PERUN

V2 *OPTICAL*

Installation manual

This is a manual for technicians, who will be installing Perun V2 *Optical* in the replica or a gel blaster. Be sure to also read the user manual, so that you can properly test the replica. Installation can only be done by experienced airsoft technicians. The warranty does not cover damages resulting from incompetent montage.

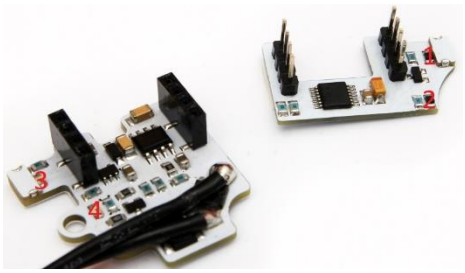
Table of contents

1. How does it work? 2
2. Compatibility 3
2.1. Compatible gearbox shells 3
2.2. V2 long/SR25 3
2.3. DSG/short stroked gears 3
2.4. Max Torque gears 3
2.5. Main spring rate and rate of fire 3
2.6. Batteries 3
3. Perun V2 *Optical* installation 4
4. First run 7
5. Fuse 7
6. Factory settings 8
7. Hair trigger 8
8. Troubleshooting 9

1. How does it work?

Perun V2 *Optical* uses optical switches for the detection of sector gear, trigger and selector plate position. It has no moving parts at all. That provides not also great reliability but also flexibility, thanks to which Perun V2 *Optical* will work without problems in almost any combination of gearbox shells, triggers, selector plates and sector gears.

Key elements:
1 – sector gear optical sensor (little black element)
2 – trigger optical sensor (little black element)
3 – sector gear IR LED diode (little yellow element)
4 – trigger IR LED diode (little yellow element)



Optical sensors and IR LED diodes work in pair as a barrier switch. If the trigger is at rest, it obstructs vision between the trigger sensor and diode. Once the trigger is pulled, the infrared radiation flows from the diode to the sensor signaling that a shot should be fired. This way the mechanical trigger lock can be retained. It also allows for the "hair trigger" modification (see more on page 7).

The same principle is used for the sector gear. When sensor (1) and diode (3) are obstructed, it means that a gear tooth is between them. Perun V2 is using information whether gear teeth are present or not, to determine which gearbox cycle phase is currently taking place. Algorithm used for counting teeth allows any gear to be used and no adjustment has to be made to enable compatibility with DSG, short-stroked or SR25 gears. The only exception are Max/Infinite Torque gears, which are incompatible with Perun V2 *Optical*.

In Perun V2 *Optical*, "SAFE" mode is provided by stock mechanical trigger lock. To see the difference between "SEMI" and "AUTO" selector positions, the selector plate position is detected by an IR reflective sensor, which is indicated by a red circle on a photo to the right. It works by emitting infrared radiation and checking how much of it is mirrored back from the opposite surface. Most radiation is reflected, if the opposite surface is white and close to the sensor, and the least if it is black and far away (more than 5mm). When the selector is in "AUTO" position, the selector plate should be covering the selector sensor, and thanks to the white sticker delivered together with Perun, reflecting a lot of infrared radiation back to the sensor, indicating "AUTO" selector position.

When selector is in "SEMI" position, selector plate should not be over the optical sensor. Sensor then will have black body of the lower receiver in front of itself, reflecting little infrared and thus indicating "SEMI" selector position. In some replicas even in "SEMI" position selector plate will cover part of or whole sensor. In that case selector stickers with thin or thick black belt should be used.

2. Compatibility

2.1. Compatible gearbox shells

Perun V2 *Optical* was tested with positive outcome in gearbox shells manufactured by: **G&P, G&G, Classic Army, KWA (only old gen. 2), WE, Retro Arms, Ultimate, A&K/PJ, ZCl, JG and Specna Arms**. Gearboxes made by **E&L, ICS, SRC, Cyma and Krytac** require sanding down of some elements in the contacts area. In **Krytac**, after modification bolt catch may not function properly. Please note, that manufacturers make slight changes to their gearbox shells over time and in some cases some minor modifications may also be required in gearboxes listed above as fully compatible. This refers to gearbox shells in Tokyo Marui standard. Perun V2 *Optical* will not work in gearboxes diverging from that standard, like for example ARES EFCS. Perun V2 *Optical* is compatible with gel blasters based on V2 gearboxes.

2.2. V2 long/SR25

Perun V2 *Optical* can be used in elongated V2 gearboxes (also known as version 2.5) used in SR25 replicas and works well with sector gears with additional teeth used in them.

2.3. DSG/short stroked gears

Perun V2 can be used in replicas utilizing dual sector or short stroked gears. In case of DSG it is recommended to enable AB and disable precocking.

2.4. Max Torque gears

Perun V2 *Optical* cannot be used with Max/Infinity Torque gears, because in their case sector gear teeth are seen at all times, making cycle detection impossible.

2.5. Main spring rate and rate of fire

Perun V2 can be used with any main spring, as it was tested with positive outcome even with M210 spring. The highest allowed rate of fire is 50RPS.

2.6. Batteries

Allowed battery voltage - 7V to 17V, which permits use of the following battery types:
Li-Po, 2 to 4 cells (7.4V to 14.8V)
NiMH/NiCd, 8 to 10 cells (9.6V to 12V)
Li-Fe, 3 to 4 cells (9.9V to 13.2V)

Batteries with any discharge rate („C" parameter) or capacity (mAh) can be used, as long as they are strong enough to power the replica properly, while not getting hot themselves.

3. Perun V2 *Optical* installation

A video showing the installation procedure for Perun V2 is available under this link or QR code:
https://youtu.be/Noib9gou86k

However, please do not rely solely on the video, as the manual below contains vital details that need to be known to the technician installing Perun V2.

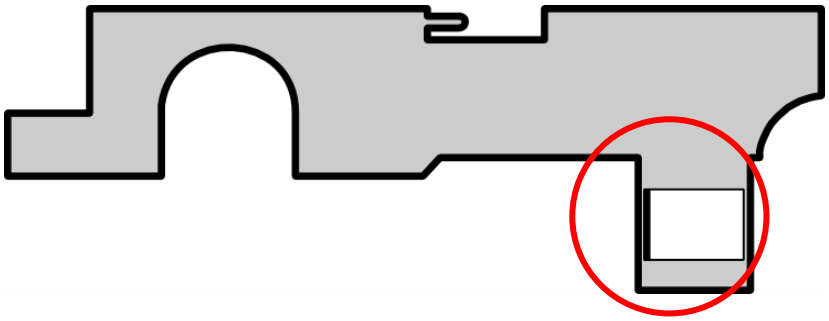
IMPORTANT: Make sure not to damage the wire insulation! If the wires get in contact with body or gearbox, that can easily transfer higher voltage from battery to the Peruns upper board and burn the microcontroller or other vital parts of Perun.
Wire damage can be a cause of warranty loss in case of malfunction.

If it is not absolutely necessary, avoid making changes to the wiring. Improperly earthed soldering iron can cause an electrostatic discharge which can damage the MOSFETs.

ATTENTION:

- *If Perun V2 was used before and will be installed in another gearbox or, if in the current gearbox trigger or selector plate will be changed, before disassembly, program Perun V2 to enter the **calibration mode** at next start-up. You can read more about **calibration mode** in "First run" section. To program **calibration mode** at next start-up, enter the programming mode, pull the trigger 12 times, then save settings by holding the trigger until a signal is heard.*

1) Disassemble the replica and open the gearbox.
2) Remove gears, contacts together with the wiring and the cut-off lever.
3) Remove any excess grease and clean the space were contacts used to be, as well as the vicinity of the sector gear.
4) Remove the selector spring. Degrease the selector plate and stick one of the two white stickers from the "Selectors stickers" kit on it, as shown on the picture below. If needed, it can afterwards be changed to the sticker with thin or thick black belt on it.



5) Check whether the right half of the gearbox has metal buttons that press wires into the wiring grooves. If it does, file them off. Perun V2's wiring may have larger diameter than

stock wiring. While closing the gearbox, the buttons can pierce the insulation and cause a short circuit.

6) If a back wired version is being installed, cover hole in the gearbox used for channeling wires to the front with rectangular black sticker (stick it from inside the gearbox). Before doing that, degrease surfaces to which the sticker will be attached.
7) Separate Perun V2's halves and screw the bottom part in place of the contacts. If the screw head touches the soldering pad of the trigger diode, it is necessary to place the nylon gasket (provided; packed in a small bag together with the 25A fuse) between circuit board and screw head.
8) Check if after screwing Perun V2 in place, selector plates moves freely. The screw may protrude outside of the gearbox and block the selector plate. If such situation will take place, shorten the screw a little bit, use a shorter one or use the nylon gasket.
9) Place the wiring carefully.

ATTENTION:

- *Especially in the rear wired version, attention has to be paid, not to let the motor's gear damage wire insulation. Also check if after closing the gearbox, the middle pin can be inserted.*
- *Make sure, that the trigger and the trigger lock will be able to move freely.*

10) Put the sector gear in place.

11) Join the upper part with the lower part. Make sure, that the sector gear will not rub against Perun V2.

12) Put all the gearbox parts in place and assemble it.

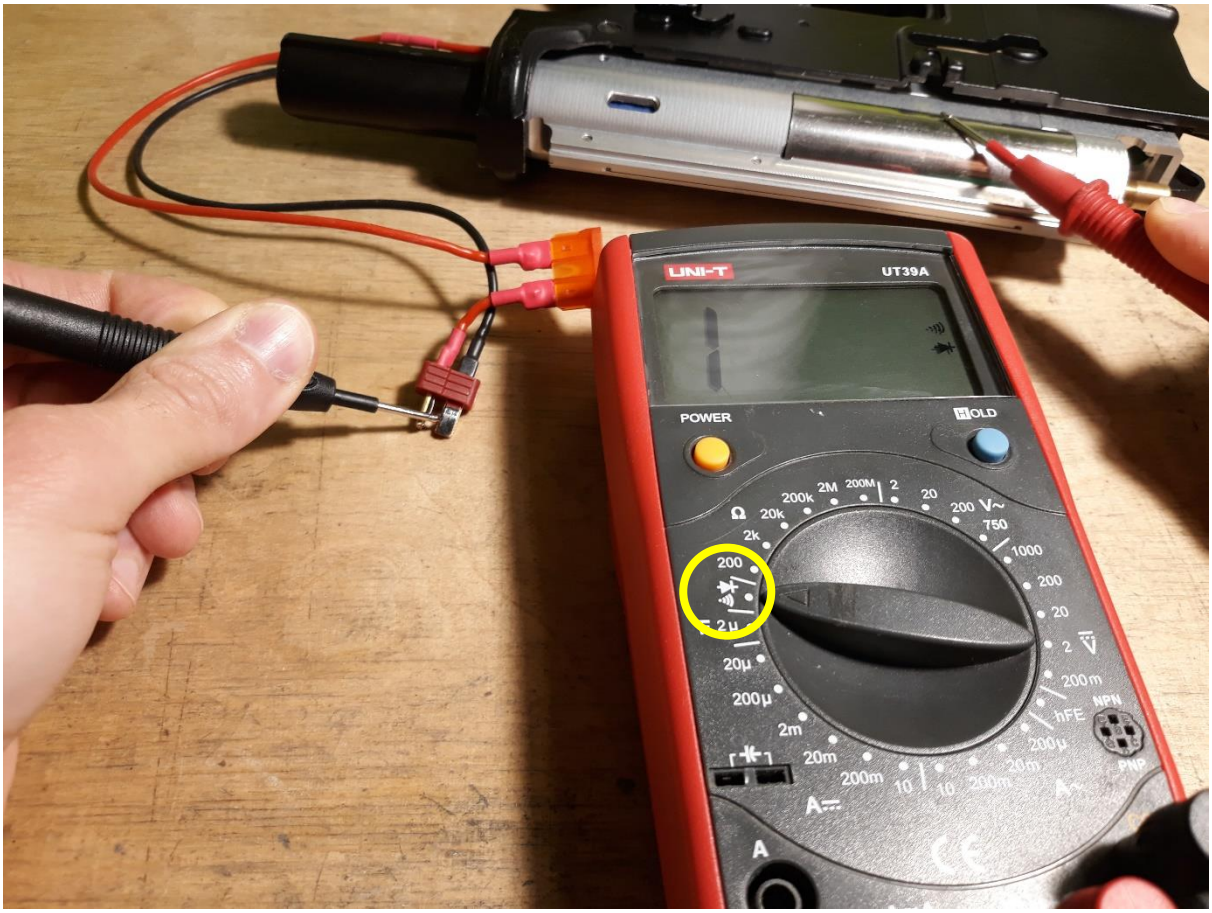
13) Place black stickers in way shown below. Do it in such a way, that as little light as possible will be able to get inside the gearbox:

14) Assemble whole replica.

ATTENTION:

- *While putting the motor in place, pay attention to the polarization! With Perun V2 the motor is positioned differently than usual. "+" pole of the motor should be directed towards the stock, whereas "-" towards the muzzle. The "-" wire is designed to be routed through rear of the pistol grip. Make sure that the connectors tightly link motor with the wiring and that they will not slip out while screwing the pistol grip plate.*

15) It is strongly recommended to check after the assembly and **before the first run**, if Perun's wiring and gearbox and/or replica's body are not electrically connected. This can be performed using the „diode" feature, which is offered by most multimeters, or by measuring the resistance. This is done to prove, that the wire insulation is not damaged anywhere, because such damage and energising of the gearbox may result in permanent damage to electronic circuits.



Checking for insulation damage. The multimeter is set to "diode" function (indicated by the yellow circle). If the probes will become electrically connected, multimeter will be emitting a sound signal. Lack of such a signal after touching the T-deans connectors (both, "+" and "–" at the same time) with one probe and the gearbox with the other (simultaneously) mean, that everything is correct. This should be checked with at least lower receiver and stock wholly assembled.

If an electronic connection between wiring and body and/or gearbox will be detected, disassemble the replica to locate the broken insulation and fix it with insulation tape.

Ready! Now check if everything works well during the first run.

4. First run

During the first run of Perun V2, trigger and selector sensors have to be calibrated. After the battery is plugged in for the first time, Perun V2 will automatically enter **calibration mode**. Take following steps:

1) Plug the battery in.

2) Set the selector in „AUTO" position.

3) Pull the trigger and hold it in any position, in which a continuous sound signal can be heard, until the signal stops. If you want a short trigger, stop pulling the trigger further once the signal starts to be heard and keep it there until the setting is being saved. In other case pull the trigger further and hold. Perun V2 will now remember this trigger position and start to fire once it has been reached.

4) Set the selector in „SEMI" position.

5) Repeat the trigger procedure from step 3).

If the procedure is passed without problems, the next time battery is plugged in Perun V2 will not enter into calibration mode and will be ready to shoot. However, if after finishing step 5), you will hear a long, single signal meaning that there are problems with "SEMI" and "AUTO" position detection, the next time the battery is plugged in Perun V2 will enter programming mode again. At this point changing selector sticker may be needed.

In case there is a need to go through the calibration procedure again, enter the programming mode on any selector position, press the trigger 12 times and save the setting by holding the trigger until a sound signal can be heard.

In case of any difficulties or questions, please do not hesitate to contact us at info@perunairsoft.pl.

5. Fuse

40A fuse is installed in the stock wiring. If the replica has spring softer than M130 **and** the rate of fire is lower than 25RPS, it is recommended to change the fuse to 25A (included). After doing so, test if the fuse parameters are not too low by firing a couple of quick shots in semi-auto mode.

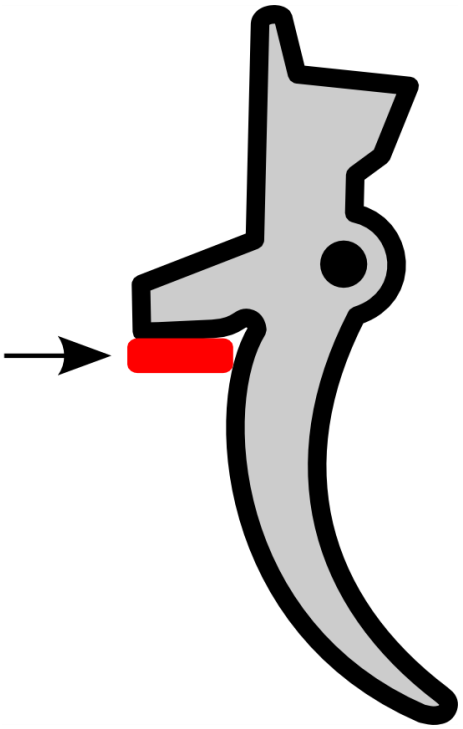
6. Factory settings

Perun V2 is delivered with functions programmed the following way:
- single fire on „SEMI” selector position,
- automatic fire on „AUTO” selector position;
- AB off,
- precocking off,
- precocking power set to 1 (this will only have effect, if precocking is enabled),
- Li-Po protection off,
- double shot off.

After any given feature was changed, it will remain this way as long as it’s not changed again. There is no “master reset” feature, which will restore default settings, but it’s possible to check all the current settings in the way shown in the programming manual.

7. Hair trigger

To achieve a shorter trigger action, a modification shown on the picture to the right can be made. In place marked by the red rectangle, a piece of material ca. 1.5mm thick should be glued. The thickness of the material may be higher or lower, depending on the user preferences, trigger shape and gearbox used.



Make sure that the trigger is not depressed too much, which may happen if the material is too thick, because it can make the calibration impossible or even worse, result with accidental shots caused solely by vibrations. You should also check, if the mechanical trigger lock works properly and protects the replica from accidental discharge. **Safety of the user and bystanders is an absolute priority!**

8. Troubleshooting

Below we show known problems that are possible to occur during installation, and solutions to those problems. In case of uncertainty, whether the problem is caused by Perun itself or the installation, we recommend to the diagnostic test.

Film showing how to conduct the test is available under the following link:

https://www.youtube.com/watch?v=o0_3gucBDq4

Problem	Possible cause	Solution
Perun V2 does not pass the calibration procedure successfully (a long sound signal is heard at the end of procedure and calibration is initiated at next start-up).	Atypical selector plate position.	Use one of the other selector plate stickers included in the “Selector sticker” kit
	Selector plate sensor malfunction.	Send Perun V2 back for repair.
Perun V2 does not detect the difference between „SEMI” and „AUTO” selector positions.	Selector plate sensor needs to be calibrated.	Enable calibration procedure at next start-up the following way: 1) remove gearbox from the body, 2) connect the motor, so that sound signals can be heard; fasten the motor to a heavy object, so that it will not jump around in case a signal to fire was received by Perun V2, 3) plug-in the battery, 4) enter the programming mode by touching the selector plate sensor and pulling it away twice, 5) pull the trigger 12 times and save the setting, so that at next start-up Perun V2 will enter calibration mode, 6) disconnect the battery and motor, 7) put gearbox back in body, put back pins and screw the pistol grip, 8) connect the motor, 9) pass the calibration procedure.
	Selector plate sensor malfunction.	Send Perun V2 back for repair.
Problem	**Possible cause**	**Solution**

Replica starts shooting by itself.	Light enters the gearbox.	Ensure, that there are no holes through which light could enter the gearbox and all protective stickers are in the right place. If needed, you can also additionally protect gearbox from light with the use of black insulation tape sticked on any holes in it.
	Trigger sensor needs calibration.	Go through the calibration procedure; try pulling the trigger further than during previous calibration.
Perun V2 emits sound signals right after the battery has been plugged in, which means that protection against accidental firing and start-up was triggered. It enables if Perun V2 will detect trigger to be pressed at start-up.	Trigger remained pressed during the start-up.	Release the trigger, replica will start to function normally.
	Trigger sensor needs calibration.	Enable calibration procedure at next start-up the following way: 1) disassemble gearbox and remove Perun V2 from it, 2) connect the motor, so that sound signals can be heard; fasten the motor to a heavy object, so that it will not jump around in case a signal to fire was received by Perun V2, 3) place a large piece of plastic between trigger optical sensor and trigger diode, 4) plug-in the battery, 5) enter the programming mode by touching the selector plate sensor and pulling it away twice, 6) simulate pulling the trigger 12 times by removing the piece of plastic from between the trigger sensor and diode and putting it back, then save the settings by removing the piece of plastic for a longer time, so that at next start-up Perun V2 will enter calibration mode, 7) disconnect the battery and motor, 8) put gearbox back in body, put back pins and screw the pistol grip, 9) connect the motor, 10) go through the calibration procedure.
	Light enters the gearbox.	Ensure, that there are no holes through which light could enter the gearbox and all protective stickers are in the right place. If needed, you can also additionally protect gearbox from light with the use of black insulation tape sticked on any holes.
Replica fires a 2-round burst in semi-auto mode.	Motor and battery are too strong for the main spring, which causes overspin.	Enable AB or precocking.
Problem	**Possible cause**	**Solution**

Perun V2 will not shoot or emit any sounds.	Blown fuse.	Check what was the reason the fuse had blown. In such situation never run Perun V2 without fuse!
	Disconnected motor connector.	Squeeze the connector, so that it is tighter and connect it back to the motor.
	Incompatible battery T-deans socket.	T-deans plugs and sockets from various manufacturers may sometimes not work together reliably. Although the plug may seem to fit the socket nicely, the conductive surfaces may not contact each other, cutting the power off. In that case try with another battery, most preferably with T-deans socket made by different manufacturer.
Semi-automatic fire does not work (replica only fires bursts or fully automatic).	Burst has been programmed on „SEMI" selector position.	Program semi-automatic fire on „SEMI".
	Sector gear optical sensor and/or sector gear LED diode are covered with grease.	Remove grease from optical sensor and diode.
	Sector gear optical sensor and/or sector gear LED diode are damaged.	Send Perun V2 back for repair.
Semi-automatic fire does not work (replica only fires bursts or fully automatic), **but only when precocking is on and the ROF of those bursts seems to be lower than normal**.	Sector gear is too far from the sector gear sensor.	Try moving Perun V2 to the left (when having it in of front of yourself in an open gearbox) and shimming the sector gear so, that it almost touches the upper half of Perun V2.

Problem	Possible cause	Solution
Battery and/or the motor heat up very much.	The battery has a too low capacity (mAh) and/or “C” parameter.	Use a battery with higher capacity and/or “C” parameter.
	The motor is too weak.	Use a stronger motor, possibly with neodymium magnets.
	Increased motor load caused by excessive friction, for example caused by: - improper shimming, - motor positioned askew in the pistol grip.	Remove the cause of the friction.
The same battery and/or motor didn’t heat up earlier.	Low-resistance MOSFET transistor and wiring used in Perun V2 provide resistance much lower than mechanical contacts and some other MOSFET circuits. According to Ohm’s law, that allows more current to be drawn from the battery and directed to the motor. This makes the trigger response and rate of fire faster, but higher current draw also leads to increased heating of electronic elements. This may become too demanding for previous battery and/or motor and a need to change to new ones may arise.	