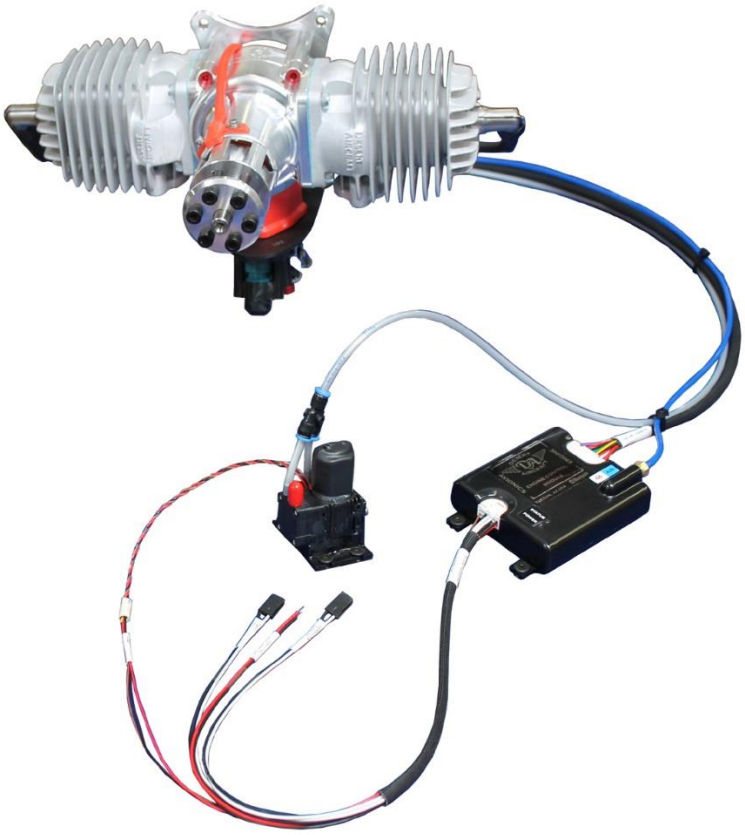
DA 100/120 EFI

Electronic Fuel Injected Engines



OWNER'S MANUAL

Document Revision Table					
Rev.	Description of Change	Revised by	Revision Date	Approved By	Approved Date
A	Initial Release	T.West	12/29/2015	D.Gallaher	12/29/2015
B	Added ECM Blink Signals	T.West	3/28/2016	D.Gallaher	3/28/2016
C	Added Throttle Kill/UAV Instructions	K.Gratien	7/14/2016	T.West	7/14/2016
D	Updated Header	K.Gratien	3/28/2017	T.West	3/28/2017
E	Updated maintenance schedule table	T.West	11/3/2017	D.Gallaher	11/3/2017
F	Updated with Revision Table	A.Sanchez	12/14/2017	T.West	12/14/2017
G	RS-232 Callout, Maintenance change	K.Gratien	4/18/2018	T.West	4/18/18

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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.

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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 Intake Assembly
2. Engine Control Unit (ECM)
3. Main Wire Harness
4. Owner's Manual
5. (Optional) Mufflers and Installation hardware
6. Fuel Pump

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.

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EFI Components and Descriptions

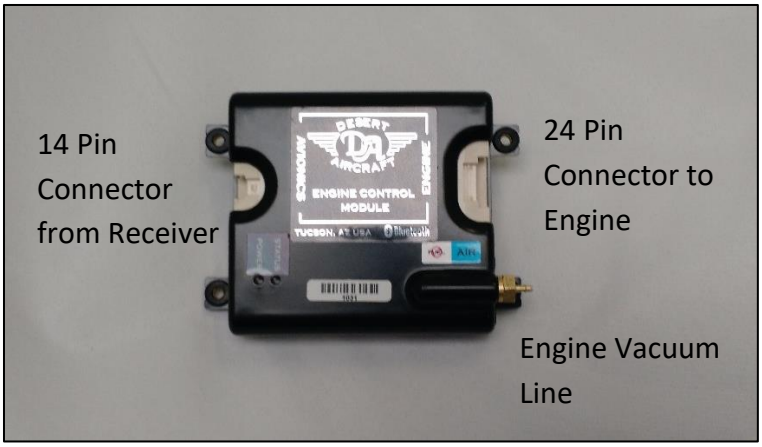

Figure 1: Engine Control Module (ECM)

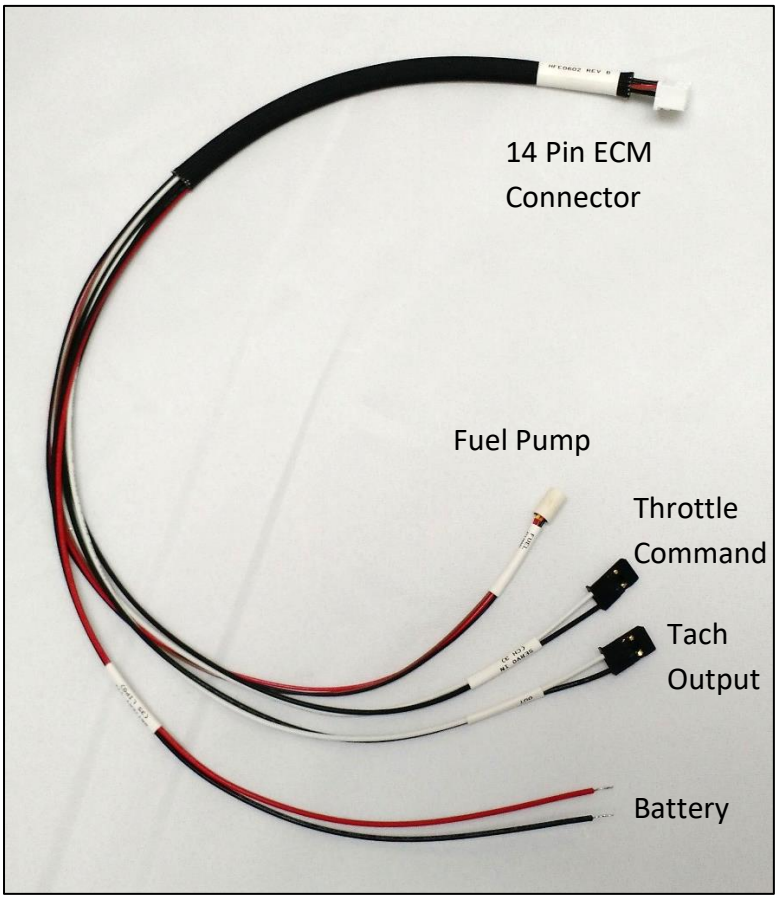

Figure 2: ECM Input Harness from Receiver

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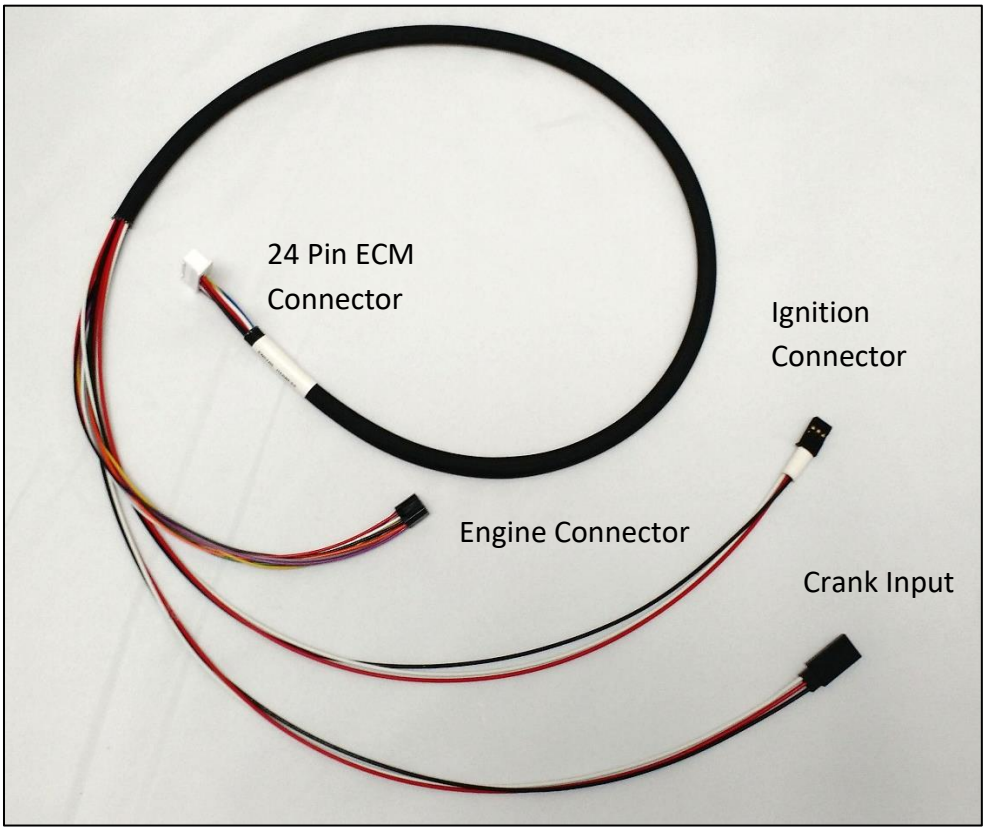

Figure 3: Main Engine Harness

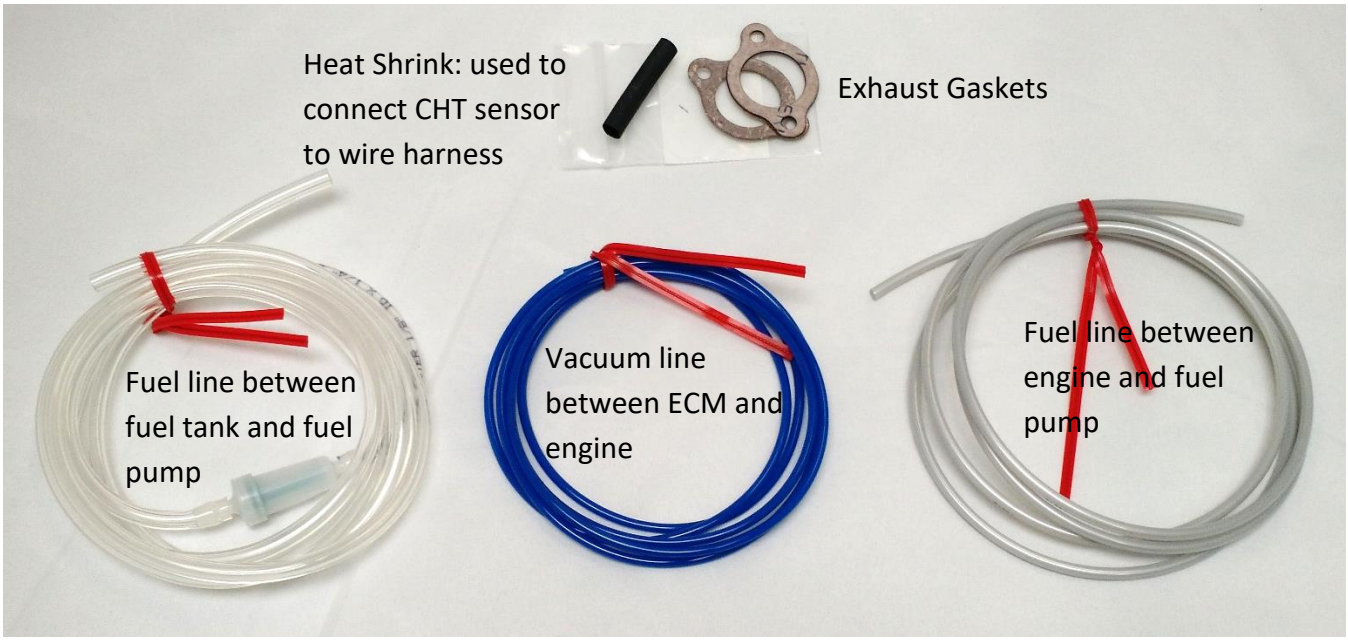

Figure 4: Assembly Hardware

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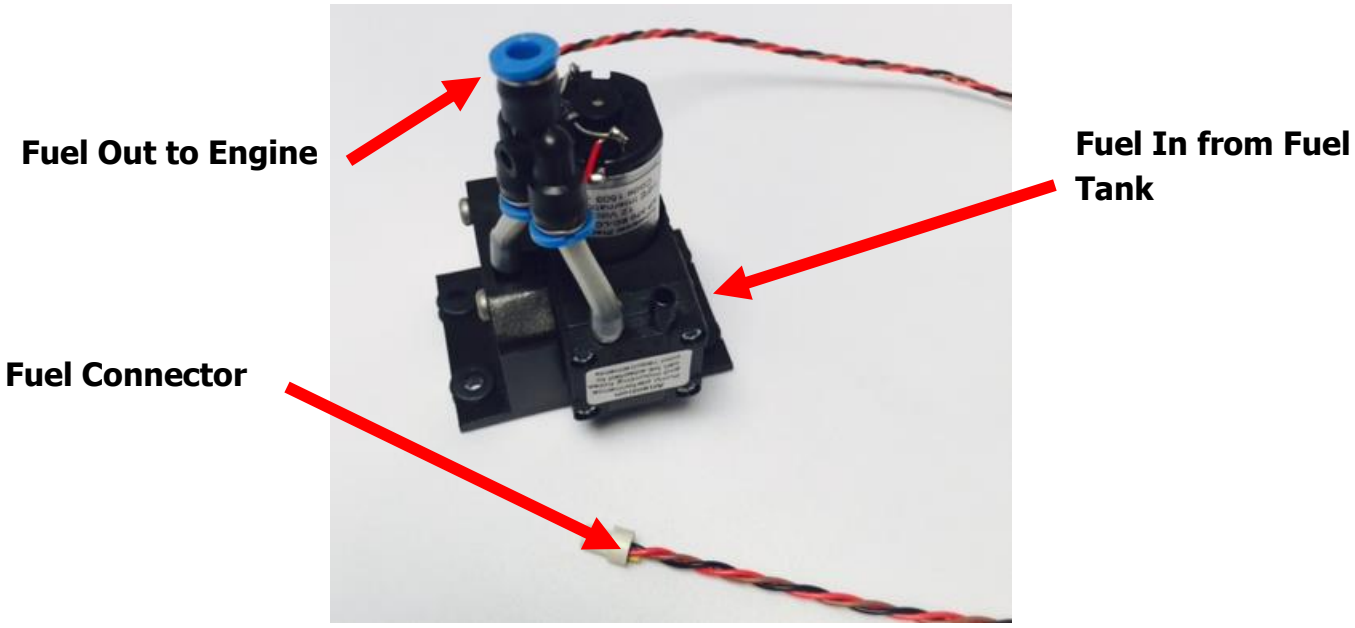

Figure 5: Fuel Pump

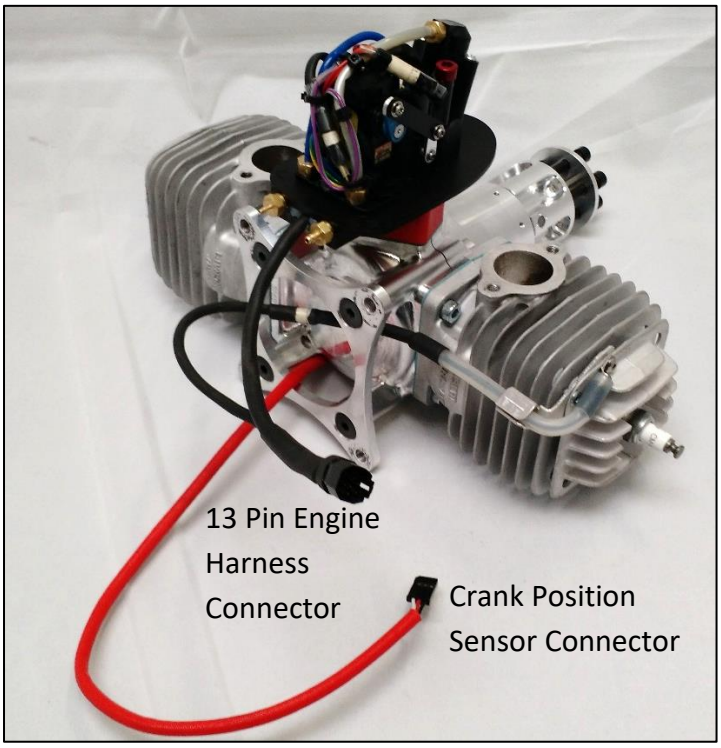

Figure 6: Engine and Crank Harness

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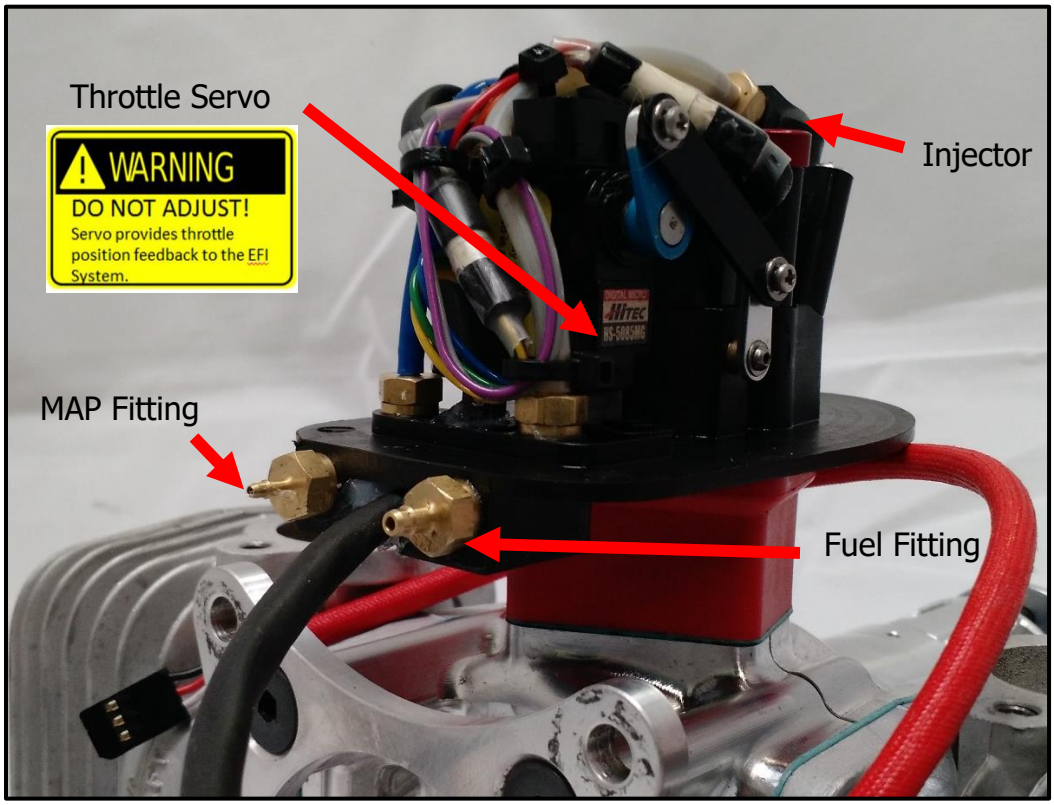

Figure 7: Intake Components

3. Getting Started:

Engine Oil

This engine was calibrated using Red Line 2 Stroke All Sport 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 All Sport**	
Mix Ratio: 40:1 40 parts gasoline to one part oil.	

Fuel Recommendations

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The engine was calibrated with premium gasoline. 91-93 octane is recommended.

a. Hardware 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 ECM and the manifold air pressure port on the throttle body.
4. Install the gray tube from the fuel pump push to connect to the injector port on the throttle body.

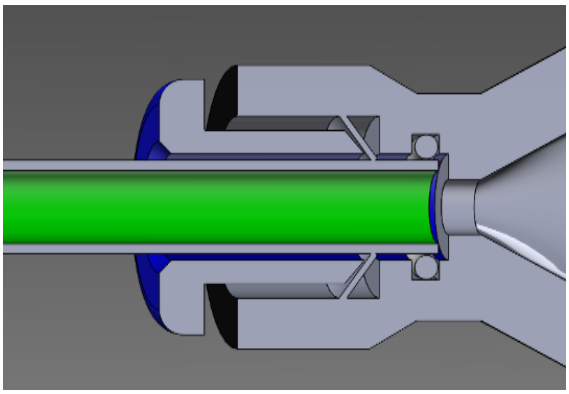

Figure 8: Push to Connect Diagram

Push tubing past locking ring and O-ring to produce a proper seal. Push locking ring to release.

5. Install the fuel filter between the fuel pump inlet and the fuel tank.
6. 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.

b. Transmitter/Receiver Set Up

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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 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 power 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.

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.

c. Starting Your Engine for the First Time

1. Verify that the ECM is powered up (Blue Light on ECM).
2. Verify that the throttle setting is at about 30%.
3. Prime your 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. Re-install the fuel line. You should not have to complete the priming process again unless the engine fuel system is allowed to run dry or has been disconnected for any reason.
4. Give the prop several aggressive flips, the engine should start.

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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.
6. Hold at wide open throttle for 15 seconds to verify that the air in the fuel system has been purged. Reduce the engine speed to idle.

Starting Again After First Start

Give the prop several aggressive flips, the engine should start. If the engine does not start, increase throttle above 50% to clear possible flooded condition. Give the prop several more aggressive flips.

4. Maintenance:

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**		
Spark Plug Replace			**X**	
Air Filter Check/Clean		**X**		
Air Filter Replace			**X**	
Fuel Filter		**X**		
HFE OEM Maintenance				**X**

Table I: Maintenance Items

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5. Signal Inputs/Outputs for ECM:

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 900µs to 2100µs 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 II: Main ECM 24 Pin Connector

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Pin	Signal	Description
1	NC	Not Connected (RS-232 level Tx)
2	PUMP SIGNAL	Variable voltage output from fuel pump assembly.
3	NC	Not Connected (RS-232 level Rx)
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 ±20mA. 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 900µs to 2100µs 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)

Table III: ECM Input Connector 14 Pin

a. 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.

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

Table IV: Blink Patterns

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6. Technical Specifications

Throttle Body air cleaner retaining nuts.

10 in-lbs.

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:	M5x 50mm	90 in. lbs. /carbon props.
Aluminum crankcase bolts:	M5x16mm	70 in. lbs.
Aluminum cylinder base bolts:	M5x16mm	60 in. lbs.
Steel cylinder base bolts:	M5x16mm	95 in. lbs.
Air Filter Cap nuts:	M5x75mm	10 in. lbs.*
Steel motor mount bolts:	M6x16mm	120 in. lbs.

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

a. 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.

Using a 4 cell Lifepo4 is also permitted as its output voltage range is with in the 14 to 10 volt range.

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7. Warranty

Thank you for choosing a 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 Fuel Injected 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 DA120 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.*

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EFI System Warranty

Your Desert Aircraft EFI system is covered with a 1 year warranty by Desert Aircraft starting from the date of shipment from Desert Aircraft.

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 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.

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

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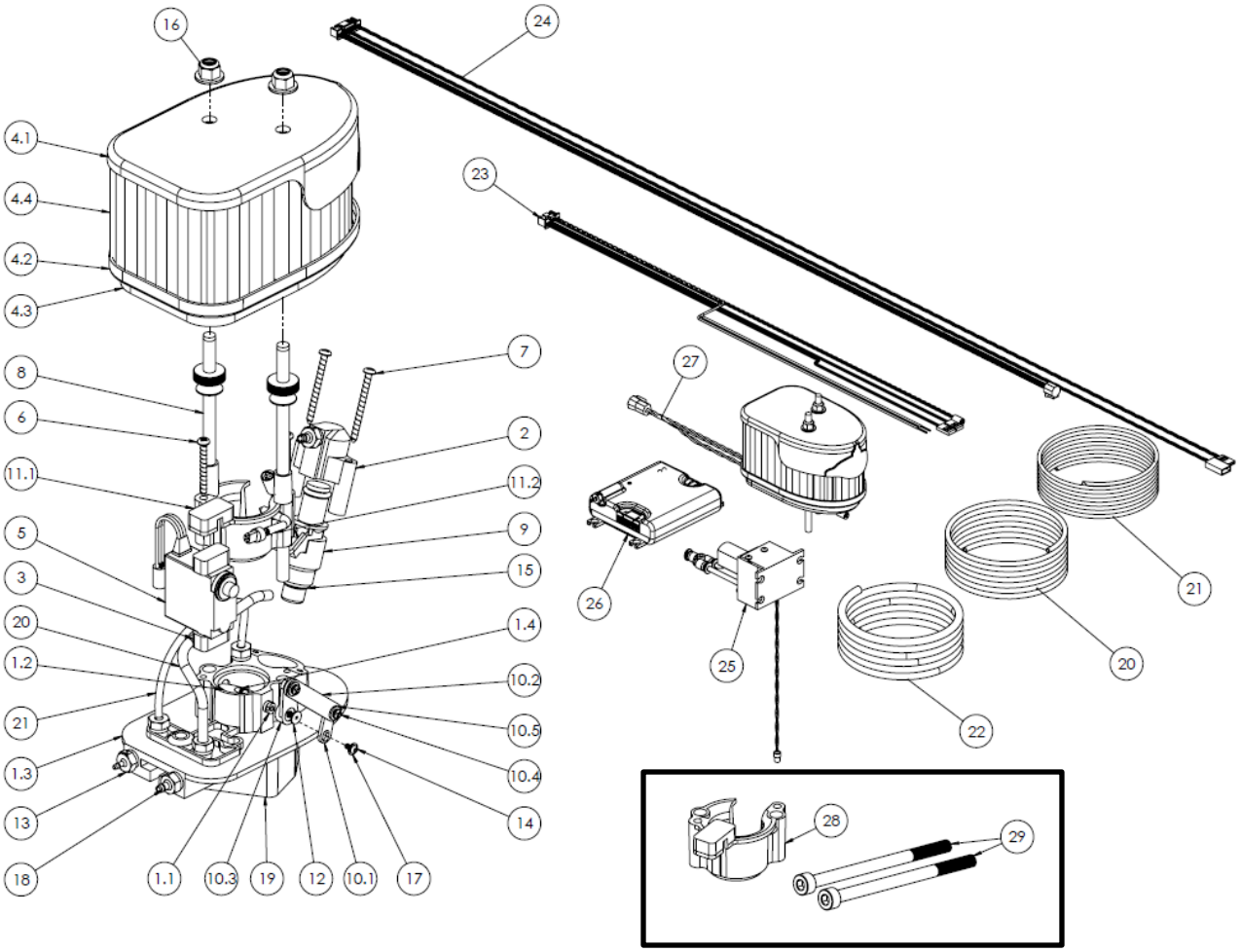
8. Part Numbers



Compact Parts

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ITEM NO.	PN	DESCRIPTION	QTY.
1	DA120EFI-1	20MM THROTTLE BODY ASSY	1
1.1	DA120EFI-2	20MM THROTTLE SHAFT	1
1.2	DA120EFI-3	20MM THROTTLE PLATE	1
1.3	DA120EFI-4	THROTTLE BODY HOUSING	1
1.4	DA120EFI-5	THROTTLE SCREW	1
1.5	DA120EFI-6	GROMMET MODIFIED	1
2	DA120EFI-7	INJECTOR CAP MODIFIED	1
3	DA120EFI-8	ISOLATOR	2
4	DA120EFI-9	AIR FILTER ASSEMBLY	1
4.1	DA120EFI-10	AIR FILTER CAP	1
4.2	DA120EFI-11	DA 100 AIR FILTER BASE	1
4.3	DA120EFI-12	DA 100 AIR FILTER FOAM	1
4.4	DA120EFI-13	FILTER	1
5	DA120EFI-14	HITEC HS-5085MG MOD.	1
6	DA120EFI-15	M3X25 SCREW	2
7	DA120EFI-16	M3X30 SCREW	2
8	DA120EFI-17	20MM ALLTHREAD ASSEMBLY	2
8.1	DA120EFI-18	20MM M5 ALLTHREAD	1
8.2	DA120EFI-19	M5X0.8 THUMB NUT 18-8 SS	1
9	DA120EFI-20	20MM INJECTOR ASSEMBLY	1
10	DA120EFI-21	LINKAGE LARGE 20MM	1
10.1	DA120EFI-22	20MM THROTTLE HORN	1
10.2	DA120EFI-23	20/25MM MAIN LINK	1
10.3	DA120EFI-24	SERVO ARM MODIFIED	1
10.4	DA120EFI-25	PHMS 2-56 X 7/32 18-8 SS	2
10.5	DA120EFI-26	SS BALL BEARING 3/16 OD	2
11	DA120EFI-27	VELOCITY STACK WITH MAT	1
11.1	DA120EFI-28	20MM VELOCITY STACK	1
11.2	DA120EFI-29	DA MAT SENSOR	1
12	DA120EFI-30	M2.3-40-M-SS-P	1
13	DA120EFI-31	M5 TO 1/16 BARB FITTING	3
14	DA120EFI-32	BHCS M2X0.4 4MM 18-8 SS	1
15	DA120EFI-33	VITON ORING 1.5MM 9MM ID	1
16	DA120EFI-34	NYLON LOCKNUT M5X0.8	2
17	DA120EFI-35	WASHER M2 2.2MM ID 5MM OD	1
18	DA120EFI-36	M5 MALE THREAD TO LARGE BARB	3
19	DA120EFI-37	REED BLOCK	1
20	DA120EFI-38	4MM FESTO WHITE TUBING	1
21	DA120EFI-39	POLYURETHANE TUBING, 1/16	1
22	DA120EFI-40	LARGE TUBING	1
23	DA120EFI-41	14 PIN WIRE HARNESS	1
24	DA120EFI-42	24 PIN WIRE HARNESS	1
25	DA120EFI-43	FUEL PUMP	1
26	DA120EFI-44	ECU	1
27	DA120EFI-45	13 PIN WIRE HARNESS	1
28	DA120EFI-46	20MM VELOCITY STACK COMPACT	1
29	DA120EFI-47	M5X75 SCREW	1

Table V: Part Numbers

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