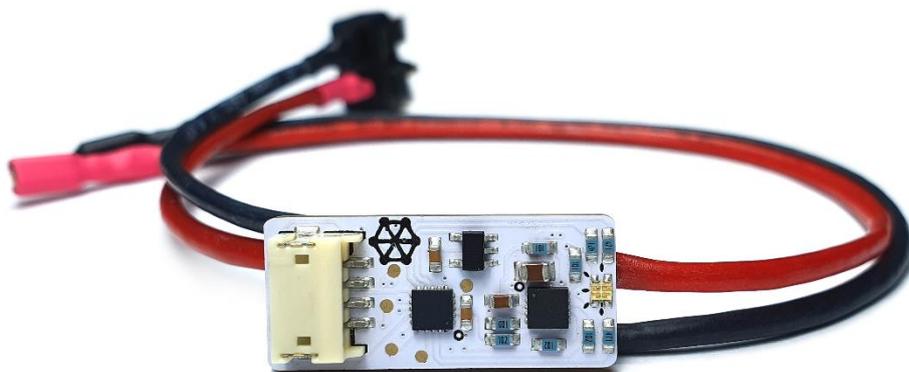# ETU++

Manual

Perun ETU++ replaces stock electronics in replicas with Electronic Trigger Unit by G&G. It provides lots of additional features, as well as allows the replica to work with many different battery types. Reading this manual will help you fully exploit this unit's potential and in case of encountering any problems, you can look here for solutions.

Manufacturer:
Perun
Barwicka 8 St.
60-192 Poznań
Poland
e-mail: info@perunairsoft.pl

Table of contents

1. Technical data

Recommended power sources

Perun ETU Upgrade Kit++ works with any power source that provides voltage between 7 and 17 volts and can deliver enough current to ensure smooth cycling of the replica. Li-Po and Li-Ion batteries with nominal voltage of 7.4, 11.1 or 14.8 volts are recommended. It is also advised to use batteries with possibly high „C" parameter and capacity. This is safer for the battery, as it should not be working on the edge of its capability. In this video, we are showing why: https://www.youtube.com/watch?v=s8RKcIy810A

Capacity and „C" parameter also influence the rate of fire of the replica: https://www.youtube.com/watch?v=5hO25aPvHcU

Compatibility with high-ROF and high-power builds

Perun ETU Upgrade Kit++ can work with even the most demanding setups, both regarding rate of fire and muzzle velocity.

Electronic fuse

Perun ETU ++ has an integrated electronic fuse, which will automatically cut the power off in case of a short circuit or when a gearbox jam is detected. The fuse does not wear out or needs to be replaced.

Battery connector type

Perun ETU Upgrade Kit++ comes with an already soldered T-Plug connector.

Power consumption when idle

Don't leave the battery connected to the replica, when you are not using it! When idle (battery connected, replica not shooting) ETU++ consumes 0,75mA. To put it in context, this would drain a half-laden 1200mAh battery in around a month.

2. 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. ("SEMI" → "AUTO" → "SEMI" → "AUTO" → "SEMI")
Successful entry into the programming mode for "SEMI" will be confirmed by **one sound signal and blue LED light.**
- **For "AUTO"** – keep the selector on "AUTO" for a couple of seconds, then go to "SEMI" and back, twice. ("AUTO" → "SEMI" → "AUTO" → "SEMI" → "AUTO")
Successful entry into the programming mode for "AUTO" will be confirmed by **three sound signals and 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.

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.

Video manual is available here: https://youtu.be/OxTmKhq7bs8

Function and LED color	Description
Firing mode Green	Choose one of the firing modes for any selector position: safe, semi, 2-5 shot burst and auto. No sound signal, steady green light – safe 1 short single signal and blink – semi 2-5 short signals and blinks – 2-5 round burst 1 long signal and blink - auto
AB Blue	Active brake (AB) stops the motor after the shot, preventing the spring from remaining in a compressed state and eliminates double shots on semi in replicas with high rate of fire ("overspin"). 5 levels of braking strength are available – from 1 (weakest braking) to 5 (the strongest). Braking can be also completely disabled. It is advised not to use braking all the time, if not necessary, or to use it on the lowest possible level, because strong braking negatively impacts the service life of motor brushes and causes increased heating. *Tip: Switch to semi, fire a single shot and hold the trigger after the shot. This will cause a second single shot with strongest AB setting to be fired after 2 seconds, making sure the main spring remains uncompressed. It is advised to do that when you finish shooting for the day.* No sound signal while LED glows blue means, that the active brake is disabled. 1 to 5 signals indicate braking levels from 1 (the weakest) to 5 (the strongest). *Attention! While precocking is on, the AB setting becomes irrelevant. However, any programmed AB setting will be stored in memory and will become effective as soon as precocking is disabled.*
Precocking Yellow	When shooting on semi, precocking keeps the piston in rear position, ready for shot. This decreases the time between pulling the trigger and the actual shot, increasing realism, and giving advantage in CQB fights. Precocking level must be set individually to each replica and according to user preferences. Precocking power is automatically adjusted to battery voltage and semi or automatic shots. *Tip: To release the spring after using precocking, switch to semi, fire a single shot and hold the trigger after the shot. This will cause a second single shot with strongest AB setting to be fired after 2 seconds, making sure your spring remains uncompressed. It is advised to do that when you finish shooting for the day.* No sound signal while LED glows yellow means, that the precocking is disabled. 1 to 8 signals indicate precocking levels from 1 (the weakest) to 8 (the strongest). *Attention! AB setting does not affect the functioning of precocking, it is ignored if precocking is enabled.*
Binary trigger Purple and teal blinking alternately	Binary trigger allows the semi shots to be triggered not only after the pull, but also after the release of the trigger. *Tip: Hold the trigger for 2 seconds to cancel the second shot.* No sound signal while LED blinks purple and teal alternatively means, that the binary trigger is disabled. 1 signal indicates activation of the binary trigger.

Function and LED color	Description
ROF reduction ⚪ White	This function allows to lower the rate of automatic fire. 5 reduction levels are available: 1 – 6% ROF reduction 2 – 12% ROF reduction 3 – 18% ROF reduction 4 – 24% ROF reduction 5 – 30% ROF reduction ***Attention!*** *Those are approximate values and may vary depending on replica configuration.* No sound signal while LED glows white means, that the ROF reduction is disabled. 1 to 5 signals indicate reduction levels from 1 (the smallest) to 5 (the greatest). ***Attention!*** *Semi-automatic shots and the first shot in burst are always fired without any power reduction to retain good trigger response.*
DMR mode 🟣 Purple	DMR Mode allows only semiautomatic shots and limits their frequency. 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. No sound signal while LED glows purple means, that the DMR mode is disabled. 1 to 5 signals indicate interval levels from 1 (the shortest) to 5 (the longest).
Li-Po and Li-Ion alarm 🔵 Teal	Li-Po and Li-Ion alarm informs the user that battery voltage has fallen below 3.7V per cell, at which the battery should not be further used and must be recharged. Unit automatically detects number of cells in the battery and determines safe voltage range. The need for battery replacement is signaled by short sound signals every one minute. Disable this function if you are using batteries other than Li-Po or Li-Ion. No sound signal while LED glows white means, that the alarm is disabled. 1 signal indicates activation of the alarm.
Master reset 🔴 Red	Master reset returns the unit to factory settings. To reset, pull and hold the trigger for 2 seconds. A long sound signal confirms return to factory settings.

3. Factory settings

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

- Firing mode – semi on "SEMI" and auto on "AUTO"
- AB – level 3
- Precocking – disabled
- Binary trigger - disabled
- ROF reduction – disabled
- DMR Mode – disabled
- Li-Po and Li-Ion alarm – enabled

4. Diagnostic system

Perun ETU Upgrade Kit++ 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 the 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
Disconnected motor / Switch check 🟡 Yellow, blinking	This not only provides information about disconnection of the motor, but it is also a switch check mode for the trigger, selector, and sector gear switches. With the motor disconnected, engaging the switches will cause the LED to glow purple (trigger), green (selector) or blue (sector gear) for a moment. This can be used for troubleshooting problems with the switchboard in the gearbox. Reconnecting the motor will restore normal function. ***Attention***: *Motor check only takes place at start-up. A disconnection after the start-up will not be signaled!*
Fuse activation 🔴 Red, continuous, or blinking	Activation of the fuse with a distinction between a short circuit (continuous red) and gearbox jam (blinking red). In some situations, this distinction may not be correct, for instance a gearbox jam may be incorrectly read as a short circuit and vice versa. Unit will start functioning normally after the battery is reconnected, unless there still is a short circuit that will be detected at next start-up.
Trigger pull detected during start-up 🟡🟣 Yellow and purple blinking alternately	Unit detected that the trigger was being held during start-up. This can also indicate a short circuit of the signal wiring or mechanical malfunction of the trigger mechanism. Unit will start functioning normally after the trigger is released.
Gearbox cycle detection failure 🟡🟢 Yellow and green blinking alternately	Unit did not receive information about cycle end from the sector gear switch and stopped firing only after safety time limit was exceeded. This may indicate problem with the switch, cut-off lever or damaged wire.
Unit temperature is too high 🟡⚪ Yellow and white blinking alternately	Too high temperature of the unit (electronic board) was detected. It will not function again until it cools down, after which it will operate normally.
Battery with too low voltage is connected 🟡🔵 Yellow and teal blinking alternately	Battery with a voltage below 7V is connected. Change the battery to one with voltage between 7V and 17V.
Battery with too high voltage is connected 🔴🔵 Red and teal blinking alternately	**Battery with a voltage over 17V is connected. The battery must be immediately disconnected, as it can cause permanent damage!** Change the battery to one with voltage between 7V and 17V.

Problem and LED color	Description
Main transistor or driver damage 🔴🟡 Red and yellow blinking alternately	Main transistor or driver is damaged. Unit needs to be sent back for repair.
Battery voltage sensing malfunction 🔴⚪ Red and white blinking alternately	Battery detection system is malfunctioning. Unit needs to be sent back for repair.

Other known problems:

Problem	Cause	Solution
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.
	Too high precocking level.	Set precocking to a lower level.
	Trigger mechanism malfunction.	Check the cut-off lever and contacts, replace if needed.
Replica does not shoot; the unit does not emit any light or sound.	Incompatible T-Deans battery connector.	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.
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 did not heat up earlier.	Low-resistance MOSFET transistor and wiring used in Perun ETU UPGRADE KIT++ 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.	

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

5. Switch check

You can easily check the switch set in the gearbox by disconnecting the motor. When ETU++ is connected to the battery, but disconnected from the motor, it informs about this by yellow, flashing light. If during that flashing a properly working and connected switch will be closed, the unit will signal that by changing the LED color for a moment.

Attention! To enter this mode, the motor must be disconnected first, only then connect the battery!
Attention! After you enter the switch check mode, it will be active for 5 minutes, after which the unit will shut down. To restart it, simply reconnect the battery.

LED color	Switch
Disconnected motor / Switch check 🟡 Yellow, blinking	No switch activation is being detected at this moment
Selector switch was closed 🔴 Red	This should happen after the selector is set to "AUTO".
Selector switch was opened 🔵 Blue	This should happen after the selector is switched from "AUTO" to any other position.
Trigger 🟣 Purple	Trigger switch was closed.
Sector gear 🟢 Green	Sector gear switch was closed.

Checking the trigger and selector sensor can be done by simply pulling the trigger or switching the selector between "SEMI" and "AUTO" positions. This can be done without any disassembly of the replica.

In order to check the sector gear switch, it's best to open the gearbox and remove everything out of it, except for the switches and the sector gear (make sure to keep the shimming the same as in assembled replica, it can influence whether the switch would work or not). Then roll the sector gear by hand and see, whether the color of the light changes to green.

6. Custom/DIY projects

ETU++ is a perfect solution for teching enthusiasts, who engage in creating totally custom projects and need a firing control unit. If you have inputs from switches installed on trigger, selector, and sector gear cut-off, but need electronics that would steer the replica using information from those switches, ETU++ is the way to go. It may also help in converting replicas known to have problems with trigger or cut-off mechanism, like P90 or Steyr AUG, to a switch-based operation. Below are the details on how to properly prepare the wiring to make it work with ETU++.

Switch wiring scheme

ETU++ socket has 4 pins for 4 signal wires. Of those, 3 are for selector, trigger, and sector gear cut-off (information about cycle end) and the 4th is a common ground, to which all the switches must be connected.
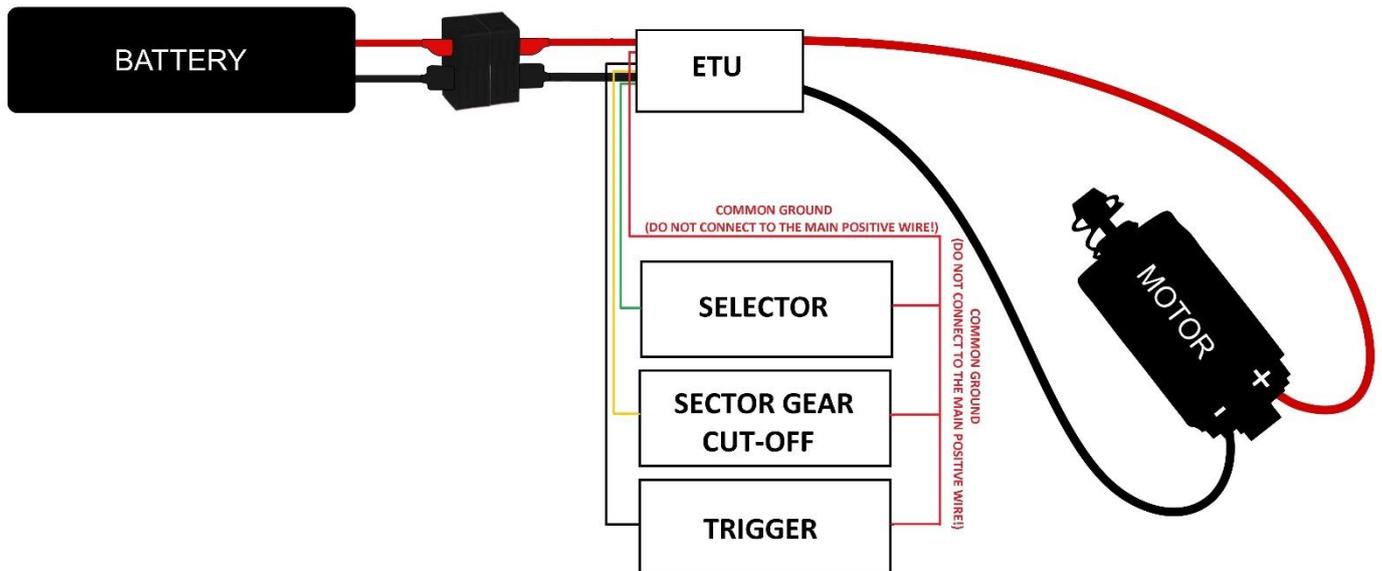
Do not allow the motor wires to get into (uninsulated) contact with any of the signal wires. This would result in an immediate and permanent failure of the device!

Plug

Plug that is used in G&G replicas with ETU and works with Perun ETU++ is **JST ZHR-4**. It is available in many electronic shops. We recommend using plugs with pre-installed wires that can be lengthened, because correct preparation of the bare plug might be difficult. The correct plug wiring order is shown here.
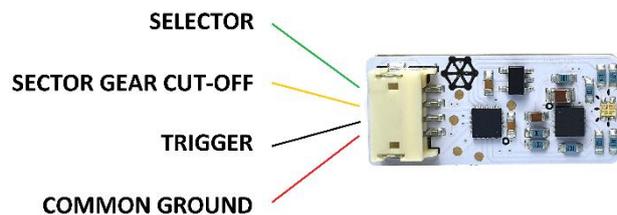
Switches

Almost any switch can be used, as ETU++ is resistant to contact bounce, while low voltage and current used to detect switching allows using a wide variety of models. Therefore, use any switches that will best suit your project. Here is a short description, of what does ETU++ expect from each of the switches:

Selector: When the switch is closed, ETU++ sees it as "AUTO" and when it's open, it sees "SEMI". This is pretty much irrelevant however, as the firing modes in ETU++ are freely programmable.

Please note that safe mode can only be achieved either by a mechanical safety, or by sacrificing one of the firing modes and making it safe by programming electronic safety.

Trigger: Switch should be closed by the movement of the trigger and opened upon releasing the trigger.

Sector gear cut-off: Once per gearbox cycle ETU++ should receive an information from a sector gear switch, or cut-off switch. This can be achieved in many ways, but probably the easiest is by reading either directly from the cut-off knob of the sector gear or from the cut-off lever. The amount of time the sector gear switch is being pressed during the cycle is irrelevant, the electronic unit is only looking for the closing of the switch.