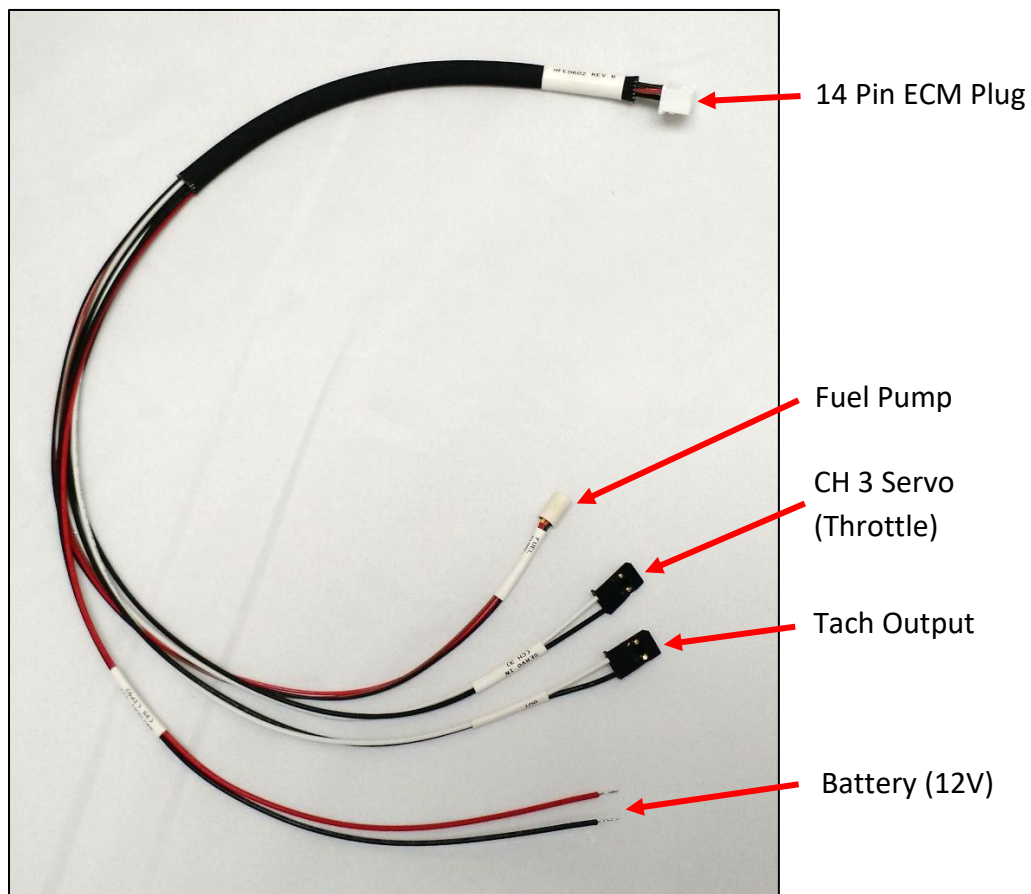


Figure 2: ECM Input Harness

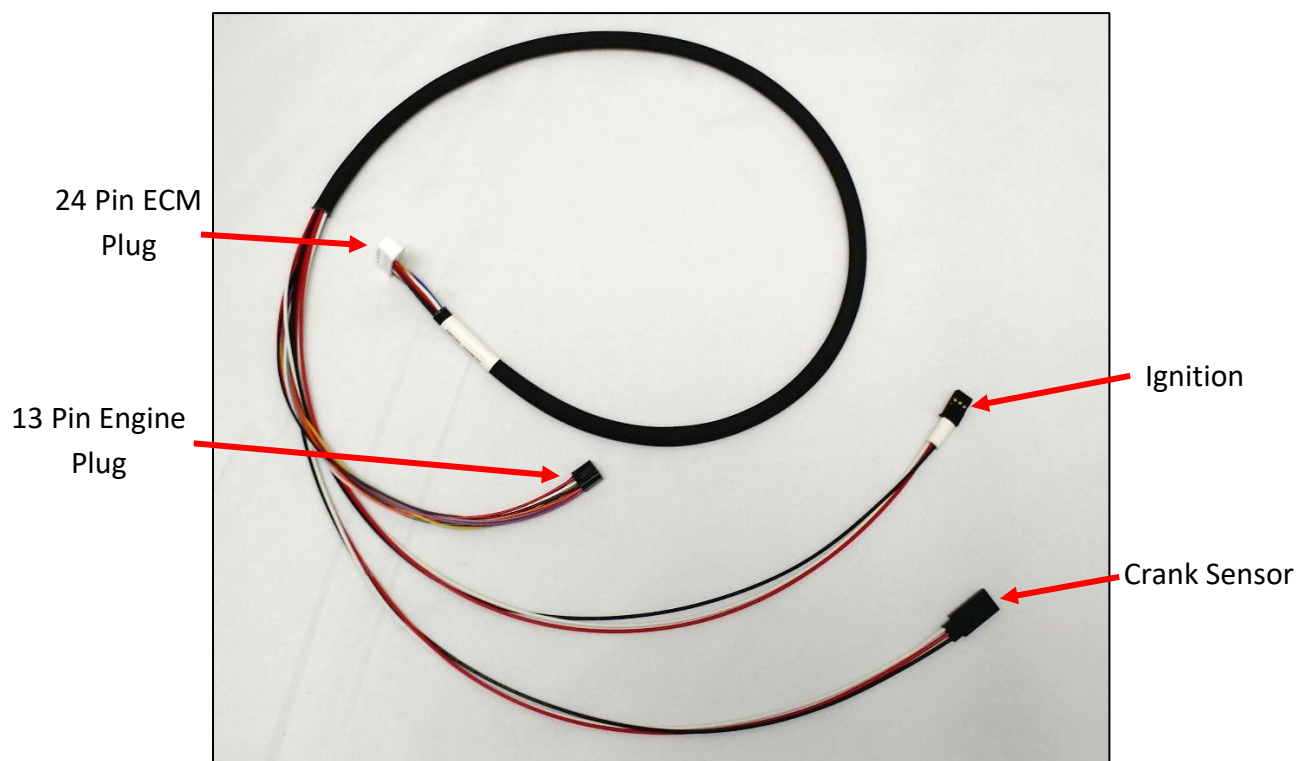


Figure 3: Engine Wire Harness

Heat Shrink: used to connect CHT sensor to wire harness

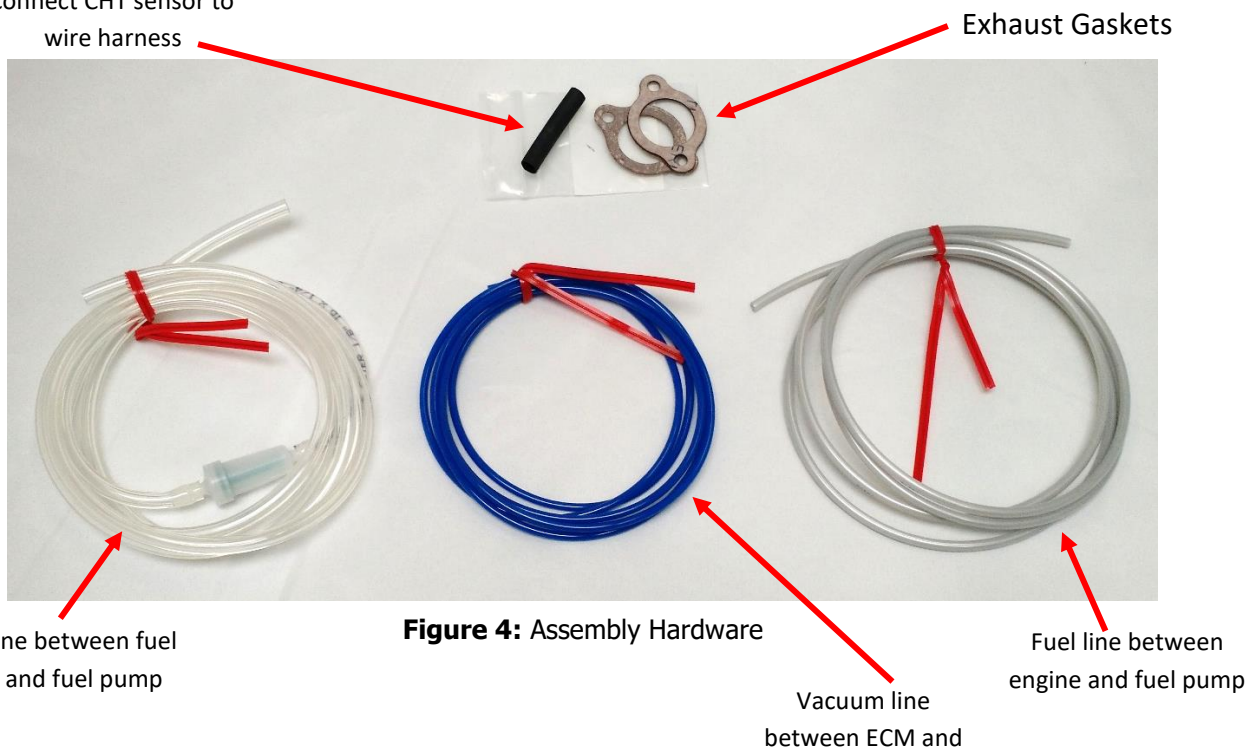


Figure 4: Assembly Hardware

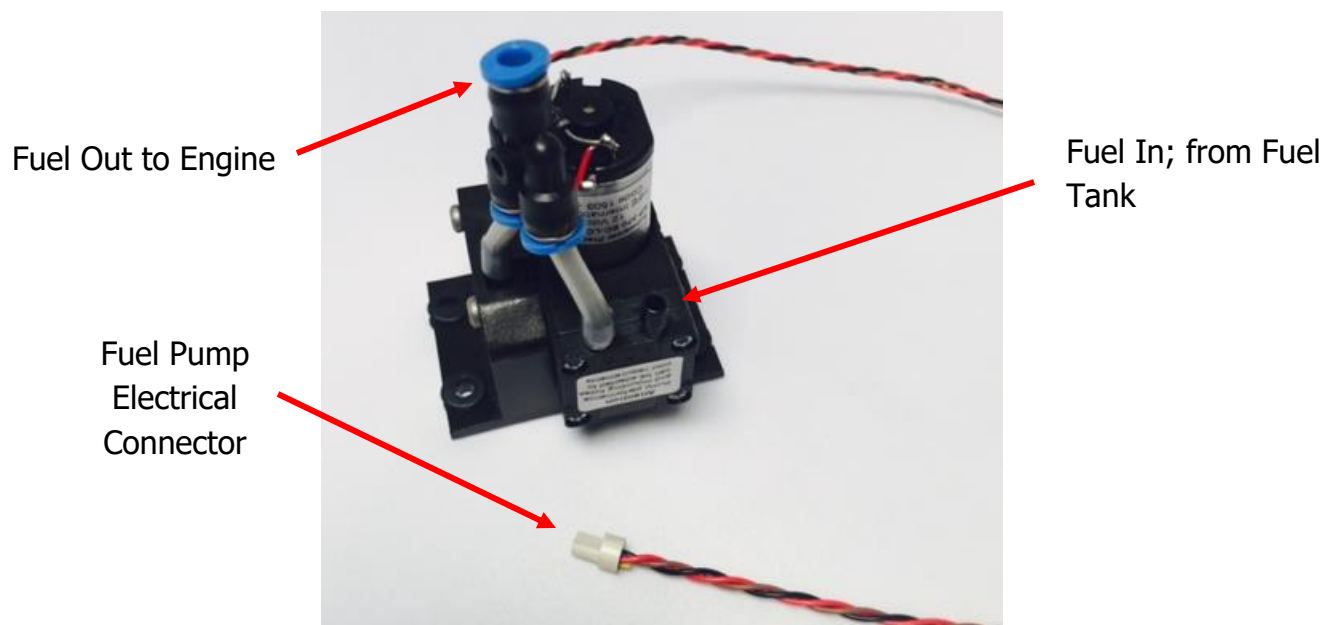


Figure 5: Fuel Pump

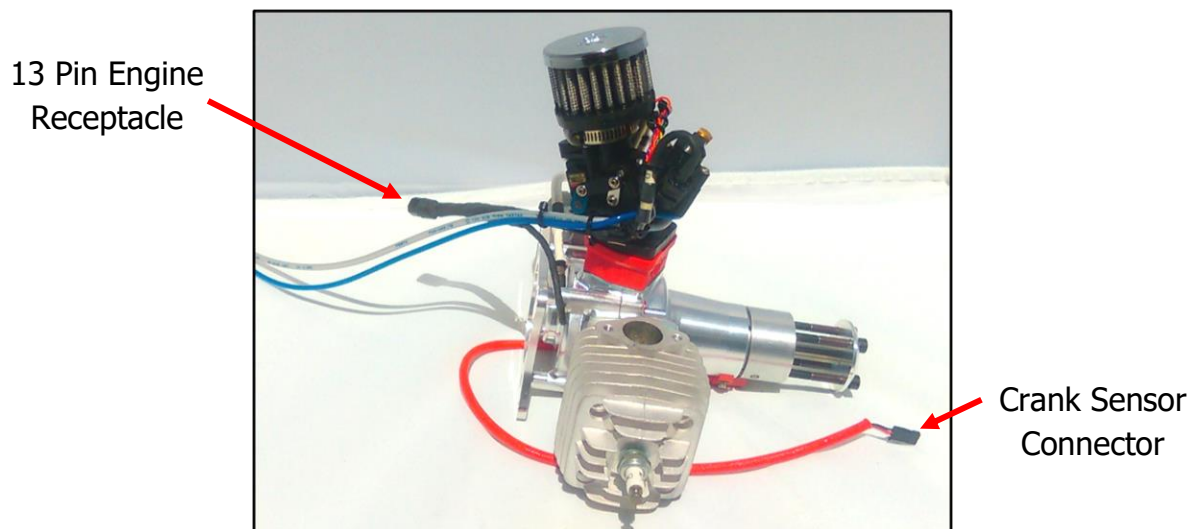
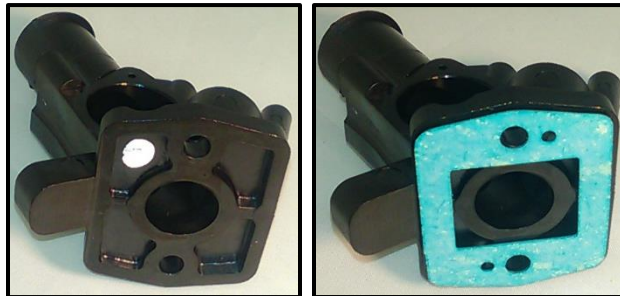
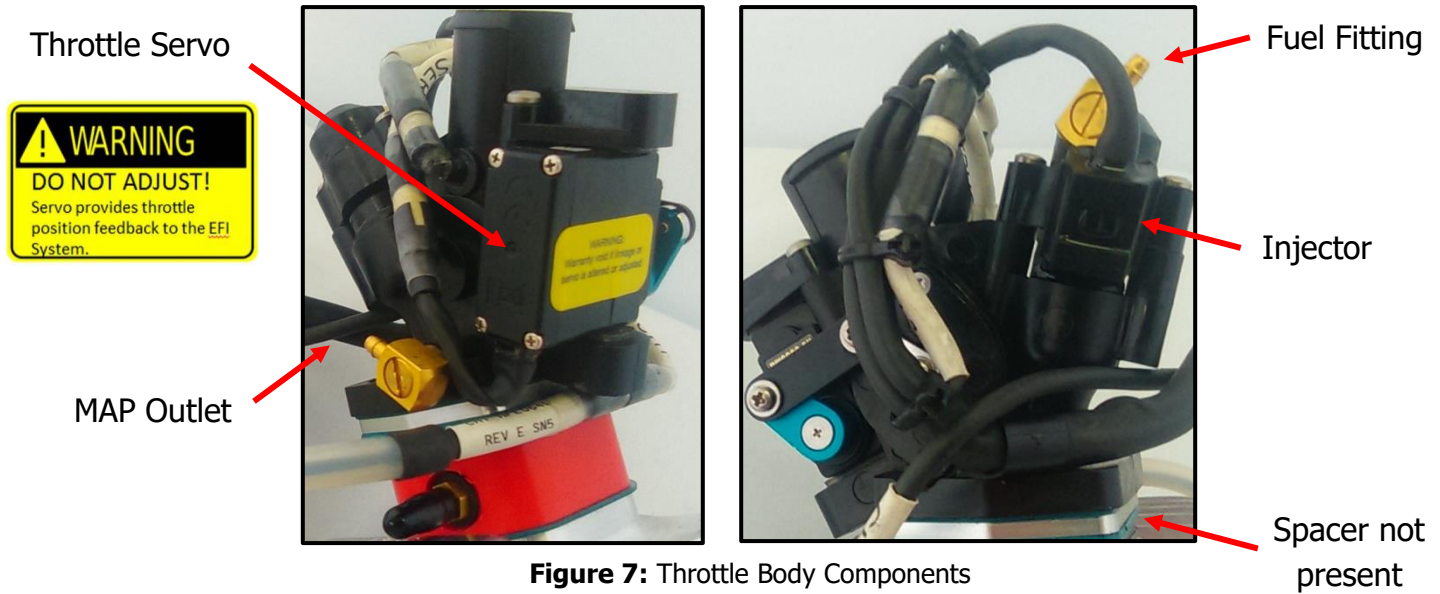



Figure 6: Engine and Crank Harness



3. Getting Started

Engine Oil

This engine was calibrated using Red Line 2 Stroke Racing oil at a mix ratio of 40:1. This oil type and mix ratio should be maintained to ensure that the fuel injection system and engine operates as designed.

Oil Brand: Red Line	
Oil Type: 2 Stroke Racing Oil	
Mix Ratio: 40:1	
40 parts gasoline to one part oil.	

Fuel Recommendations

The engine was calibrated with standard 87 octane gasoline.

3a. Fuel and MAP Line Installation

1. Do not install the ECM to the engine or motor mount; the vibration will damage the hardware. Route the ECM to a location inside the aircraft and mount it where vibration is minimal. The ECM does not produce excessive heat and can be encapsulated in foam to isolate it from vibration if needed.
2. Refer to the diagrams in section 2 for wire harness designations and connections.
3. Install blue tube between the MAP inlet on the ECM and the MAP outlet on the throttle body.

4. Install the gray tube from the fuel pump push to connect to the injector port on the throttle body. Make sure the blue fuel filter is in this line between the pump and engine.

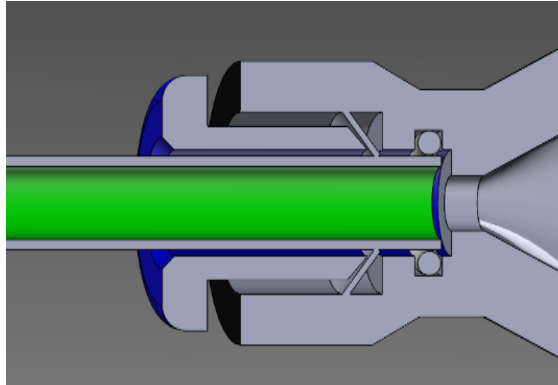


Figure 9: Push to Connect Diagram. Push tubing past locking ring and O-ring to produce a proper seal. Push locking ring to release.

5. Install the green fuel filter between the fuel pump inlet and the fuel tank.

FUEL SYSTEM WARNINGS

Do not connect the fuel port to the Manifold Air Pressure tube.

Do not exceed 15 PSI (1 bar) of fuel pressure.

3b. Transmitter/Receiver Set Up

1. Throttle commands use the standard output from Channel 3 of the receiver. Expected pulse width range from 900µs for closed throttle and 2100µs for wide open throttle. You may need to extend the end limits for channel 3 in your transmitter to produce the appropriate range. Adjust the exponential rate to get the desired throttle response.
2. **(Throttle kill)** Using the DA EFI system does not require an opto-kill switch for proper operation. When the pulse width from the receiver falls below 960µs (5%



throttle), the ECM will remove power to both the injector and ignition system, thus stopping the operation of the engine.

3. **(UAV option)** Provide 5V to the enable line; when power is removed ECM will remove power to both the injector and ignition system thus stopping the operation of the engine.
4. Any 3 cell LiPo, 4 cell Lifepo4, or equivalent battery with a minimum of 2000mA/hr rating will run the engine for up to 2 continuous hours.

3c. Starting Your Engine for the First Time

1. Verify that the ECM is powered on (Blue Light on ECM).
2. Verify that the throttle setting is between 25%-30%.
3. Prime the fuel system for the first time by removing the fuel line from the back of the throttle body. Cycle the battery power to the ECM in 5 second intervals until fuel is flowing from the fuel line, then re-install the fuel line. The priming process will not need repeating unless the engine fuel system is allowed to run dry or has been disconnected.
4. The engine should be started using an external spinner, or using a built-in starting alternator. **Flip starting as an additional option but is not recommended due to possible injuries.**

Note: The engine may struggle to run for the first few minutes as it is purging all the air from the fuel system. This may not be evident until you go to wide open throttle.

5. Allow the engine to run for a few minutes at idle; around 3000 RPM.
6. Hold at wide open throttle for 15 seconds to verify that the air in the fuel system has been purged.
7. Reduce engine speed to idle; around 3000 RPM. The engine is now ready for flight.



Starting Again After First Start

1. Verify that the ECM is powered on (Blue Light on ECM).
2. Verify that the throttle setting is between 25%-30%.
3. The engine should be started using an external spinner, or using a built-in starting alternator. **Flip starting as an additional option but is not recommended due to possible injuries.**

Note: The engine may struggle to run for the first few minutes as it is purging all the air from the fuel system. This may not be evident until you go to wide open throttle.

4. Allow the engine to run for a few minutes at idle; around 3000 RPM.
5. Verify all systems are functioning properly. The engine is now ready for flight.

Flood Clearing

If the engine is flooded, increase the throttle above 50% and turn the engine over for 5 seconds. Return the throttle to 25%-30% and proceed with start procedure.

4. Maintenance

Table I: Maintenance Schedule

Item	Before Each Flight	Every 50 Hours	Every 100 Hours	Every 200 Hours
Engine Oil Pre-Mix	X			
Spark Plug Check/Adjust		X	X	
Spark Plug Replace			X	X
Air Filter Check/Clean		X		
Air Filter Replace			X	
Fuel Filter		X		
HFE OEM Maintenance				X

5. Signal Inputs/Outputs for ECM

Table II: Main ECM 24 Pin Connector

Pin	Signal	Description
1	NC	Not Connected
2	NC	Not Connected
3	NC	Not Connected
4	NC	Not Connected
5	NC	Not Connected
6	IGN PWR	+6V power supply output from the Engine Control Unit for the ignition power.
7	NC	Not Connected
8	IGN GND	Ignition Ground
9	NC	Not Connected
10	IGN SIGNAL	Modified integrator filtered output.
11	SERVO POWER	+6V power supply output from the Engine Control Unit for the throttle servo power.
12	CRANK PWR	+5V power supply output from the Engine Control Unit for the crank sensor.
13	SERVO GND	Throttle servo ground.
14	CRANK GND	Crank sensor ground.
15	SERVO SIGNAL	Throttle position with logic-level output. A Pulse Width Modulated (PWM) signal at nominally 100Hz with ON time ranging from 900 μ s to 2100 μ s corresponding to throttle position. This pin has an 8mA draw.
16	CRANK SIGNAL	+5V logic-level digital input. Bi-polar type.
17	CHT (+)	Cylinder head temperature sensor. Variable resistance thermistor.
18	CHT (-)	Cylinder head temperature sensor reference.
19	MAT (+)	Manifold Air Temperature sensor. Variable resistance thermistor.
20	MAT (-)	Manifold Air Temperature sensor reference.
21	NC	Not Connected
22	NC	Not Connected
23	INJECTOR GND	Injector Switching to Ground. Frequency matches engine RPM.
24	INJECTOR POWER	Battery voltage.

Table III: ECM 14 Pin Input Connector

Pin	Signal	Description
1	Tx	RS-232 Transmit
2	PUMP SIGNAL	Variable voltage output from fuel pump assembly.
3	Rx	RS-232 Receive
4	NC	Not Connected
5	GND	Crank signal output ground reference
6	PUMP (+)	Fuel System power (routed internally from system power pin 14 and enabled by a high side driver (relay) from ECM state commands).
7	TACH OUT	+5V logic-level digital output. This pin has a maximum continuous load of $\pm 20\text{mA}$. Output signal has a 50% duty cycle.
8	PUMP (-)	Fuel system ground reference.
9	THROTTLE SIGNAL	Throttle position with logic-level input. A Pulse Width Modulated (PWM) signal at nominally 50Hz with ON time ranging from $900\mu\text{s}$ to $2100\mu\text{s}$ corresponding to throttle position (0% to 100%). This pin has an 8mA draw.
10	GND	Throttle input ground reference.
11	ENABLE (Special feature available on request)	Engine enable signal from AP. A 5-volt signal present to enable (UAV option only). This pin has an 8mA draw. 10k pull down resistor.
12	GND	Enable ground reference
13	MAIN GND	Main Ground
14	POWER 12V	Main power input. 10 to 14 volts. Maximum power draw is 12 W at wide open throttle. (11.1v 3 cell LiPo 2000ma or bigger)

5a. ECM Blink Patterns

If the engine is not starting, checking the STATUS light on the top of the ECM can signal what problem is seen by the ECM. The pattern repeats after 3 second pause, and blinks at 1 to 2 Hz.

Table IV: Blink Patterns

Number of Blinks	Fault
1	High battery disconnected
2	MAT disconnected/no signal
3	CHT disconnected/no signal
5	Pulse train (throttle) not active



6. Technical Specifications

Only use NGK CM-6 spark plugs.

Plug gap is .018" to .020" (.38 to .50 mm)

	Size	Torque
Spark plug:	CM-6, 10mm	90 in. lbs.
Steel prop bolts:	M4x 40mm	65 in. lbs.
Aluminum crankcase bolts:	M5x20mm	70 in. lbs.
Aluminum cylinder base bolts:	M5x13mm	70 in. lbs.
Throttle Body mounting bolts:	M5x40mm	20 in. lbs.

*Caution: Care must be taken to not over tighten the throttle body mounting bolts. Over tightening can distort and damage the injected molded reed valve parts, rubber gaskets, and throttle body.

6a. Battery Recommendations:

Any 3 cell LiPO battery or equivalent battery pack with an amp hour capacity of 2000mA/hr or greater will run the engine for 2 hours continuously. A 4 cell LiFePO₄ battery pack is also permitted.



7. Warranty

Thank you for choosing an HFE International and Desert Aircraft product.

Your Total satisfaction is our #1 priority.

If you have any questions on the installation and operation of this engine, please contact us directly. Please have your engine serial number on hand when calling for service.

Desert Aircraft Engine Customer Service:

Phone: 520.722.0607

Email: UAV@Desertaircraft.com

1815 South Research Loop

Tucson, Arizona 85710

U.S.A

Engine Core Warranty

Your DA70 motor and ignition system are covered with a 3 year warranty by Desert Aircraft, starting from the date of purchase.

- This warranty covers defects in workmanship and materials only.
- Do not disassemble the motor or ignition system. Disassembly of the motor or ignition system can void the warranty on that item.
- Any modifications to the motor, or the ignition system, other than those authorized by Desert Aircraft, will void this warranty.

This warranty does not cover the following:

- Shipping expenses to and from Desert Aircraft for warranty service.
- Damage caused by improper handling, operation, or maintenance.
- Damage caused by a crash.
- Damage caused by using improper fuel or additives.
- Damage incurred during transit to Desert Aircraft. **WRAP AND PACK ENGINE CAREFULLY!!**

NOTE: DESERT AIRCRAFT WILL NOT SHIP ANY WARRANTY REPLACEMENT ITEMS UNTIL POSSIBLY DEFECTIVE ITEMS IN QUESTION ARE RECEIVED BY DESERT AIRCRAFT.



HFE International EFI System Customer Service:

Phone: 520.578.0818

Email: sales@hfeinternational.com

1646 S. Research Loop

Suite 170

Tucson, AZ 85710

EFI System Warranty

Your HFE International EFI system is covered with a 1-year warranty by HFE International starting from the date of shipment from HFE International.

- This warranty covers defects in workmanship and materials only to include Fuel Pump, wiring, ECM and throttle body.
- Do not disassemble the ECM or Throttle Body assembly. Disassembly of the ECM or Throttle Body assembly will void the warranty on that item.
- Any modifications to the ECM, or Throttle Body assembly, other than those authorized by HFE International, will void this warranty.

This warranty does not cover the following:

- Shipping expenses to and from HFE International for warranty service.
- Damage caused by improper handling, operation, or maintenance.
- Damage caused by a crash.
- Damage caused by using improper fuel or additives.
- Damage incurred during transit to HFE International.

NOTE: HFE INTERNATIONAL WILL NOT SHIP ANY WARRANTY REPLACEMENT ITEMS UNTIL POSSIBLY DEFECTIVE ITEMS IN QUESTION ARE RECEIVED BY HFE INTERNATIONAL.

8. Replacement Parts List

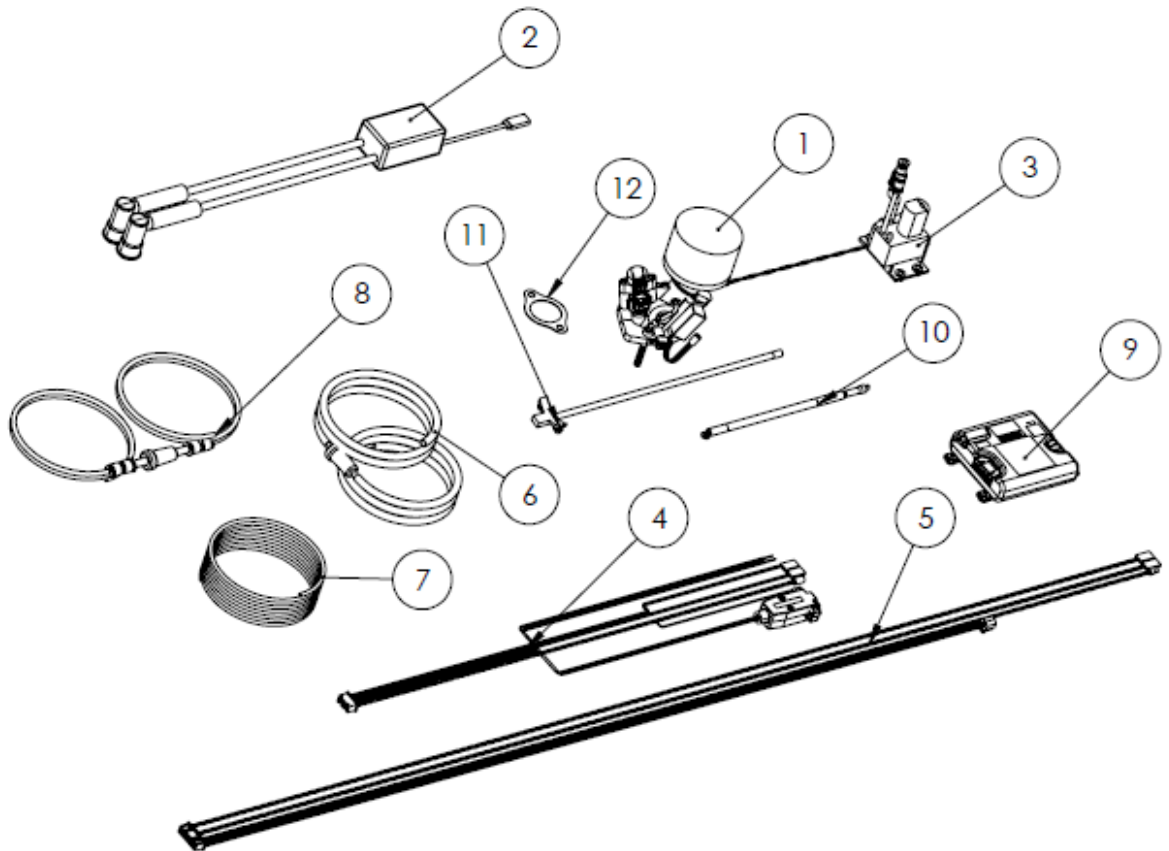


Table V: Part numbers and descriptions

ITEM NO.	PART NUMBER	DESCRIPTION
1	HFE0274M	14MM THROTTLE BODY ASSEMBLY
2	M2IGN	TWIN IGNITION
3	HFE0689	FUEL PUMP COMMERCIAL
4	HFE0602	14 PIN ECM HARNESS
5	HFE0643	24 PIN ECM HARNESS
6	HFE0780	FUEL CELL TO FUEL PUMP LINE
7	MUT-1012-BLUE 5FT	1/16 ID X 1/8 OD MAP TUBING
8	HFE0829	FUEL PUMP TO THROTTLE BODY LINE
9	HFE0202	ECM
10	HFE0640	CHT SENSOR
11	HFE1101	CRANK SENSOR BIPOLAR
12	MG35EX	DA70 MUFFLER GASKET