



SYSTEM OVERVIEW

Air Source & Input Pressure

The Fusion Engine operates on input pressures between 80-120 PSI. Although it is possible to run the system at pressures below 80 PSI, the best performance will be in the 80-120 PSI range.

- **DO NOT APPLY MORE THAN 120PSI. INPUT PRESSURES IN EXCESS OF 120 PSI MAY DAMAGE THE SYSTEM.**
- **DO NOT USE LIQUID PROPELLANTS SUCH AS CO2 OR PROPANE. USE OF CO2 OR PROPANE MAY DAMAGE THE SYSTEM.**

A suitable air system will be required to operate the Fusion Engine. This includes a compressed air tank, regulators, remote line and fittings. The Fusion Engine is designed for use with standard paintball compressed air tanks (HPA not CO2). Tank choice is dependent on budget and shot capacity needed between fills. Below is a formula for estimating the number of shots per fill with a particular size and pressure tank:

$$\text{Tank Capacity} \times (\text{Tank Pressure} / 100) = \text{Shots per Fill}$$

For example:

48ci / 3000 PSI Tank = $48 \times 30 = 1440$ Shots

68ci / 4500 PSI Tank = $68 \times 45 = 3060$ Shots

110ci / 4500 PSI Tank = $110 \times 45 = 4950$ Shots

Dual stage regulation is highly recommended for maximum performance. Below are recommended first and second stage regulators.

Primary / First Stage	Secondary / Final Stage
<ul style="list-style-type: none">• AKA SST (Airsoft Version)• AKA 2-Liter Plus, Low Pressure (Airsoft Version)	<ul style="list-style-type: none">• SMC ARX20-N01• SMC AR10-M5G-Z

Please contact your preferred dealer for information on purchasing air system packages.

Power Source

The Fusion Engine Fire Control Unit (FCU) can accept an input voltage of 6.8-12VDC. Common Airsoft and RC batteries may be used. Although the system can function on a 9V alkaline battery, it is not recommended.

Batteries should have a continuous current rating of at least 1A. Large capacity, high output battery packs are not necessary as there is no increase in performance over packs which meet the minimum requirements (6.8V / 1A).

Velocity Adjustment

There are two primary methods of adjusting velocity with the Fusion Engine.

Large adjustments are made by changing the air nozzle to one with either a smaller or larger bore. This effectively shifts the velocity adjustment range down or up respectively. There are currently 6 color coded nozzle bores available. Fine adjustments are made at the final stage regulator by adjusting pressure within 80-120 PSI operating range.

Velocity and cyclic rate are independently adjustable, however, due to the nature of pneumatic systems the maximum potential cyclic rate is related to input pressure. As input pressure is increased, the maximum potential cyclic rate will also increase.

Nozzle Sizing

In addition to nozzle size and input pressure, muzzle energy will also vary with barrel length. As with other gas operating systems, muzzle velocity will increase with longer barrel lengths. The chart below may be used to estimate the expected maximum velocity of a particular nozzle and barrel length combination.

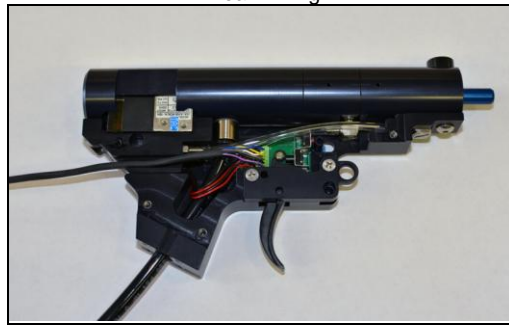
Readings taken with 0.20g BBs at 120 PSI (max input pressure).

	Green	Gold	Blue	Black	Silver	Red
275mm	315	350	380	425	445	500
380mm	325	365	405	455	495	550
509mm	365	400	435	475	515	590

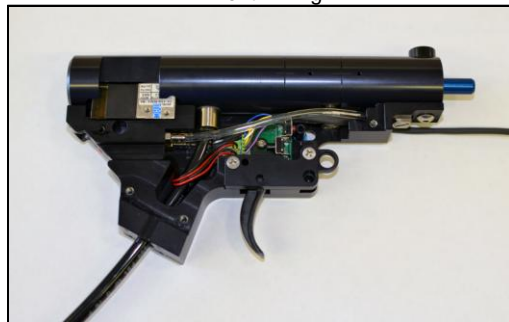
Front / Rear Wiring

The Fusion Engine may be wired for either front or rear wiring. After removing 4 screws, the right side plate can be removed to access the wiring harness.

Rear Wiring



Front Wiring



In addition to the standard front and rear wiring, the Fusion Engine may also be wired to the grip as the motor is no longer used.

FIRE CONTROL UNIT

The Firing Cycle

Cyclic rate is determined by the sum of all delay and dwell times in one shot cycle combined with the ROF delay setting. One shot cycle + ROF delay is outlined below:

1. Nozzle Solenoid On
 2. Hold Nozzle Open for **dn** (Next round is feeding up from mag)
 3. Nozzle Solenoid Off
 4. Wait **dr** (Nozzle is returning to forward position)
 5. Poppet Solenoid On
 6. Hold Poppet Open for **dp** (Round is being fired)
 7. Poppet Solenoid Off
 8. IF in Burst or Auto mode, wait **rF** before beginning the next shot cycle
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Adjusting FCU Settings

To enter programming mode, press inward on the programming button. The display will show "SAFE" indicating the trigger is disabled and the system is in programming mode. Press the programming button again to exit programming mode. Setting changes are automatically saved upon exiting.

While in programming mode the various settings may be accessed by pushing the programming button left or right. The values are changed by pushing the button up or down.

The Fusion Engine FCU may be returned to the factory defaults by holding in the programming button while plugging in the power supply.

Sleep Mode

The Fire Control Unit will automatically enter a power saving mode after two minutes of inactivity. When in this mode, the display will turn off and certain internal functions are temporarily halted.

The unit will automatically wake from the power saving mode upon sensing activity at the trigger, selector or programming button.

Power Saving Mode will not activate if the Fire Control Unit is in SAFE (programming) mode.

GPIO Port

The GPIO (General Purpose Input/Output) is an additional port on the FCU intended for future expansion and interaction with secondary control units or sensors such as:

- Auto Winding Magazines
- Empty Mag Sensor
- Tracer Unit Activation

The GPIO port is not enabled in the default firmware.

Description of Settings

<p>FA – Full Auto Mode</p> <p>Full auto mode controls the function of the “Auto” selector position. When set to FU the FCU is in the normal Full Auto mode. Settings 02 through 09 will provide burst modes from 2 rounds up to 9 rounds. A setting of 01 is a “single shot burst”, effectively turning the Auto selector position into a second semi auto position.</p>	Default Value: FU
<p>dn – Nozzle Dwell</p> <p>The nozzle dwell variable controls how long power is applied to the nozzle solenoid, affecting the time that the nozzle is held rearward. The higher the value, the longer the nozzle is held to the rear, which allows tuning for slower feeding magazines.</p>	Default Value: 14
<p>dp – Poppet Dwell</p> <p>The poppet dwell variable controls how long power is applied to the poppet solenoid, affecting the duration for which the firing valve is held open and allows adjustment of the gas volume released. The higher the value, the longer the poppet is held open. There is an internal base dwell of 2ms. This is added to the value shown on the LCD (0.1ms increments). For example, the recommended value of “20” produces 2ms + (0.1ms x 20) = 4ms total dwell.</p>	Default Value: 25
<p>dr – Return to Battery Delay</p> <p>The RTB delay determines how long to wait for the nozzle to return forward while chambering the next round. Due to the design of the AEG magazine/hopup, the actual delay time required varies each shot. We do not recommend setting this value below 17.</p>	Default Value: 22
<p>rF – ROF Delay</p> <p>The ROF delay variable determines the delay between shot cycles and acts as an overall cyclic rate adjustment once other settings have been optimized. Increasing the value will decrease cyclic rate. This variable is only applied in Full Auto or Burst modes.</p>	Default Value: 12
<p>db – Debounce Threshold</p> <p>The debounce threshold is used to filter electrical noise from the trigger switch and prevent trigger bounce. This setting adjusts the minimum time which must elapse after a “trigger release” is read before the next “trigger pull” will be processed.</p>	Default Value: 0
<p>Cb – Closed Bolt Mode</p> <p>Closed Bolt Mode allows simulation of a closed bolt mechanism by firing the round first, then cycling the nozzle. This allows for even faster trigger response and more consistent seating in the hopup at the expense of dry-firing the first shot on a new magazine.</p>	Default Value: OF Cb OF – AEG Mode Cb On – Closed Bolt Mode
<p>AS – Auto Switch</p> <p>Auto Switch reverses the functions of the Semi and Full Auto selector positions.</p>	Default Value: OF
<p>Lb – Lipo Battery Monitor</p> <p>The Lipo Battery Monitor displays a “Low Battery” warning on the LCD display when the measured battery voltage drops below a pre-determined threshold.</p>	Default Value: 00 Lb 00: Lipo Monitoring is Off Lb 02: 2 Cell Lipo (7.4V Nominal) LB 03: 3 Cell Lipo (11.1V Nominal) LB 04: 4 Cell Lipo (14.8V Nominal)

PolarStar LIMITED 6 MONTH WARRANTY

This PolarStar product is protected by a Limited 6 Month Warranty. This warranty is limited to the product being free of manufacturer defects in materials and workmanship. PolarStar will repair or replace said products or part thereof which upon inspection by PolarStar are found to be defective in materials or workmanship. This warranty does not cover damage caused from misuse, abuse or neglect of maintenance.

As a condition to the obligation of PolarStar to repair or replace said product, the product must be returned to PolarStar together with a copy of the products original proof-of-purchase.