Perun HPA Trigger Board V3

User and installation manual

Perun HPA Trigger Board replaces mechanical contacts in your HPA system and provides lots of useful features. Optical and magnetic sensors eliminate moving parts that are prone to damage, thus increasing the reliability. The elasticity of this unit gives you certainty, that replica made from parts made by different manufacturers will not have any incompatibility issues. Adaptive trigger control allows switching from a very short trigger travel to a long one even in the field, with almost any trigger, including stock ones.

Reading this manual will help you fully exploit this unit's potential and in case of encountering any problems, you can look for solutions to them here.

Manufacturer:
Perun Tech Sp. z o. o.
Barwicka 8 St.
60-192 Poznań, Poland
e-mail: info@perunairsoft.pl

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1. Technical data

Compatible Perun accessories

Perun HPA Trigger Board V3 works with Clicker V3. Magnet holder is compatible with that of Perun V3 Hybrid.

Compatible HPA engines

Perun HPA Trigger Board was designed to work with FCU's made by:

- Polarstar (F1, F2, Jack)
- Wolverine (Heretic, Hydra, SMP, Reaper, Inferno gen 1 or gen 2 engine with Premium electronics; will not work with FCU's that have trigger and selector switches already built into the FCU like the Spartan)
- Redline (N7, only electronically controlled versions with an FCU)

⚠ Redline FCU's programming mode cannot be reached when used with Perun HPA Trigger Board. A separate traditional trigger board operated by hand and possibly also an additional wire rig is required to enter the programming mode of the FCU.

⚠ **WARNING!** Perun HPA Trigger Board **does not work** with **T238 and Gorilla FCUs** due to different electronic design compared to other FCU manufacturers! Combining Perun HPA Trigger Board with those FCUs can result in damage to both electronic boards.

Compatible gearboxes

Perun HPA Trigger Board are designed to fit version 3 gearboxes in Tokyo Marui standard, **as well as those using a microswitch**, like Arcturus or Nuprol.

Perun HPA Trigger Board V3 was successfully tested in and should fit **without the need for any modification** in V3 gearboxes made by following manufacturers: Arcturus, ASG, E&L, LCT, G&G, JG (including Echo 1 versions) and Ultimate. Grinding of the contacts screw area is needed in Cyma gearboxes. Please be advised that despite our best efforts to provide reliable information, we cannot guarantee full compatibility for all the gearbox shells mentioned above. Replica manufacturers sometimes slightly change dimensions of their parts from batch to batch, bringing need for some adjustment or in extreme cases, making them incompatible.

Recommended power sources

Perun HPA Trigger Board works with any power source that provides a voltage between 4 and 20 volts. Whatever powers the FCU will also be fine for Perun HPA Trigger Board.

Stand-by current consumption

Whenever the battery is connected and selector is set to "SAFE", unit consumes 0.15 mA of current. While unnoticeable during normal play, together with current consumed by the FCU it may deplete your battery completely and damage it, if you store the replica with battery connect for a week or more. Therefore, always remember to disconnect the battery after use.

2. Warranty and liability limitations

Warranty

We offer a 24-month warranty on this electronic trigger unit from the date of retail purchase. This warranty covers defects in materials or workmanship under normal use conditions. The warranty does not cover:

- Damage caused by improper installation, misuse, or neglect.
- Any alterations, modifications, or repairs made by unauthorized persons or third-party services.
- Damage resulting from the use of third-party components or accessories not approved by the manufacturer.
- Wear and tears are due to regular use or external factors such as extreme conditions.
- Any incidental, consequential, or punitive damages, including damage to the airsoft replica or any other parts such as the gearbox, motor, or batteries, arising from improper use of the trigger unit.

Claims Process

To submit a warranty claim, contact our customer service team at info@perunairsoft.pl with a detailed description of the defect. If your claim is approved, we will repair or replace the unit at our discretion. This warranty does not cover shipping costs for returning the product. This warranty gives you specific legal rights, and you may have other rights which vary depending on your region.

Limitation of Liability

The manufacturer and its affiliates are not liable for any personal injury, damage, or loss of property arising from:

- Improper installation or use of this product.
- Failure to follow the instructions provided in this manual.
- Use of the product in a manner not intended or recommended by the manufacturer.

3. How does it work?

Perun HPA Trigger Board uses optical and magnetic sensors for the detection of trigger and selector plate position. It has no moving parts at all. That provides not only great reliability but also flexibility, thanks to which Perun HPA Trigger Board will work without problems in almost any combination of gearbox shells, triggers and selector plates.

Selector sensor

There are two selector sensors on Perun HPA Trigger Board. These sensors work by emitting infrared (IR) radiation and detecting how much of it is coming back to them due to reflection from nearby objects. White objects reflect most of the IR, while black almost none. Objects must be very close (less than 1mm) to the sensors to be detected, so lack of anything above them also results in no readings.

When the white area on the selector insert is above the “SEMI” sensor, it is reflecting IR back to it, letting the unit know that the corresponding selector position has been set – provided that the sticker is well placed. The same principle works for “AUTO”. “SAFE” is detected, when the white area on the sticker is not present above any of the sensors.

Selector calibration allows selector sensors to work properly even if the selector plate insert is not in the perfect position.

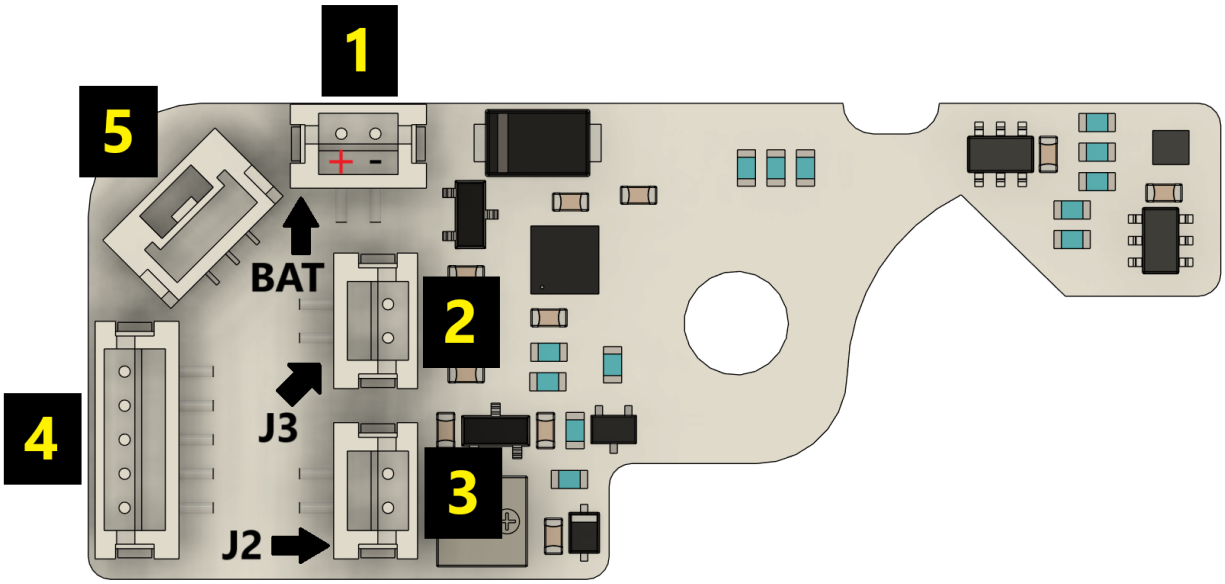
Trigger

Hall-effect sensors are monitoring the magnetic field generated by the magnet in the magnet holder installed on the trigger. These readings are then conveyed to the microcontroller of the unit, which depending on the sensitivity setting and trigger position, may trigger a shot. The magnetic sensors are also able to detect whether an external magnetic object is present near to the replica and in such case, will activate external magnetic field alarm to prevent an unintended shot.

4. Installation

Pin output

HPA Trigger Board V3 has the following sockets:



1. **Battery connection.** Plug in the wire that comes with Trigger Board here, to power it up. Power the FCU through the same wire using the additional socket.
   This is the only socket which will always be used regardless of HPA engine brand that the Trigger Board is connected to. Positive pin is to the left and negative to the right (see sketch).
   ⚠ **Applying power supply with reverse polarity will permanently damage the unit!**
   Socket manufacturer: JST, type: ZH, 2 pin
2. **Nozzle solenoid**. Responsible for controlling the movement of the nozzle that loads BBs into the hop-up chamber.
   Applicable only in dual solenoid systems (for instance Polarstar F2).
   Works only when a Polarstar-compatible FCU is also connected via the 5-pin interface socket.
   Socket manufacturer: JST, type: ZH, 2 pin
3. **Poppet solenoid**. Controls solenoid, which releases compressed air to propel the BB.
   Works only when a Polarstar-compatible FCU is also connected via the 5-pin interface socket.
   Socket manufacturer: JST, type: ZH, 2 pin
4. **5-pin interface socket.** Serves as the interface between the solenoids and the FCU in Polarstar, Redline and other Polarstar-compatible systems.
   Socket manufacturer: JST, type: ZH, 5 pin
5. **Wolverine socket.** Used to connect to the Wolverine FCU.
   Socket manufacturer: JST, type: GH, 3 pin

Most likely connections schemes are:

a) **Polarstar-compatible systems** - 1 (power), 2 (nozzle; **applicable only in dual-solenoid engines**), 3 (poppet) and 4 (to FCU)
b) **Wolverine** - 1 (power) and 5 (to FCU)
c) **Spark Labs Wolf** - 1 (power) and 4 (to FCU, requires custom made wiring)

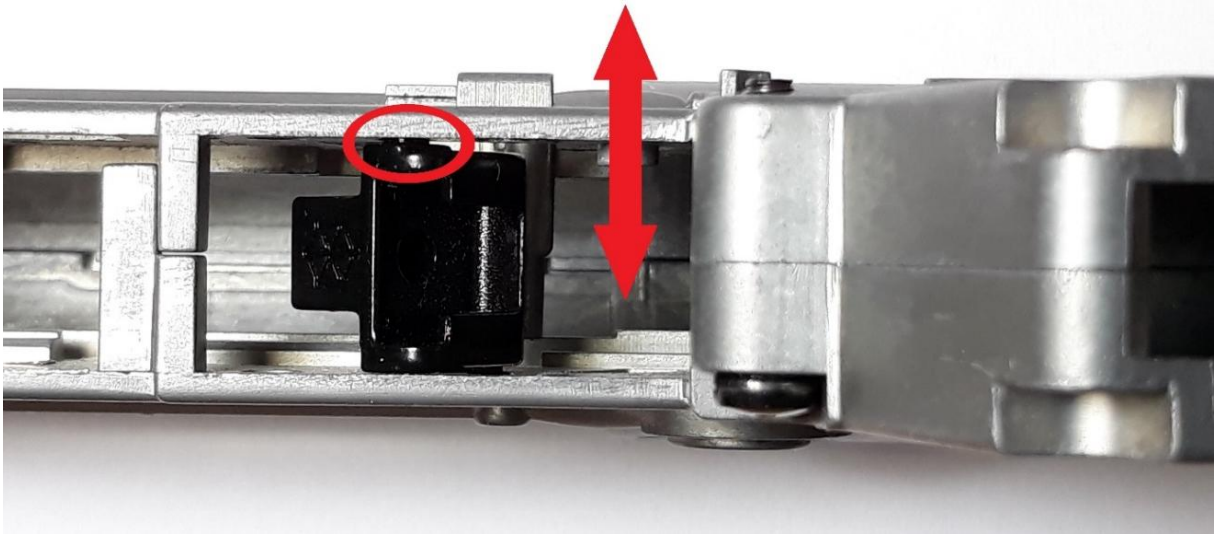
Spark Labs Wolf connection

To use HPA Trigger Board V3 with Wolf engine, custom cable has to be used with pinout as shown below. On the Trigger Board side, 5 pin JST ZH plug should be used, while on the Wolf side, 8 pin JST ZH plug is recommended.
Be advised that in many cases it might be difficult to fit both Wolf FCU and Trigger Board inside the gearbox and some grinding of the shell might be necessary to free up space.
ZH connectors with less pins can be used if 5 and 8 pins are not easily available. ZH plugs with less pins fit into bigger sockets after shaving some of the material on the side of the plug.

Installation

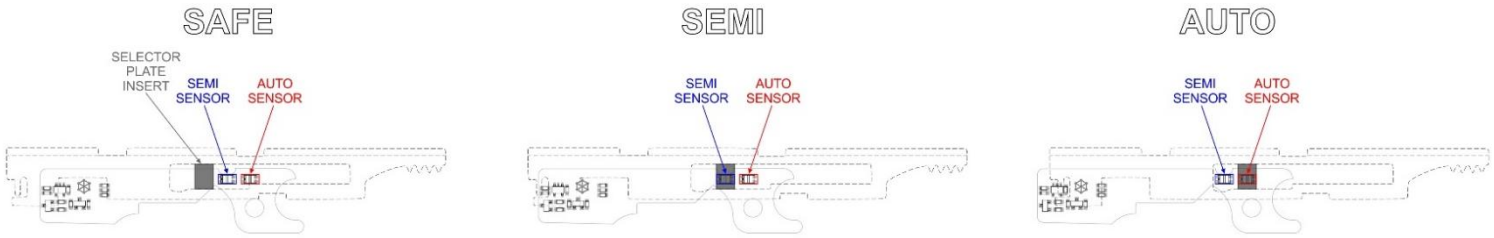
A note for AK-type replica users – because AUTO and SEMI in AK's are reversed in comparison most systems and we need to hold to single terminology, ***for the time of installation let us assume a "SAFE->SEMI->AUTO" selector setting****, like in most replicas. After the installation is finished, you will be easily able to set a standard AK "SAFE->AUTO->SEMI" setting.*

1. Disassemble the replica and the gearbox. Remove everything from the gearbox.
2. Place only the magnet holder in the gearbox and screw the shell back. Check whether the magnet holder does not have too much space and can move to the sides, as shown on the photo below.



If there is too much space, limit the play using standard AEG washers, exactly the same as the ones used for shimming the gears. The height of the washers should be such that the **magnet holder can wobble only a little bit, while it can still move completely free and without resistance**. It is very important, as either too much sideways play of the holder or friction, which would cause it not to return to exactly the same position each time the trigger is released, could result in faulty functioning of the unit, including activation of the "external magnetic field" error code.

3. Screw Perun in place. Make sure it is held firmly by the screw and **does not wobble**. Do not worry about the PCB, as in the screw area there are no electronic paths, and you do not need to use any gaskets. Do not use excessive force, though.
4. Tear one of the selector inserts off the provided 3-piece set and cut it (or even better – sand it down) to a length that will make it tightly fit in the selector. **The insert should be as close to the sensors as possible!** The horizontal black lines on the selector are there to help you better control how much material you remove and to do it evenly. Make sure that they face upwards (outside of the gearbox) after installation. The sketch below shows, how does the selector sensor work and how should the selector insert be placed in relation to the selector sensors. For some more popular replicas you can also **refer to selector insert placement guide on page 11.**
   Use the scheme shown above to find the right spot to place the insert and apply a small amount of cyanoacrylate glue to fix it in place.

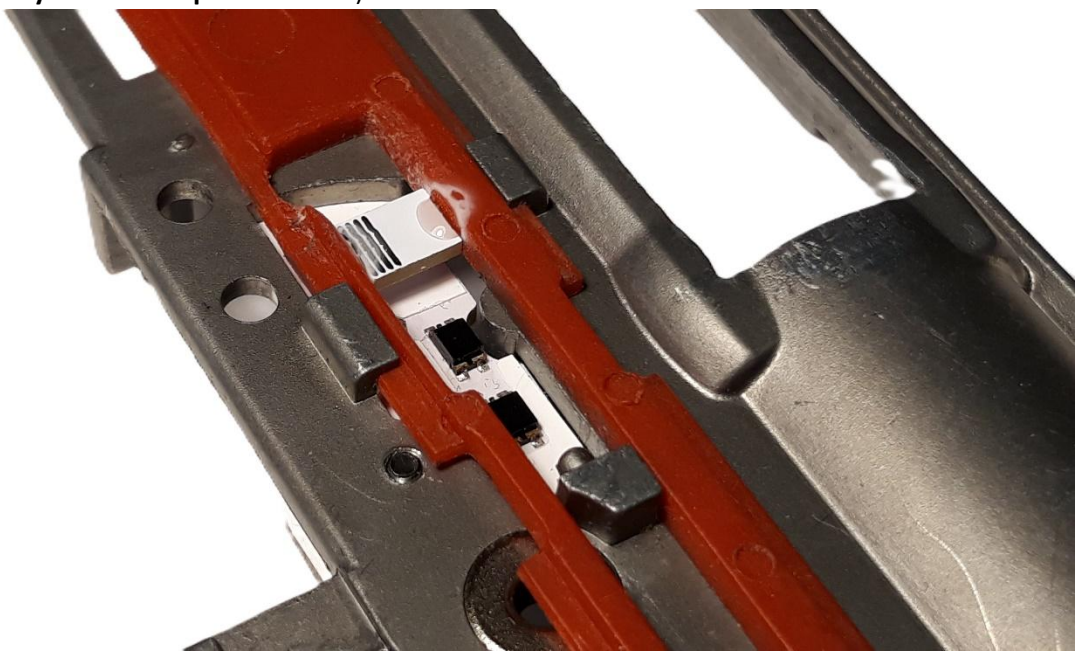


Selector plate insert is to the left of the semi sensor.

Selector plate insert is above the semi sensor.

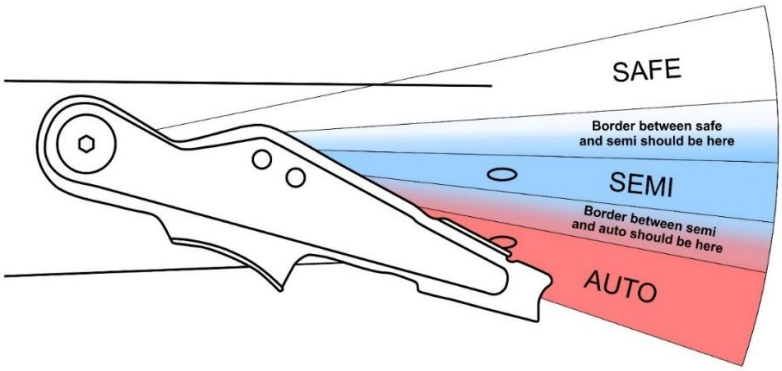
Selector plate insert is above the auto sensor.

The result should look like on the photo below (**the exact placement of the selector plate insert may vary between replica models!**):

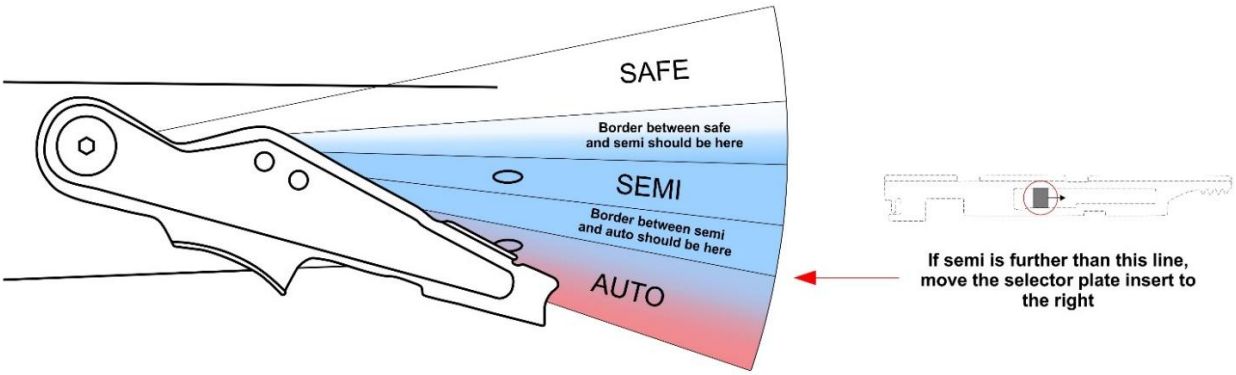


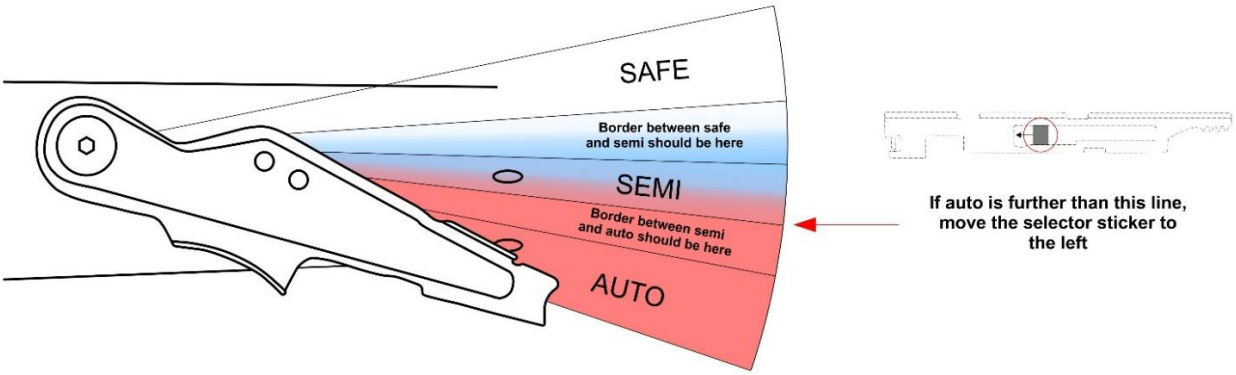
5. Assemble the gearbox only with the sector gear, Perun, and the trigger inside.
6. Put the gearbox in the receiver, install the selector lever.

7. Connect the battery to the electronic board and use the **Sensor check feature (details on page 11.)** to verify, whether all the sensors work properly. The selector should work in the following way:



Above is shown an ideal case, with perfectly placed selector insert. However, it is quite hard to find this perfect spot after first try. If the readings are only a little bit off, selector calibration can make up for that and after calibration selector should work correctly. However, if the readings are highly incorrect or the calibration is unsuccessful, try moving the selector insert according to guide below. The selector's calibration should not be done at this stage!





8. If everything works correctly, remove the gearbox from the receiver.
9. Open the gearbox again and put the rest of the components inside. Connect Perun HPA Trigger Board to the power and the FCU using provided adapters and signal cables.
10. Assemble the gearbox. Put the whole replica together. Watch out for the wires, make sure that the insulation does not get damaged during the assembly!
11. It is recommended to check for any short circuits between the plugs, gearbox and body using a multimeter.
12. Perform the selector calibration.

5. Selector calibration

There are two modes for the selector plate detection – **default** and **calibrated**. **Default is the factory setting** and relies on correct placement of the selector plate insert and may not always be perfect. It is recommended to perform selector calibration in all cases. After successful calibration, selector will be in the **calibrated** mode. **After each unsuccessful calibration selector will return to default mode.**

To perform the selector calibration have the replica is wholly assembled. It should only be done now, after installation, once all the components are in place.

1) Enter Sensor Check Mode

Connect the battery and pull and hold the trigger while LED blinks yellow immediately after start.
A slow blinking yellow LED that stays more than a few seconds means sensor check mode is active.

2) Start Calibration

Pull and hold the trigger. The LED should turn solid violet while the trigger is held.
After a few seconds, the LED will start rapid white blinking – calibration has started.

3) SAFE Position Calibration

Set the selector to SAFE. Hold the trigger until the LED turns green, then release.
The LED should now blink blue rapidly.

4) SEMI Position Calibration

Set the selector to SEMI. Hold the trigger until the LED turns green, then release.
If all went well, the LED should now blink red rapidly.

⚠ *If instead of seeing green LED and then red, you immediately see red and then it returns to blinking yellow, it means that system didn't detect a change between SAFE and SEMI and you are back in the sensor check mode. Refer to Unsuccessful Calibration below.*

5) AUTO Position Calibration

Set the selector to AUTO. Hold the trigger until the LED turns green, then release.
If you see a red LED, go to Unsuccessful Calibration.
The LED should now blink blue rapidly.

⚠ *If instead of seeing green LED and then blue, you immediately see red and then it returns to blinking yellow, it means that system didn't detect a change between AUTO and SEMI and you are back in the sensor check mode. Refer to Unsuccessful Calibration below.*

6) Final SEMI Confirmation

Set the selector back to SEMI. Hold the trigger until the LED turns green, then release.
Red LED? See Unsuccessful Calibration.

7) Verify Calibration

Stay in sensor check mode.
Switch through the selector positions and check if the LED colors match:
SAFE → White
SEMI → Blue
AUTO → Red

Unsuccessful calibration

If the calibration was unsuccessful, this could be due to following problems:

1. Improper positioning of the selector plate insert.
2. Problems with the selector plate. Make sure that it does not have too much slack.
3. Failure of selector sensor. If selector sensor does not react at all to any movement of the selector plate insert (no white, blue or red signals in sensor check), it is most probably damaged and you should contact Perun.

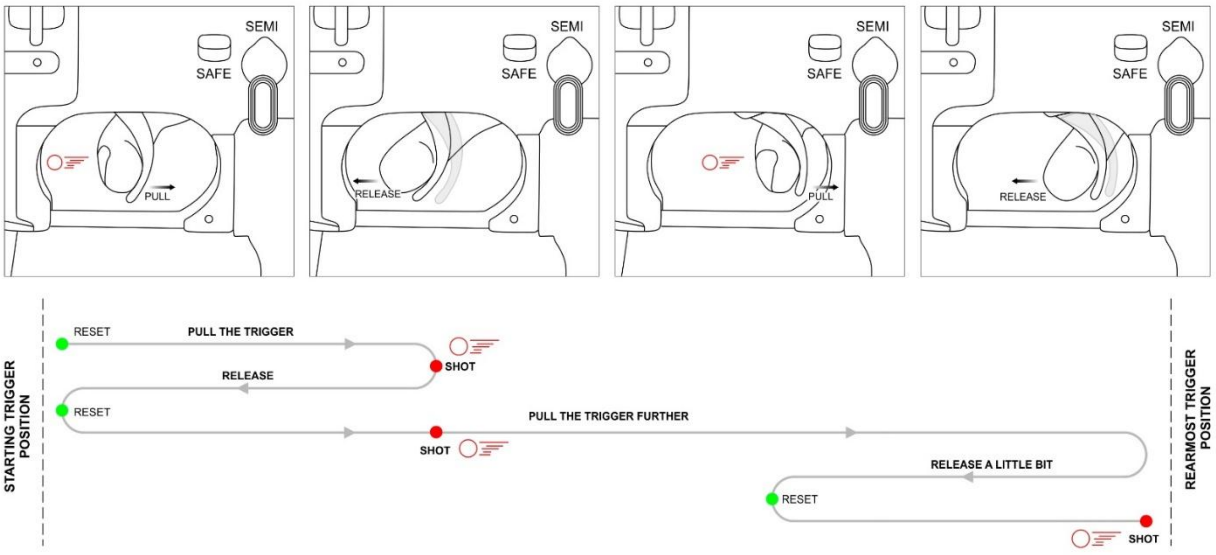
6. During the start-up

Every time, when connecting the battery to the replica, Perun will quickly blink yellow for a couple of seconds. If during that time the trigger will be pulled and held, Perun will enter the sensor check mode. If you do not want to activate the sensor check, just wait until the LED turns green, which signals successful initialization. After that LED will remain dark until you enter the programming mode or an error is detected.

7. Adaptive trigger control

Each time the battery is connected, Perun senses the trigger resting position and uses it as a reference (therefore, make sure to never pull the trigger during startup). Depending on the current trigger sensitivity setting, Perun will automatically fire after the trigger has traveled a long enough distance. This allows very short trigger pulls with no trigger modification needed whatsoever and the trigger sensitivity changes possible even in the field.

When in normal semiautomatic mode, the Perun Trigger Board uses the adaptive trigger activation method. This means that the trigger threshold and reset points are mobile and move together with the trigger, as shown on the sketch below:



This results in two things:

1. If high trigger sensitivity is set, in most cases (depending on the trigger model) you should be able to pull the trigger all the way back and shoot by only slightly releasing it from the rearmost position and pulling it again. It also allows to easily “spam” in the semiautomatic mode because you only need to quickly pull the trigger, not necessarily having to make sure it is fully released. This might be a point of interest, particularly for speedsoft players.
2. For players looking for more realism, what might be important is that the trigger must always be reset (released) a certain distance before another shot can be taken, which is noticeable at lower sensitivities. This emulates how triggers in real firearms work and provides a greater degree of control.

For trigger sensitivity levels from 1 to 6, adaptive trigger control checks how far the trigger can mechanically travel after each battery connection. **Because of that, trigger pull for the first shot will always be shorter, when trigger sensitivity levels 1-6 are set.** The second stage in 2-stage trigger will also be activated faster during the first pull.

8. Features and programming

To enter the programming mode:
For "SEMI" – keep the selector on "SEMI" for a couple of seconds, then go to "AUTO" and back, twice and very fast! ("SEMI" → "AUTO" → "SEMI" → "AUTO" → "SEMI")
Successful entry into the programming mode for "SEMI" will be confirmed by **a blue LED light.**
For "AUTO" – keep the selector on "AUTO" for a couple of seconds, then go to "SEMI" and back, twice and very fast! ("AUTO" → "SEMI" → "AUTO" → "SEMI" → "AUTO")
Successful entry into the programming mode for "AUTO" will be confirmed by **a red LED light.**

Switching the selector between "AUTO" and "SEMI" and back allows to move between the modes. Pulling the trigger allows to enable, disable, or set levels for the modes.

⚠ *Programming is only possible within 5 minutes after connecting the battery or after the last time the programming mode was active.*

Full feature description

All the settings are set independently for "SEMI" and "AUTO" selector positions, except for Li-Po alarm and Master reset, which work for both selector positions.

Function and LED color	Description
Firing mode Green	Choose one of the firing modes for any selector position: safe, semi, auto, binary, and progressive. Steady green light – safe 1 short blink – semi 1 long blink – auto 2 short blinks – binary (allows the semi shots to be triggered not only during the pull, but also the release of the trigger; hold the trigger for 2 seconds to cancel the second shot) 1 short blink followed by 1 long blink – progressive (progressive allows firing semi after pulling the trigger slightly, and auto when the trigger is pulled further; auto can be replaced by burst, if the latter is programmed for "AUTO" selector position on the FCU)
Trigger sensitivity Violet and yellow blinking alternately	This parameter decides how sensitive is the trigger. 5 levels are available, which results with a shot after the lower tip of the trigger travels roughly: 1 – 6 mm 2 – 4 mm 3 – 3 mm 2 – 4 mm 5 – 2 mm 6 – 1.5 mm 7 – 0.1 mm 8 – 0.5 mm ⚠ *Those are approximate values and may vary depending on parts used.* 1 to 8 signals while the LED blinks violet and yellow alternately indicate sensitivity levels from 1 (the lowest) to 8 (the highest).

Function and LED color	Description
DMR mode  Purple	DMR Mode allows only semiautomatic shots and limits their frequency as well. Its main use is for high power DMR-styled replicas on fields, which demand such limitations. 0.25s, 0.5s, 1s, 2s and 3s intervals are available. LED glowing steady purple means, that DMR mode is disabled. 1 to 5 blinks indicate interval levels from 1 (the shortest) to 5 (the longest).
Master reset  Red	Master reset returns the unit to the factory settings. To reset, pull and hold the trigger for 2 seconds or simply wait 10 seconds while the LED glows red and until the reset takes place without using the trigger. Blinking red confirms return to factory settings.

9. Factory settings

New units and units where master reset was activated will have modes set in the following way:

- Firing mode – semi on “SEMI” and auto on “AUTO”
- Trigger sensitivity – level 4
- DMR Mode – disabled

10. Diagnostic system and trigger speed training

Perun HPA Trigger Board has a diagnostic system that will help you find the source, should you encounter a problem. After the battery is connected, the unit undergoes a start-up check, to make sure that replica is ready to work. Successful completion of this check is indicated by a short green blink of the LED.

Problem and LED color	Description
An external magnetic field was detected  Red and violet blinking alternately	External magnetic field (originating not from the trigger magnet) was detected by trigger sensors. The unit will be blocked until the source of the magnetic field is not removed.
Sensor hardware error 1  White and green blinking alternately	These errors can only appear at startup. A hardware error has probably occurred. Try disconnecting the battery and connecting it again. If that will not help or the problem will be return at some point, contact our tech support at info@perunairsoft.pl
Sensor hardware error 2  Violet and green blinking alternately	

Other known problems:

Problem	Cause	Solution
External magnetic field error appears, despite no external magnet being close to the replica	Trigger was being held at startup.	Reconnect the battery and do not hold the trigger during the startup.
	The trigger has too much slack and can move sideways, which can activate the error.	Shim the trigger so, that it cannot move sideways, only back on forth.
	The triggers movement is obstructed and when it is released, it may end up in slightly different positions. If at some moment the trigger will move further back than it was at startup, this can activate the error.	Make sure the trigger can move freely and completely unobstructed.
		Use stronger trigger spring.

In case of any technical questions, please contact us at: info@perunairsoft.pl

11. Sensor check and trigger speed training

To check selector and trigger readings, immediately after connecting the battery pull and hold the trigger while the LED on Perun's electronic board shows quickly blinking yellow light. After you enter the sensor check mode, it will be active for 5 minutes, after which the unit will shut down. To restart it, simply reconnect the battery and hold the trigger shortly after.

Sensor check mode can also be used to practice fast shooting on semi. Each trigger pull will be accompanied with a short sound signal made by beeper on the electronic board. This sound is louder than click of the solenoid valve working idly, when the engine is not pressurized. This allows to hear feedback from the trigger quite well, without having to use up pressured air. Be advised, that in the sensor check mode, trigger is always set to sensitivity level 7 and that adaptive trigger control does not work here, so your experience in the normal firing mode can be different. "Normal" shooting will usually be easier and faster.

LED color	Sensor
Sensor check Yellow, blinking	None of the sensors detect any change at this moment.
Selector switched to "AUTO" Red	This should happen after the selector is switched to "AUTO".
Selector switched to "SEMI" Blue	This should happen after the selector is switched to "SEMI".
Selector switched to "SAFE" White	This should happen after the selector is switched to "SAFE".
Trigger Purple	Trigger pull detected. Each trigger pull will also be accompanied with a short sound signal.

12. Selector insert placement guides

Below you will find guides to the placement of the selector plate insert for some of the more popular replicas. These are our recommendations based on replicas on which we have worked on ourselves. Please keep in mind, that the following parts must be original to make this guide work:

- gearbox,
- selector plate,
- receiver,
- selector lever
- other selector system parts.

Change in any of these parts may cause enough shift in the selector plate insert so that it will need some corrections.

We also cannot guarantee immediate success even if the replica is fully stock, because differences in dimensions can occur between various models made by the same manufacturer or different batches of the same model. If the selector does not work as it should, refer to correction guidelines shown on page 6 of the installation manual.

We advise to print the guide and use it as a stencil for precise and convenient placement of the selector plate insert. Make sure that the print configuration is set to real size.