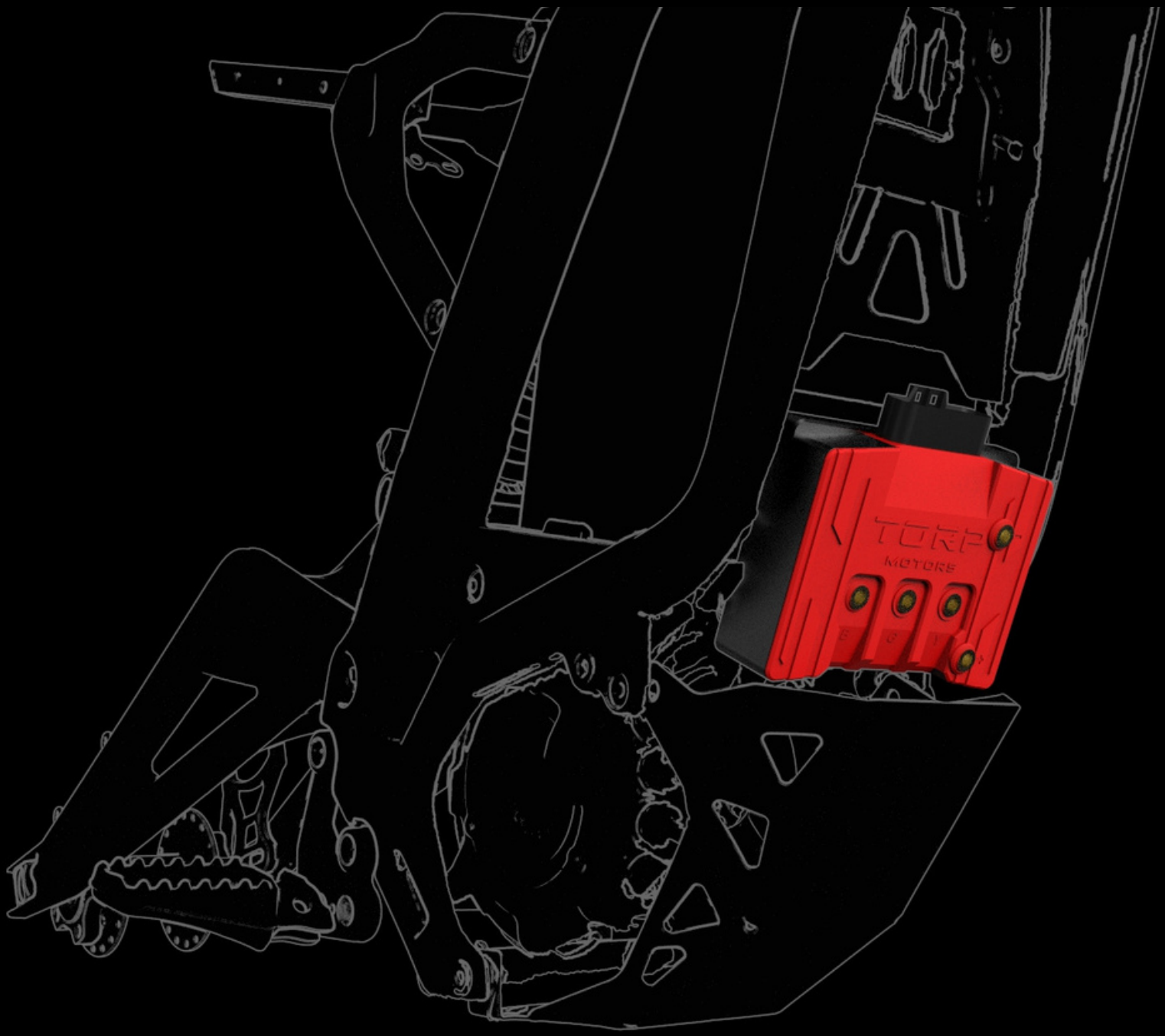
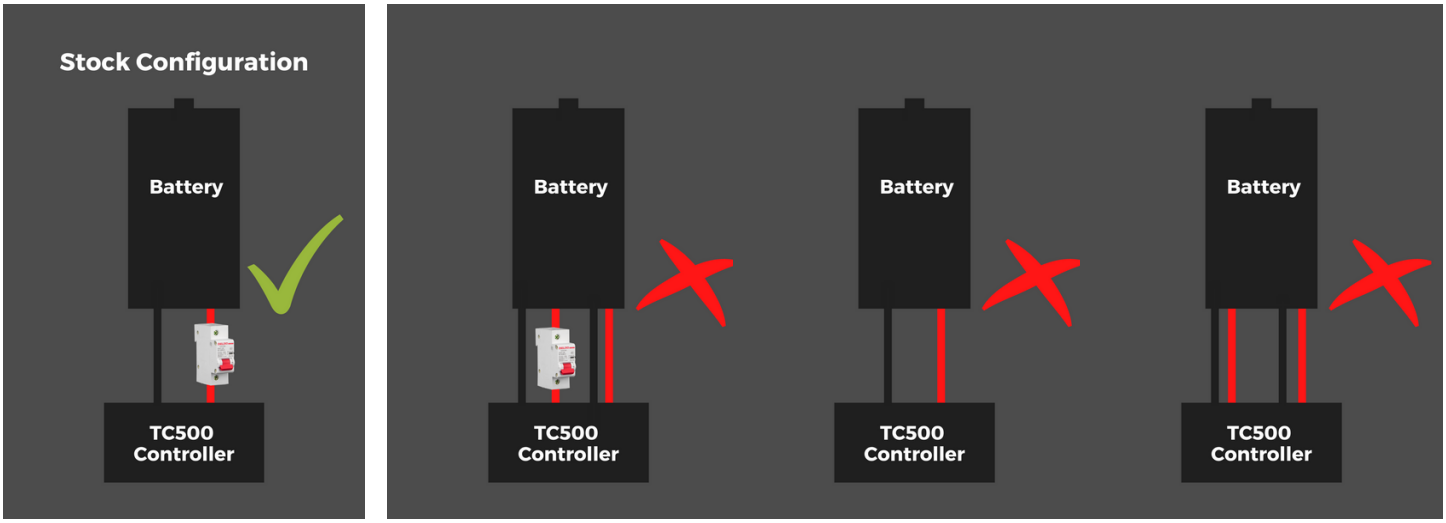
TORP CONTROLLER.

User Manual



IMPORTANT.

Please read and carefully follow the instructions in this manual. **The TC500 controller must always be used with a stock SurRon/Segway fuse! Not using the fuse with the TC500 controller is dangerous and can cause serious damage!**



Use only tools and screws that came with the controller. Using the tools and screws that were not included in the parcel, not following these instructions, or not using the fuse, can cause serious damages to you and your bike.

INTRODUCTION.

TC500 controller has been developed exclusively for SurRon Light Bee and Segway X260 e-bikes, and is not compatible with any other electric motor. TC500 is not compatible with Segway X160. TC500 controller is also **not compatible with motor model number P/N: 11100-YQ2A-0100**. Please check your motor model number before installing the TC500 controller. In general, all SurRon/Segway X260 motors, manufactured after 2018 are compatible with the TC500 controller.

TC500 controller is compatible with both versions of the stock display (L1 E & the off-road version). Both speed and the distance are displayed on it. For the additional options, like battery monitoring and settings, you will have to use your smartphone or buy a Torp Display, that is sold separately.

This is a plug&play controller that needs no previous knowledge of electronics and programming for installation and setup. Everything needed for successful installation is included in the box.

THE BOX CONSIST OF:
-TC500 controller
-Wire-harness
-5 phase screws with washers
-2 screws for fastening the controller to the bike`s frame
-2 screws for installation of the plastic shield
-2 hex keys
-Shield
-Short instructions

All the settings and diagnostics are managed through an intuitive and easy-to use smartphone app for Android and IOS. The users can use their smart-phone as a display during the rides and to set up all the controller`s features through the app.

INSTALLATION.

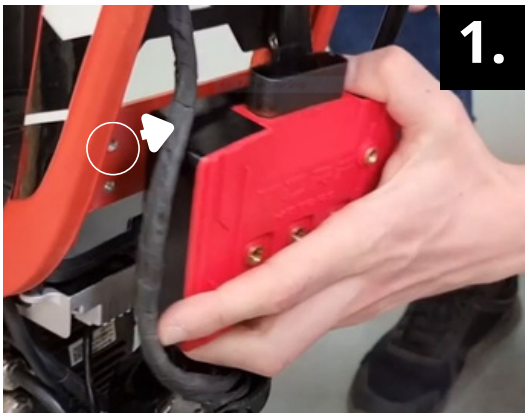
Before starting with the installation, drain the bike`s capacitors.

1. Switch off the fuse
2. Switch on the bike and wait for the capacitors to drain.

Now you can start removing the stock SurRon controller and the battery from the frame, and lower the skid-plate that covers the wiring.

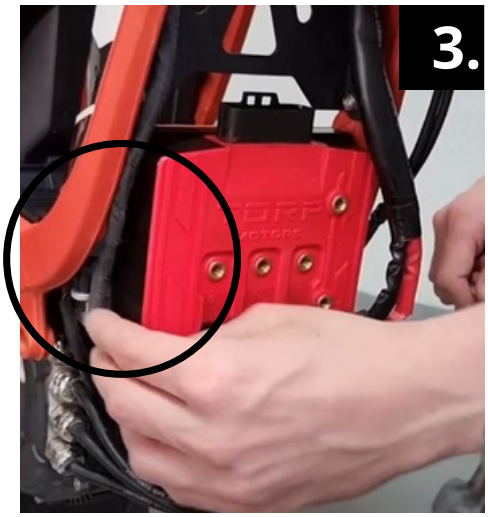
FOR THE INSTALLATION
you will need:
-2 M5 screws (smaller screws)
-A smaller hex key

STEP 1:
Place the controller in a way that the holes on its back align with the upper holes on the bottom front of the frame.

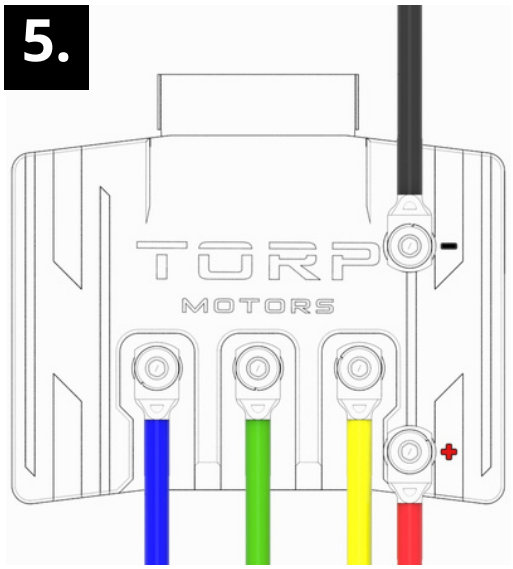


STEP 2:
Insert each screw in one hole and fasten them by using a smaller hex key.

STEP 3:
There is a cable on the left of the controller. Stick it behind the controller.



STEP 4:
There are 5 screws with washers already on the controller. Remove them from the controller and start connecting the controller to the phase motor wires.



DON`T MESS THIS ONE UP!

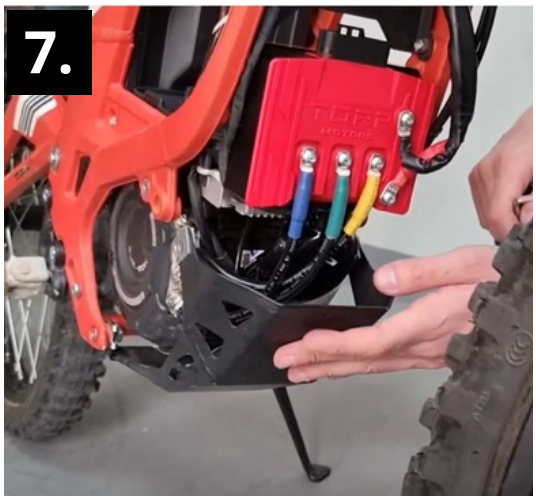
STEP 5:
Connect the power and phase motor wires as shown on the picture using the screws with washers that you have removed from the controller in the previous step:

Power Wires:
-The red battery wire to the positive (+) electrode
-The black battery wire to the negative (-) electrode

Phase Motor Wires:
-The Blue motor wire to the letter B
-The Green motor wire to the letter G
-The Yellow motor wire to the letter Y

STEP 6:
Use a larger hex key to gently fasten the screws with washers. **Max Torque that should be used is 3.5 Nm!**

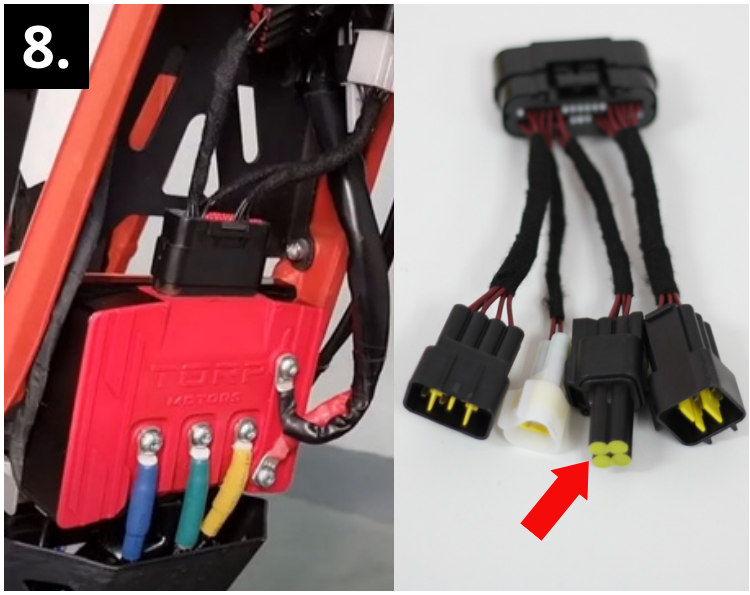
STEP 7:
Put the bike`s skid-plate back to its original position by screwing back the top screws on each side.

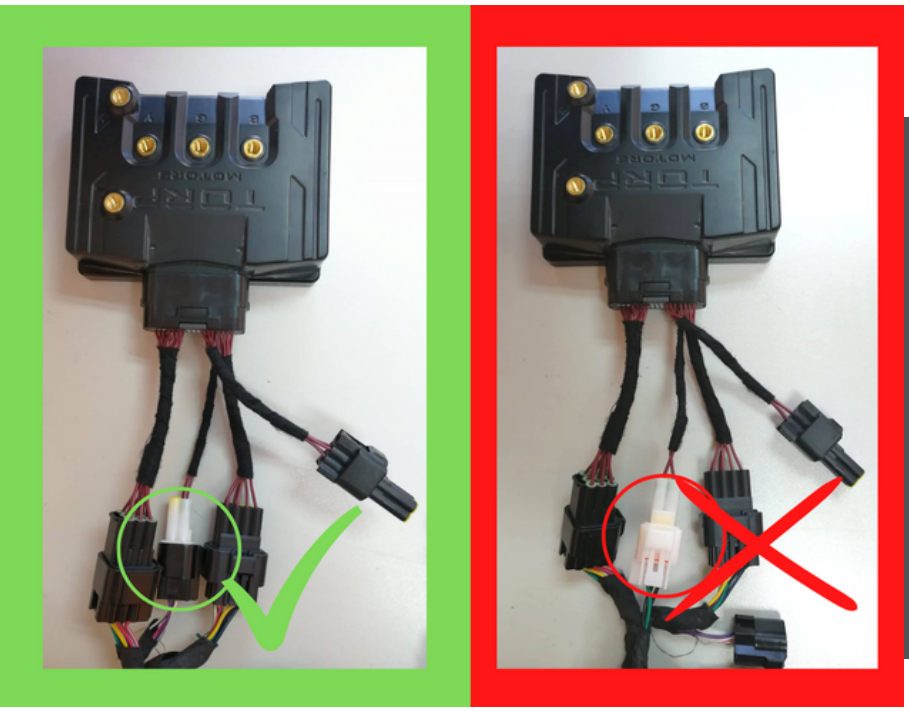


STEP 8:

Use the wire harness that came with the controller to connect the controller to the bike. Connect the largest connector to the controller and the three smaller connectors to the bike`s wiring, in the same way the stock controller has been connected.

There is also a 4th connector with a cap on it. This connector will be used with the dedicated display, once it is made available.





DON'T MESS THIS ONE UP!

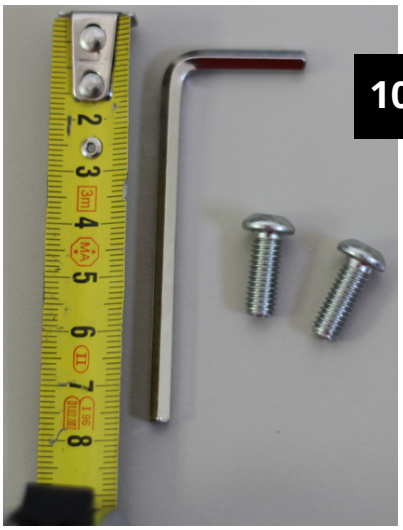
This is how communication connector must be connected:

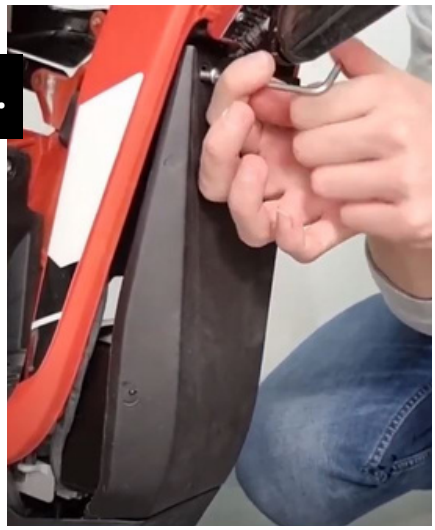
Always connect together **white** and **black** connector, never **white** and **white**!

When pushed together, **all connectors** must make **a clicking sound**!

STEP 9:

Take the plastic shield that came with the controller and mount it by placing its lower part into the skid plate.

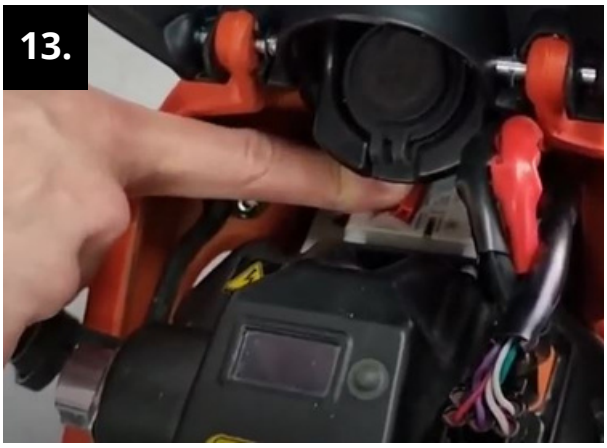




STEP 10:
Use the longer M6 screws and a larger hex key to fasten the shield to the frame.

STEP 11:
Put the battery back to the frame.

STEP 12:
Connect the battery to the battery power connector and to the 6-pin connector.



STEP 13:
Turn the fuse back on. Always use the Controller with the stock SurRon/Segway fuse!

CONNECT THE CONTROLLER TO THE APP

for further setup.

HOW TO CONNECT?
To connect the TC500 controller with the Torp Controller App, first go to the Google Play Store (Android) or AppStore (IOS) and download the App to your smartphone.

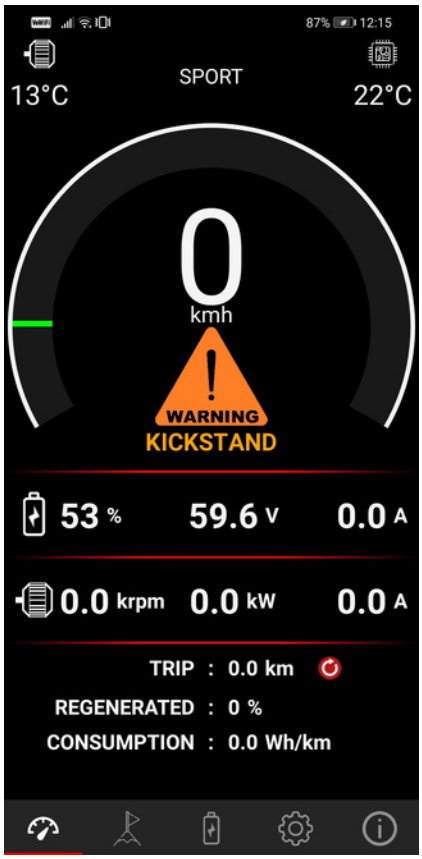
-Allow the App to access the phone's location, photos and media and accept the Terms & Conditions.

-Put the key into the ignition and turn on your bike.

-The App will automatically detect your controller.

-Choose your controller from the list. The Bluetooth ID can be found on the label on the side of the controller.

-Now you are connected and can start setting up your controller.



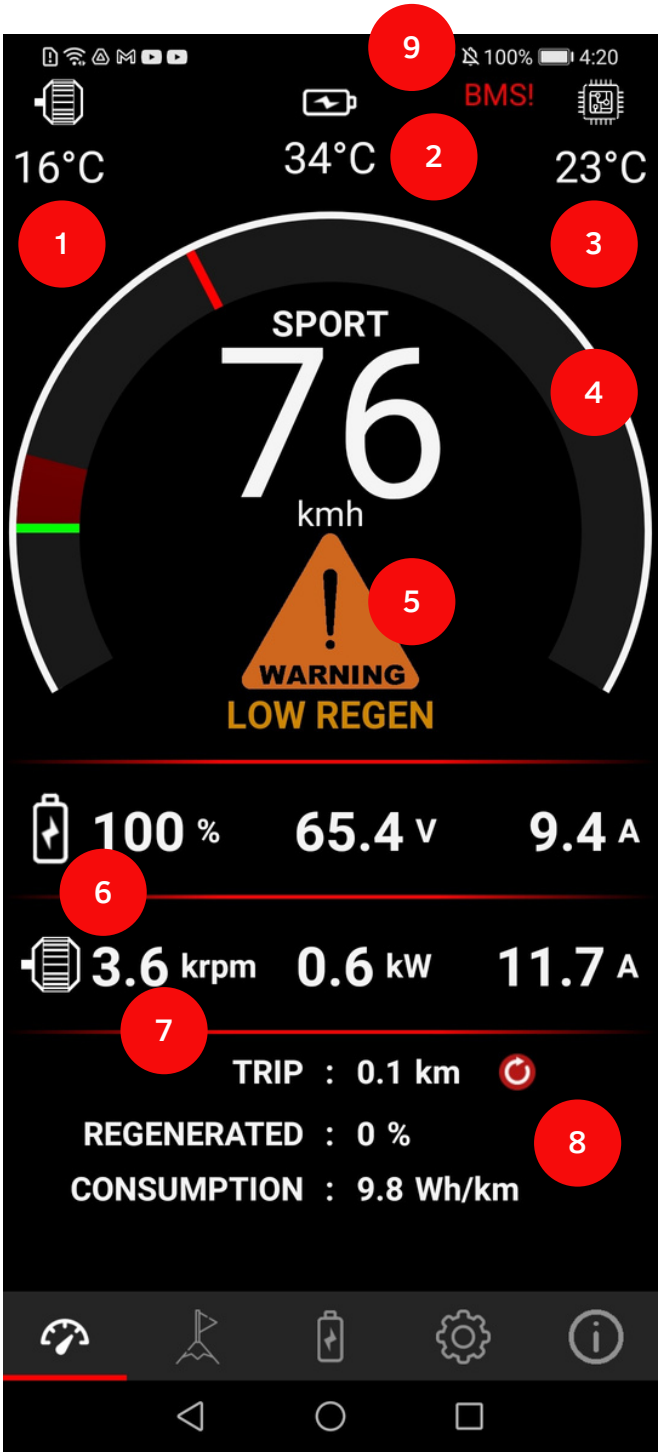
IMPORTANT: After the installation make sure to calibrate the throttle and Hall sensors! Check the "Setting up the throttle" and "Calibration of hall sensors" sections of the manual and follow the instructions.

We suggest you always ride with the app set to the 1s screen. This is how the Torp Controller App will be able to recognize potential errors which will help our support team with detecting and solving any problems that might occur with the controller.

THE APP OVERVIEW.

1st Screen: GAUGE

The TC500 controller is compatible with the stock SurRon display, where you will be able to track your speed and distance. However, we recommend using your smartphone as the display during the rides.
The first screen serves as a gauge, showing all your riding information in real time. Here are also displayed all the potential errors and warnings.



1-Motor Temperature: **Monitor** the Motor Temperature in real-time.

2-Battery Temperature: Monitor the battery temperature in real-time.

3-Controller Temperature: Monitor the battery temperature in real-time.

4-Power Gauge: Displays the power.

5-Warnings & Errors: All Warnings and Errors are displayed here. More details on their meaning can be found in a table below.

6-Battery Info: State of charge (SOC), battery voltage, and battery current.

7-Motor Info: Motor RPMs, Motor Power and Motor Current.

8-Predict your Trip: Check the distance you have passed, the amount of regenerated energy, and the consumption of the battery. You can plan your trip based on this information.

9-BMS!: There is a problem with BMS communication. Please check the wiring!

THE LIST OF WARNINGS AND ERRORS

-**KICKSTAND:** Your kickstand is lowered. Lift it to start riding.
-**CRASH SENSOR:** Crash sensor activates in case of a fall. Turn the bike off and turn it back on after a few seconds to continue riding.

LIMIT:

-**TEMP CONTROLLER:** The temperature of the controller has reached the top limit value. The power will be gradually reduced.
-**TEMP MOTOR:** The temperature of the motor is rising. To prevent overheating, the power will be gradually reduced. The motor temperature limit is set in the “Motor Temp Cuttoff” settings on the "Settings" screen.
-**MOTOR TEMP SENSOR:** Motor temperature sensor is not connected. Power is limited.
-**LOW VOLTAGE:** The battery is almost drained or there is a voltage sag due to the acceleration. The power will be gradually reduced.
-**LOW REGEN:** The battery is nearly full. The regen will be reduced.
-**BATTERY TEMP:** Battery temperature has reached limit values so the power will be reduced.
-**BMS TEMP:** Discharge mosfets in BMS have overheated. Power will be gradually reduced.

CUTOFF:

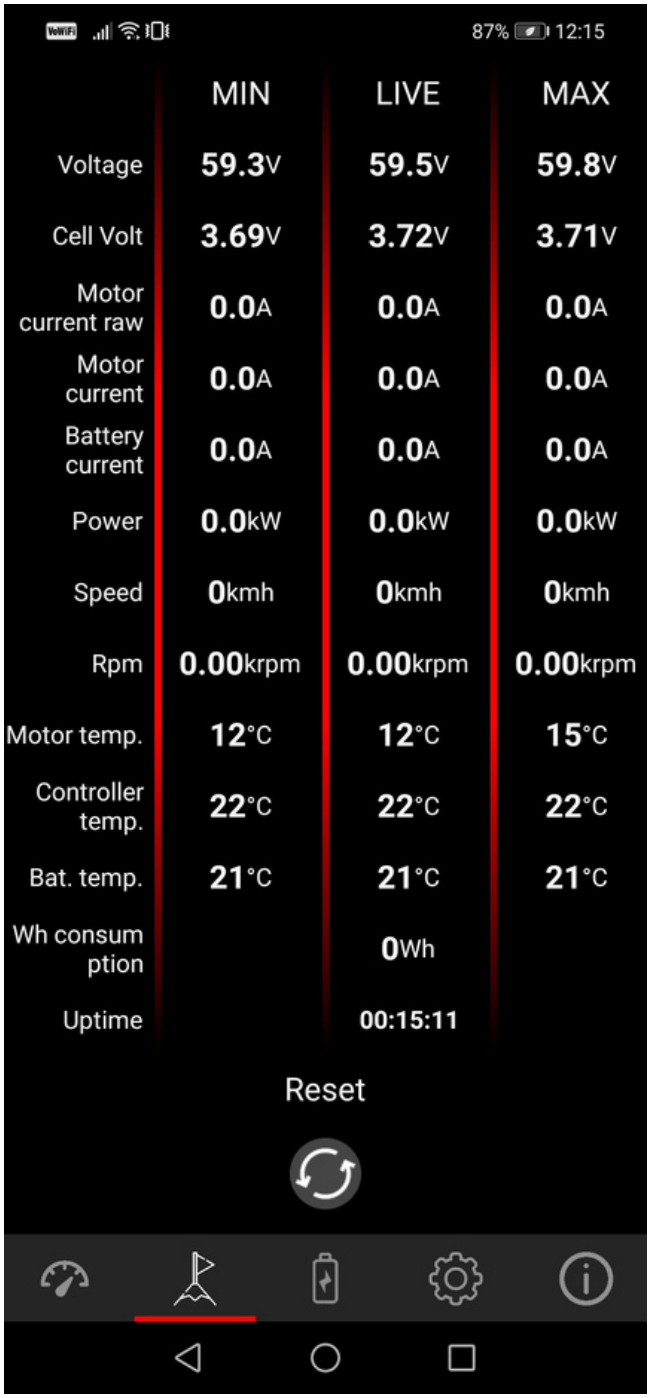
-**CUTOFF LOW VOLTAGE:** The battery is completely drained and the bike will not start. You can set the cutoff value in Voltage Min setting in the App (3rd Screen) . Charge the battery to continue riding.

-**OVERVOLTAGE:** Battery voltage is above 90V.
-**UNDERVOLTAGE:** Battery voltage dropped under the values set in the controller`s settings. Charge the battery.
-**OVERCURRENT:** Motor Current is above permitted limit.
-**CONTROLLER OVERTEMP:** Controller has overheated. Wait for it to cool down to continue riding.
-**MOTOR OVERTEMP:** Motor has overheated. Wait for it to cool down to continue riding.
-**PHASE FET: MOSFET error:** Controller`s phase is in short-circuit. Contact the manufacturer.
-**HALL SENSOR:** Motor Hall Sensor connector is not connected, or there is a problem with the Hall Sensor itself. Check the wiring.
-**THROTTLE PROBLEM:** The problem with a throttle wiring was detected, that has been solved in the meantime. Turn your bike off and on again to continue riding.
-**THROTTLE #1-5:** Various problems with the throttle wiring.The most common cause for these errors lie in one of the wires not being properly connected or if the wire is broken. Turn off the bike, check the wiring and turn the bike on again.

-**CUTOFF THROTTLE:** The throttle has been activated while the bike is being turned on.
-1st solution: Release the throttle when turning on the bike;
-2nd solution: Re-calibrate the throttle (see the "Setting up the Throttle" section of this document) ;
-3rd solution: Check the wiring.
-**CUTOFF BATTERY TEMP:** Battery has overheated. The bike will stop until it cools down.
-**HALL PROBLEM:** The Hall sensor has disconnected during the ride. Check the wiring.
-**HALL DISCONNECTED:** The Hall sensor has disconnected during the ride. Check the wiring.
-**CUTOFF BMS TEMP:** The BMS mosfet temperature has reached the limit. The bike will stop until it cools down.

2nd Screen: PEAKS

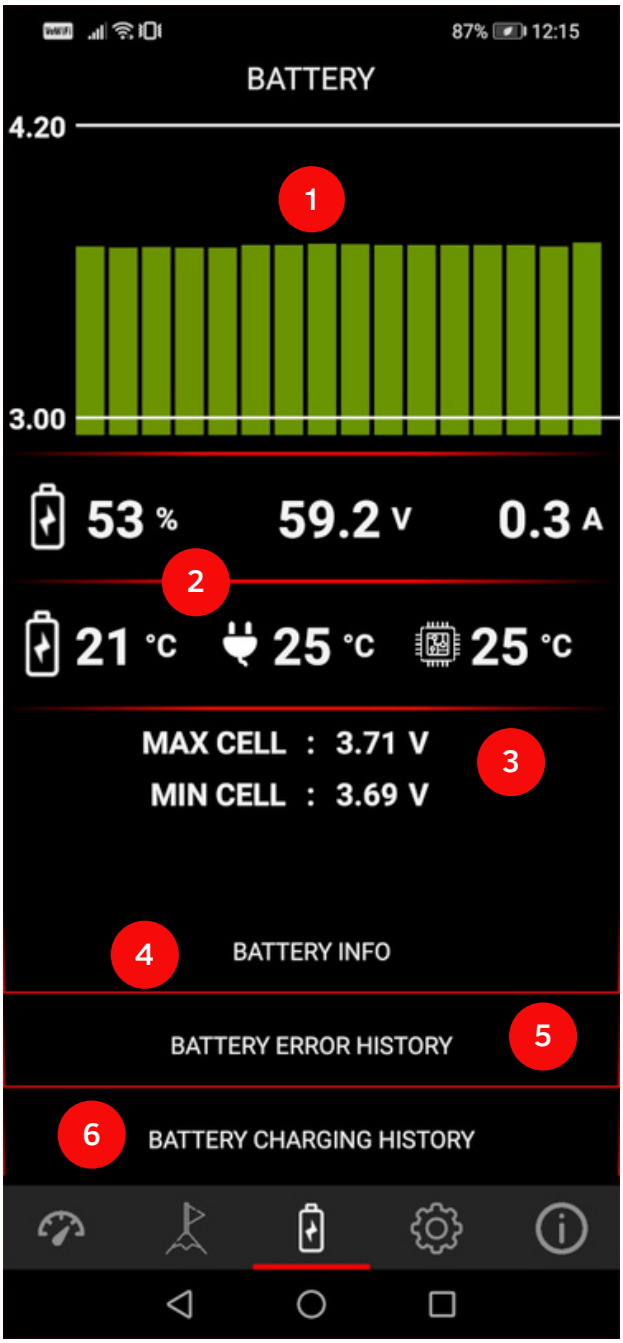
Check all the minimal and maximal values that occurred during your ride.



3rd Screen: BATTERY INFO

You will be able to see all the functions of this screen only with the stock SurRon battery and stock BMS. It also works with the bypassed battery, but with limited display of data (battery current, cycles and SOH will not be displayed correctly).

Use this screen to determine the health of your stock SurRon battery. The screen shows you the state of health of each of the battery cells and can serve as a useful tool to check the health of the battery or to determine the cause of battery malfunctions.



1 - Battery Cell Voltage: Check the voltage of each battery cell. The more the columns are aligned, the healthier the battery.

2- Battery Overview: Check the SOC, battery voltage, battery current, battery temperature, charging MOSFET temperature, and discharging MOSFET temperature in real-time.

3-Min & Max Battery Cell Voltage: Minimal and maximal battery cell voltage. Lesser the difference, healthier the battery.

4-Battery Info: Check the current stats of battery cells, charge cycles, battery estimated mileage, including errors, warnings, battery cell temperature,...

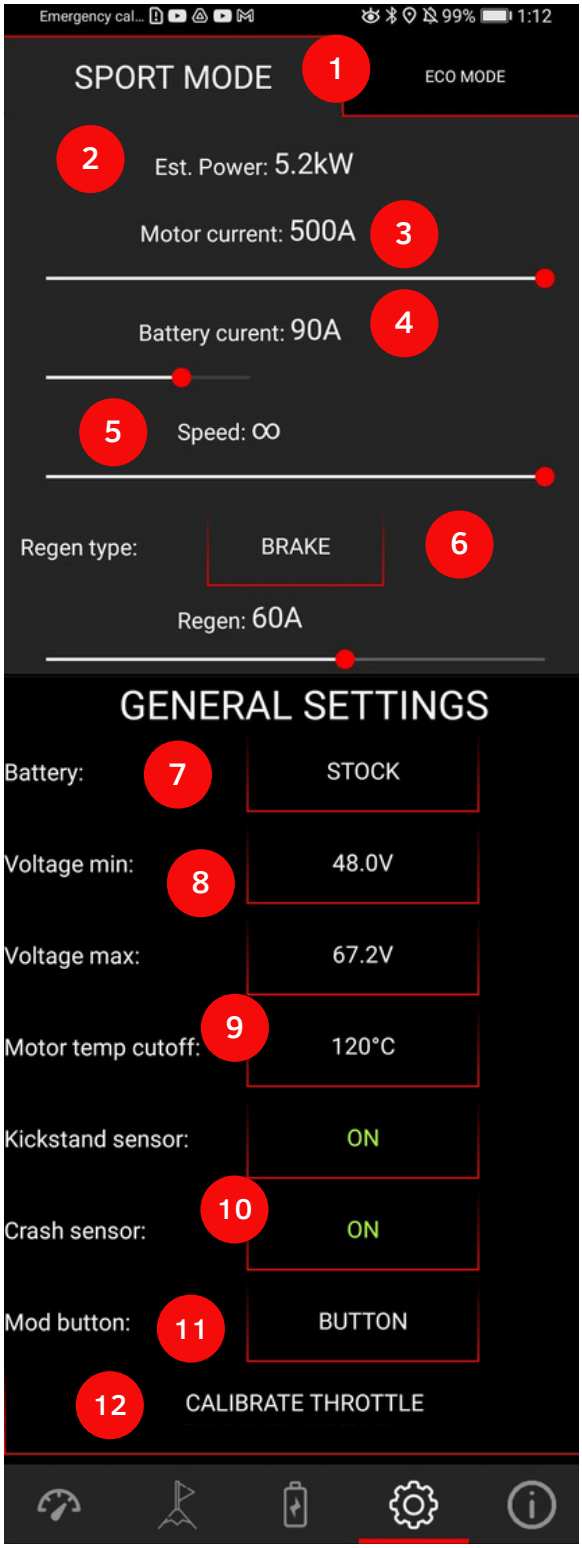
5-Battery Error History: An overview of all-time battery errors.

6-Battery Charging History: Check the charging history information of your battery.

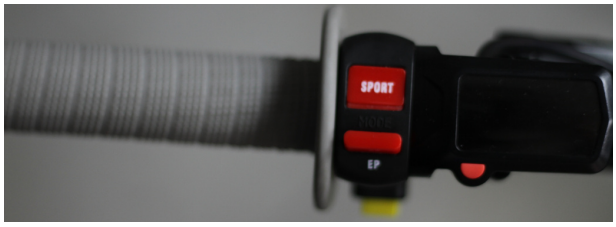
4th Screen: CONTROLLER SETTINGS

Before your first ride you should tune your controller according to your riding preferences and the battery you are using.
The app allows the user to enter certain values that can potentially harm the battery, motor or other parts. We suggest you to use the settings that have been preset in the app by default.

Note that the TC500 controller is not an original SurRon/Segway part, therefore you are using it strictly at your own risk. The damages that are caused by using the controller are solely your responsibility.



1-Sport & Eco Mode: Choose the desired mode by pressing the mode button on the handle bar of your bike.



After that, set the parameters in a tab according to the chosen mode (Sport/Eco).

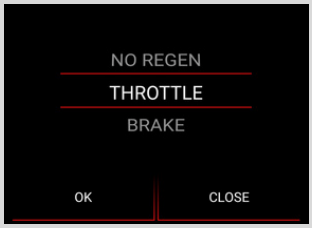
2-Estimated Power: Power estimate sets itself automatically, according to the chosen settings. It is calculated by taking into account the battery current, motor current and voltage (voltage is set according to the battery type).

3-Motor Current: Motor Current affects the torque of the motor. It is most noticeable at a lower speed.

4-Battery Current: Battery Current affects the maximum power. It also affects torque, which is most noticeable at medium and higher speeds.

5-Speed: Set the maximum speed limit. In case you choose ∞your speed is not limited.

6-Regen Type:



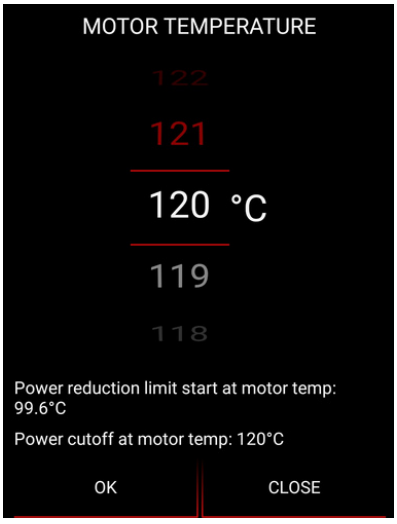
The Controller supports the regen from the original SurRon brake signal and the regen from the throttle release. Choose the regen type by scrolling the menu and press OK. After that, use the slider below to choose how much current should be regenerated. Set the amount of the regenerated current according to your preferences. In case the battery is fully charged, the LOW REGEN warning will appear on the 1st screen.

7-Battery Type: TC500 controller is compatible with:

-stock Surron Light Bee/Segway X260 battery,
-bypassed stock Battery,
-custom 60V battery, and
-72V custom battery.

Select the battery you use and the Controller will set the minimal and maximal voltage to the optimal values.
The selected Battery Type affects the limits that can be set within the App.

8-Min & Max Voltage: Minimal and maximal voltages are set automatically, according to the battery type you choose from the menu above. You can also customize the voltage values for each Battery Type, but we recommend you use the controller in the limits of preset values. Customize the settings carefully, while setting the “Min Voltage” too low can cause the battery to over-discharge.

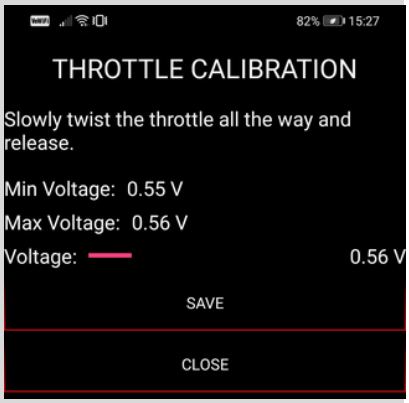


9-Motor Temperature Cutoff: Set the max temperature at which you would like for the controller to limit the power. The controller will gradually limit the power before reaching the max motor temperature. The temperature at which the controller starts limiting the power is indicated at the bottom of the screen. Setting the motor temperature to the red values can cause the motor to overheat and fail.

10-Kickstand and Crash sensor: The TC500 controller is compatible with stock SurRon Kickstand and Crash sensors. You can simply turn them on and off through the App. In case the Kickstand is ON and the kickstand is lowered, the motor will not run and you will see a KICKSTAND warning on the first screen on your App.
The same, in case the Crash Sensor is ON, and you fall, the motor will turn off and you will be presented with the CRASH SENSOR warning on the first screen of your App. In this case, turn off the bike, wait for a few seconds and turn it on again.

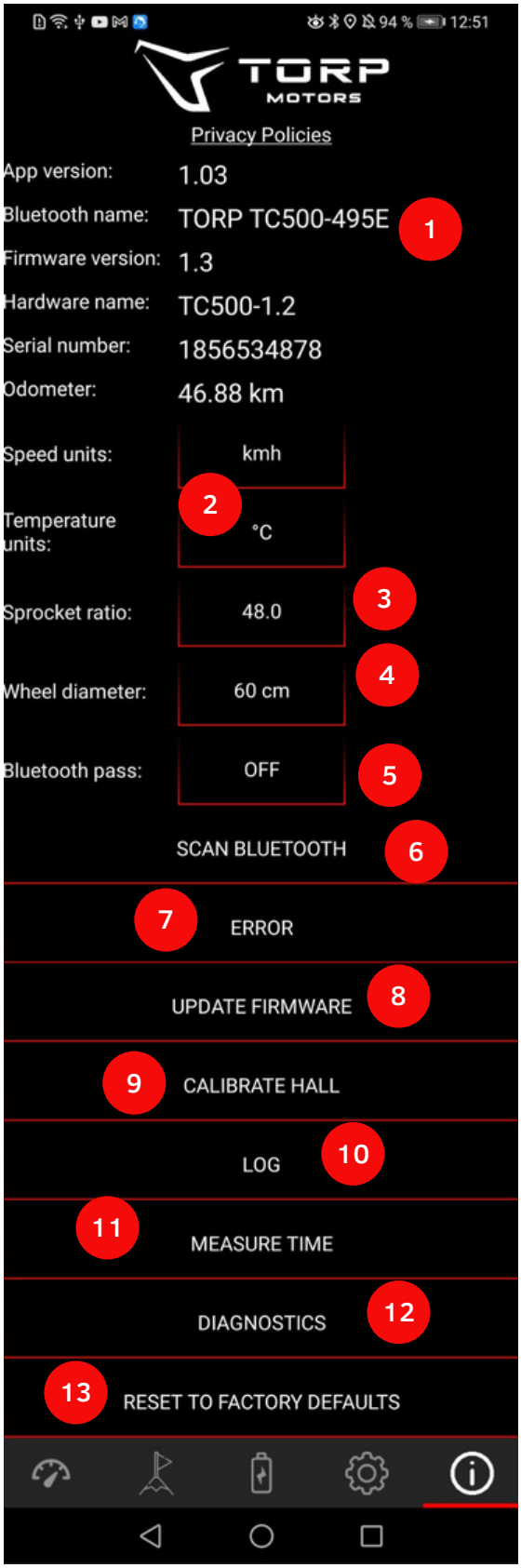
11-Mode Button: Set whether or not you would like to use a mode button on the bike`s handlebar. You have 3 options:
-OFF: The mode button on the bike is disabled. Your bike will remain in the SPORT MODE
-BUTTON: You can switch between ECO and SPORT modes with the mode button on the bike
-TORP DISPLAY: Switch between the ECO and SPORT modes using the TORP DISPLAY. (Not available yet)

12-Calibrate Throttle: We recommend calibrating the throttle when you install the controller for the 1st time or in case you have switched the stock SurRon throttle for another brand. Follow the instructions in the Throttle Calibration window and in the "Setting up the Throttle" section of this document.



5th Screen: APP SETTINGS

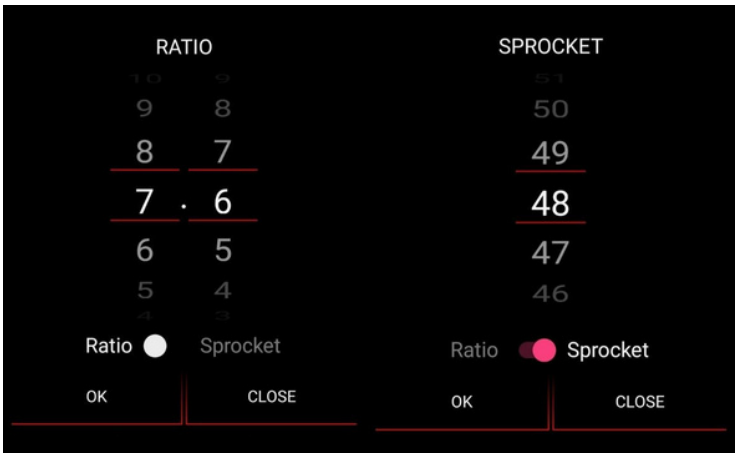
Use this screen to identify your controller and to adjust the general settings. This screen is also useful in case of controller malfunctions, since it allows you to share errors and ride logs with Torp support team.



1-General Information: Check the App and Firmware version and update them in case there is a newer version available. The App can be updated through the Play Store or App Store (depending whether you are using Android or IOS).
You can also see the identification parameters of your controller, like Bluetooth name, Hardware name and Serial number.

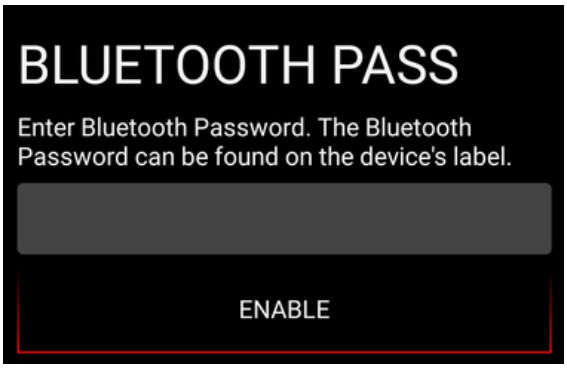
2-Speed and Temperature Units: You can choose between Metric and US Standard units. The chosen units will be applied to other sections of the App.

3-Sprocket Ratio: Change the sprocket tooth count or ratio. This function comes in handy in case you are using sprockets that are not the same size as the stock Surron/Segway sprockets. This option will affect the displayed speed, both



4-Wheel Diameter: Choose the values that correspond to your wheel. Wheel diameter will affect the displayed speed.

5-Bluetooth Pass: In case you want additional protection for your controller, enter a Bluetooth password, which can be found on the controller`s label. Bluetooth pass will be required every time you will connect to the App with a new device.



6-Scan Bluetooth: Use it for connecting to your device.

7-Error: The list of all controller errors since the last time it was disconnected from the battery. This list is useful in determining the causes for controller malfunctioning.

8-Update Firmware: Check whether a new Firmware is available. In case it is, press the button to update.

9-Calibrate Hall: It is recommended to calibrate HALL sensor after the first installation and every time after you do the factory reset. For calibration you will need your Bluetooth pass that can be found on the controller`s label and on the box. Please check the instructions on how to calibrate Hall Sensors at the end of this manual.

10-Log: You can check your ride on the map or send your ride-log file with all the stats to the chosen email address.

11-Measure Time: Measure the acceleration of your e-bike.

12-Diagnostics: An overview of all technical characteristics of the Controller that can help with determining the cause of potential errors.

13-Reset to Factory Defaults: Reset your controller to the factory settings. By pressing this button you will lose all the settings you have made previously. After you reset your controller to the Factory Defaults, you will need to re-calibrate the throttle and HALL Sensors.

ADDITIONAL SETTINGS.

SETTING UP THE CONTROLLER ACCORDING TO THE BATTERY TYPE

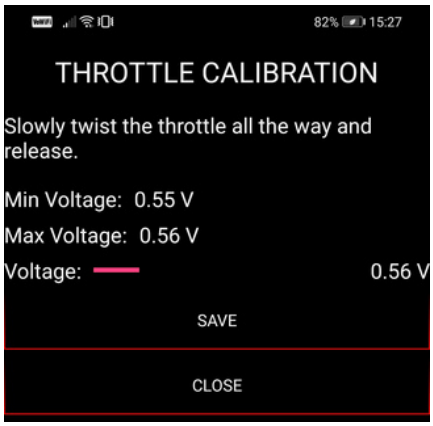
Before using the Controller, you should fine-tune its settings according to the Battery you are using. The TC500 Controller supports*:
-SurRon Stock 60V Battery
-SurRon Stock Bypassed 60V Battery
-Custom 60V Battery
-Custom 72V Battery

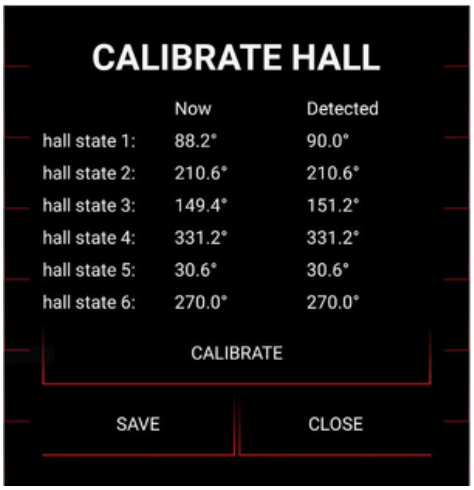
The app will adjust the parameters to optimal values based on your Battery Type. You can adjust Motor and Battery Current according to how much torque you prefer. You can also customize the voltage values for each Battery Type, but we recommend you use the controller in the limits of preset values.

*A Torp Controller can be also used with other batteries, but you should keep in mind that in this case the voltage of the fully charged battery should not be above 84V, and minimal battery voltage should not be less than 36V.

SETTING UP THE THROTTLE

Before using the Controller for the first time or in case you have swapped the stock SurRon Throttle for another brand, you should calibrate the throttle. You should also re-calibrate the throttle every time you are resetting the controller to the factory features.
Scroll to the bottom of the 4th Screen (Controller Settings) and click on the Calibrate Throttle. Then follow the instructions on the screen.





CALIBRATION OF HALL SENSORS

We recommend you to calibrate HALL sensors after the first installation of the TC500 controller and every time after you reset the controller to the Factory settings.
In order to calibrate HALL sensors, you will have to enter your Bluetooth password, which can be found on the label on the box and on the Controller.
After entering the password, you will be presented with the short instructions.

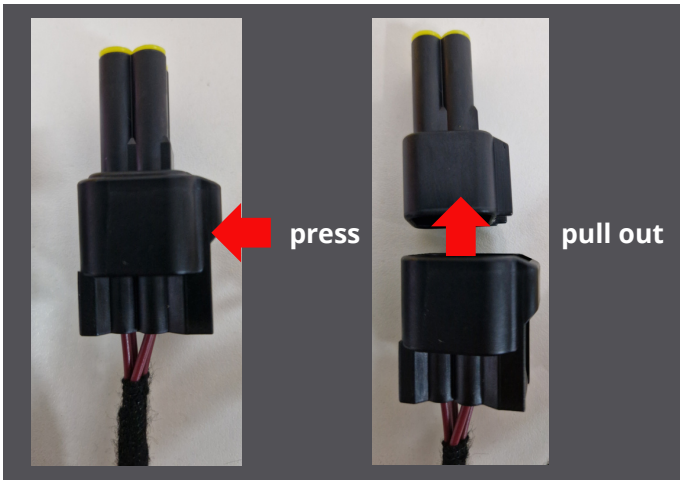
You must lift the rear wheel, which will start spinning for 20 seconds. During this time, the “Detected” column will fill with data, which means that the calibration was successful. Press "save" and exit the Calibrate Hall screen.
After the calibration, you should check the direction in which the motor is spinning. Do that by gently turning the throttle and observe if the rear wheel is turning forward. In case the wheel is spinning in reverse, you should check if the phase wires are connected correctly (see the STEP 5 of the "Installation" section of this document).

TORP DISPLAY.

Torp Display allows you to track your controller and battery data in real-time and to switch between the riding modes. Additional options will be added through regular firmware updates.

INSTALLATION

First, remove the protective cap from the connector by pressing firmly to its side and pulling it out of the connector.



The Torp Display is being installed directly to the controller`s wiring harness, as shown on the photo.

You will need Firmware version 1.4 or higher in order for the display to function. In case you are using the 1.3 version of the Torp App, follow the following steps:

1. Go to the App Store and update the Torp App to the latest version
2. When the update is complete, go to the 5th screen in the Torp App and press the UPDATE FIRMWARE button. Once the update is complete, re-calibrate the throttle and Hall Sensors.

For additional support contact us at:

support@torp.hr

with:
-your Serial Number (S/N)
-a detailed description of the error, with photos and videos

and our team will get back to you with the solution.

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7.3.2023