

Firing Rate Control System for SA80 AEG

Controlling the Firing Rate of SA80 AEG: semi-automatic and burst firing

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Background

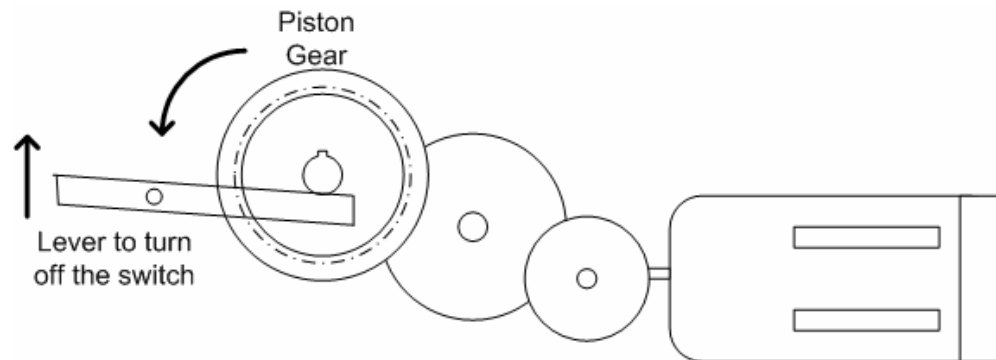
How semi-automatic works of AEG

The one and only one method – STOP CURRENT SUPPLY TO MOTOR

As all of the reader knows, AEG is powered by motor. The motor turns the gears and pull the piston back and forth, which in turns compress the air inside the cylinder and push the BBs out the barrel.

If the motor is free running, BBs are fired out in a continuous way. This is so called “full auto” firing, and that’s why AEG is called “Automatic Electric Gun”.

If semi-automatic mode is selected, a mechanical system is enabled to cut off the motor’s current supply when the piston gear rotates for one turn. In fact this mechanical system is a lever which disconnects from the main switch.



As shown in the above figure, the piston gear forces the level to turn off the main switch when it completes one single turn.

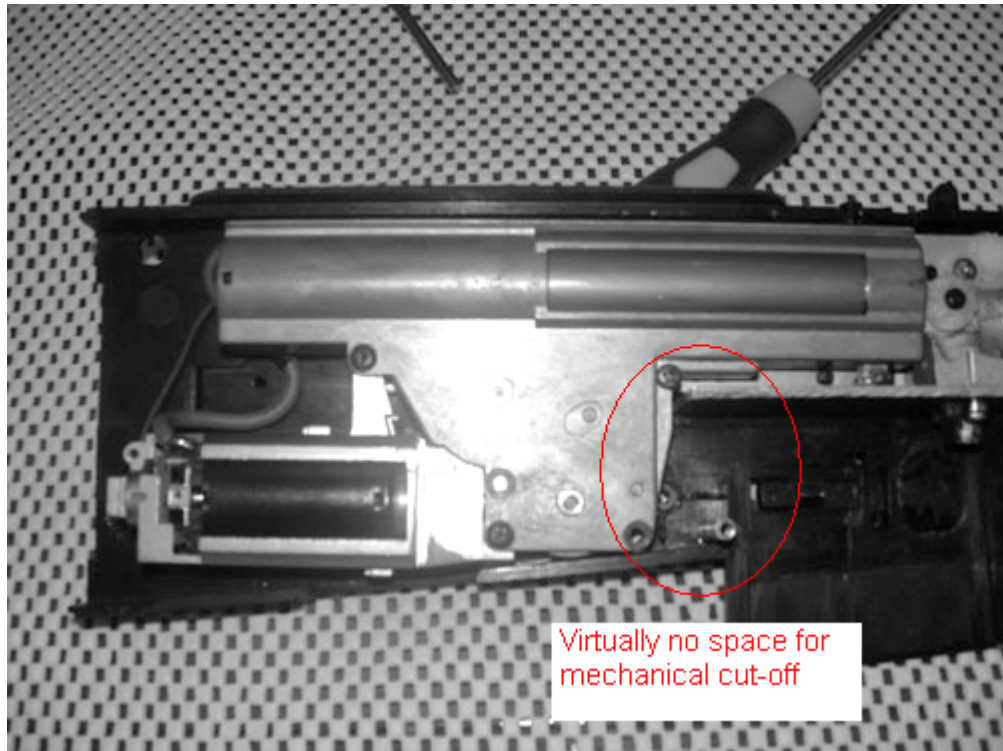
Chapter
2

SA80 Limitation

Version 6 Gearbox – P90 gearbox

Space, space, space

For a SA80 with Version 6 gearbox, there is no space to deploy the P.90 mechanical current cut-off method as mention in chapter 1.



As you see on the above figure, the P.90 mechanical switch box cannot accommodate into the SA80 case because it will block the magazine well.

A Electrical Method

Cuts off the motor's current supply in the first round, electrically!!

Electrical cut-off method

Since there is no space for the mechanical switch box, an electrical cut-off method is deployed. As shown on the above figure, a small switch is mounted on the lever, which turns on when the lever moves upward. The steps of a semi-automatic cycle can be summaries as:

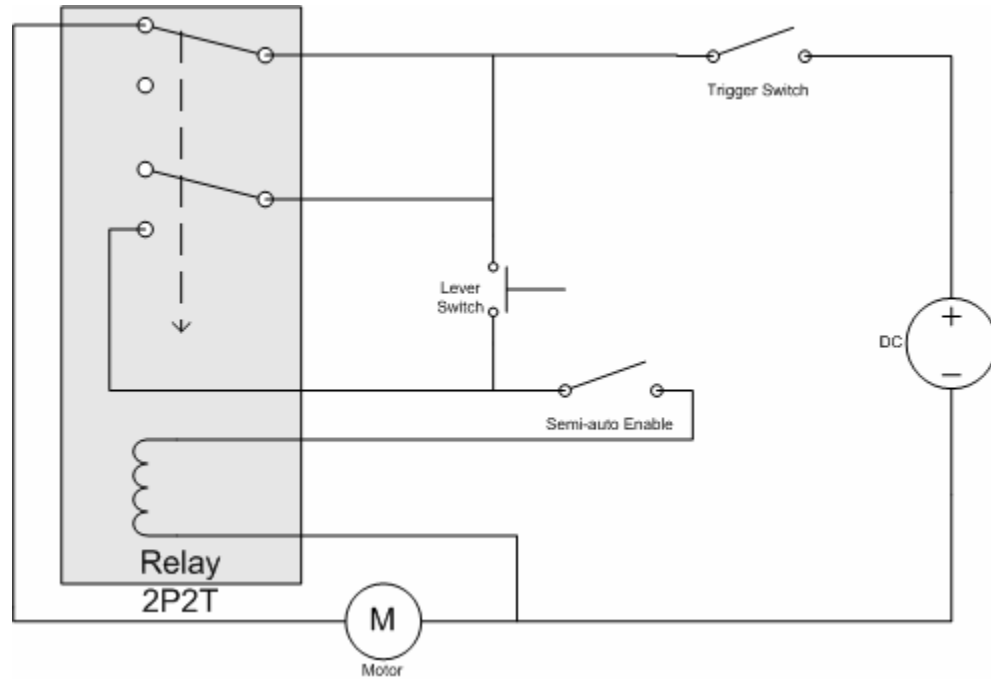
- 1) Motor is started when the trigger switch is turned on. Gears start to run.
- 2) The piston gear turns one round, which in turns moves the lever upwards.
- 3) The small switch is turned on by the lever, which cuts off the power supply to the motor.

Hey, what's next?

What the hell is the small switch cut off the power?

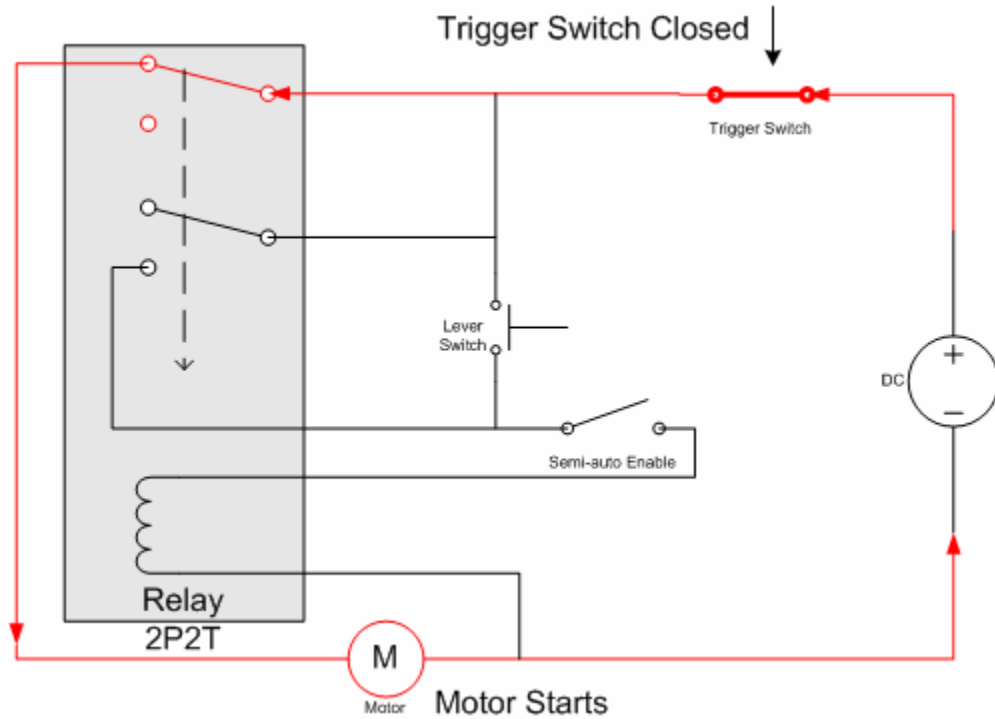
Simplest Way, use a single relay

The small switch on the lever will be used to trigger the relay, which turns off the power from the main battery. The schematic of the circuit is shown below:

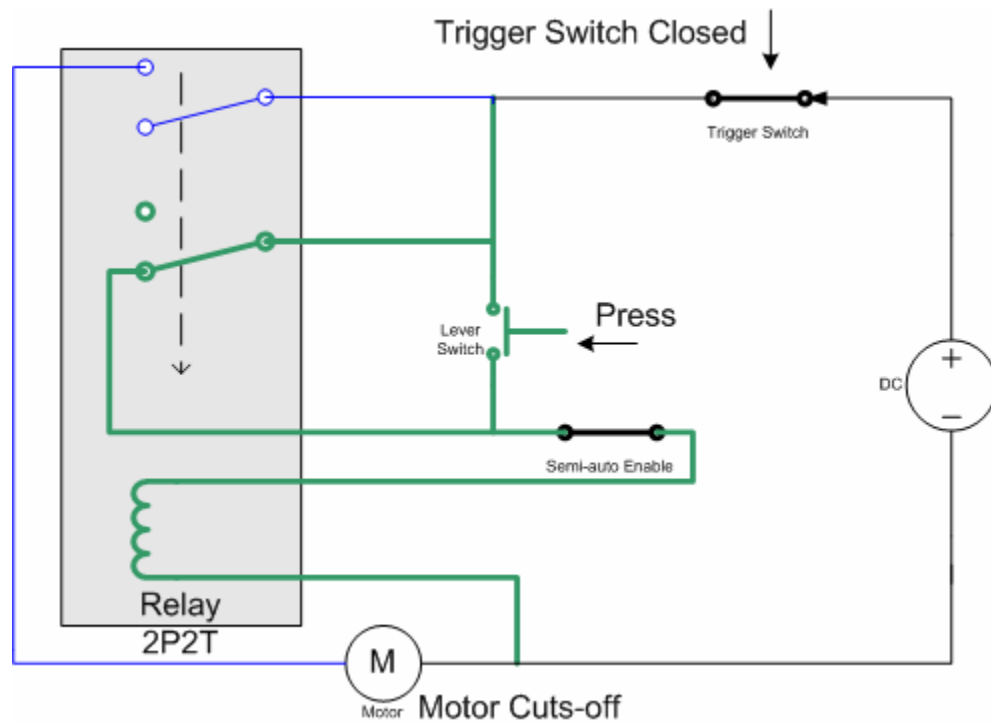


How it works??

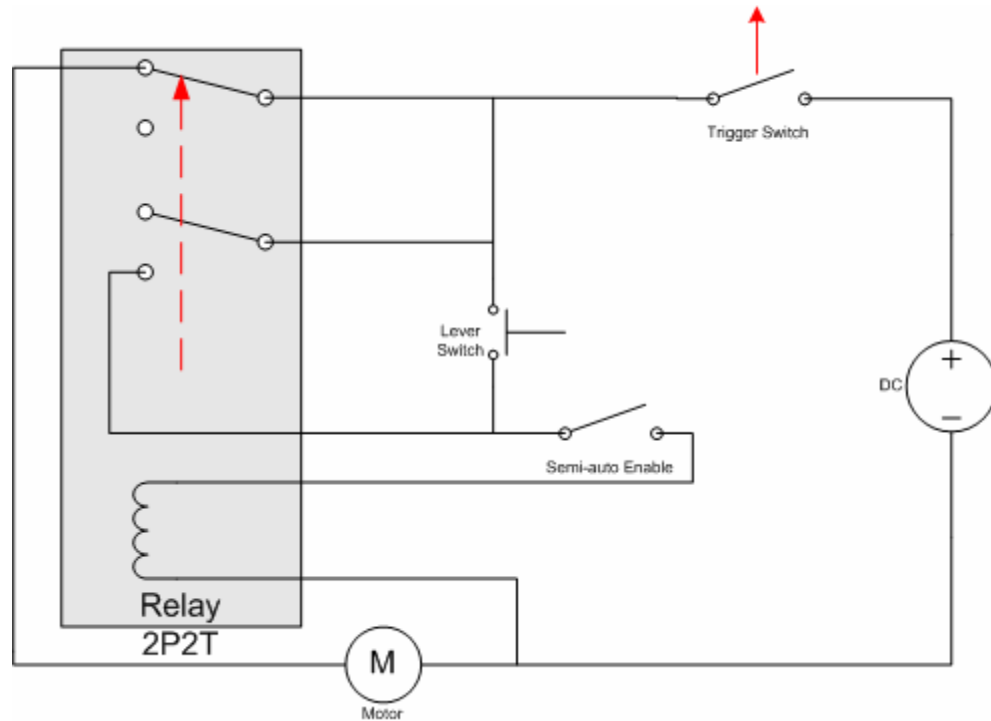
Phase 1: When the trigger is pulled, the motor starts, and the gears starts to run. The current flow is indicated by the **RED** path. When the piston gear turns one round, it will push the lever upwards and push the Lever Switch



Phase 2: The lever switch is pushed and turns on the relay. When the relay is on, it keeps itself on by the current indicated by the **green** path. The motor current is cut off (indicated in **blue**).



Phase 3: Trigger switch is released. The relay is turned off and everything goes back to phase 1 when the trigger switch is released.



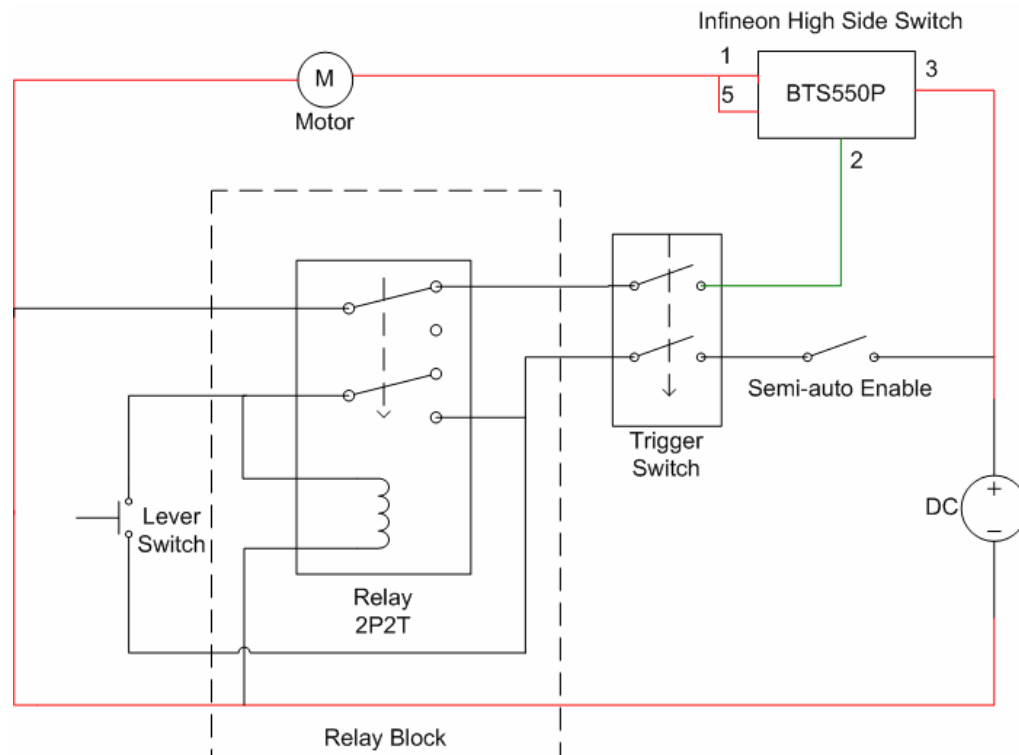
Drawbacks of Using Relay

As all of you know, the instantaneous current drawn from the motor during startup is huge. It sometimes exceeds 15 Amps, depends on the power of the piston spring you use. This implies a high current rating relay is required. Besides, the spark of the relay contact during motor startup/shutdown reduces the life cycle of relay.

An Improved Method, by using High Side Switch

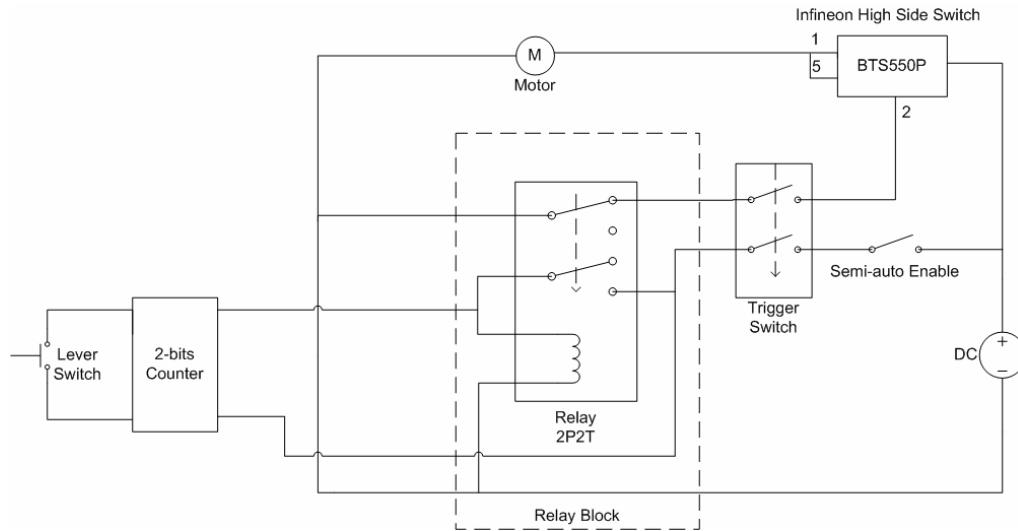
A High Side Switch can be used to replace the relay, and eliminate the drawbacks as mentioned above.

The schematic is shown in the following figure. The main current flows through the red path, which does not pass through the relay contacts. This eliminates the contact burns problem of using relay, however, the High Side Switch is quite expensive. The High Side Switch can be replaced by high power FET devices, but of course FET does not have overload protection and short circuit protection.



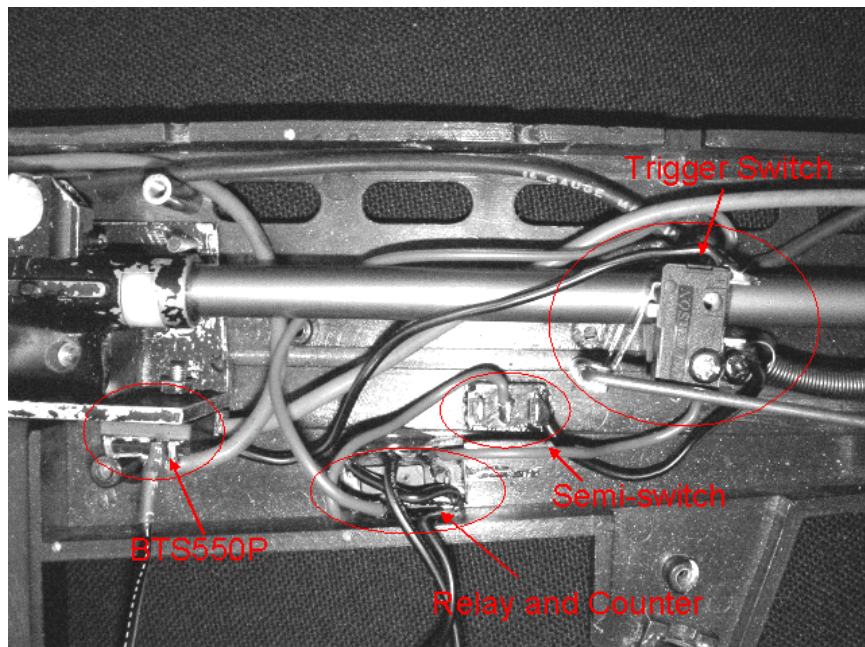
Further Improvements – 3 rounds burst

A 3-rounds burst firing can be achieved if the relay is turned on after 3 successive pushes of the Lever Switch. This can be done by using a simple counter as shown below:



The 2-bit counter triggers the relay when the Lever Switch is pushed twice. If you want other burst count, you can replace or program the counter as you like.

Everything in the box



Acknowledgements

Special thanks to Mr. Jeffrey Ho, who contribute complement samples of BTS550.

Thanks to Mr. Kevin Lam kindly provides suggestion to this document