

# Forestal e-drive system

Diagnostic Tool Manual

**FORESTAL**





This manual will cover the following topics:

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With this manual, you can follow detailed instructions on how to diagnose and update Forestal's e-drive system. To perform these actions, you will need a stable internet connection, a PC, and the bicycle placed on the repair stand.

# BESST tool and I-Can wire

Diagnosis tool for Forestal pedal assisted models

# BESST tool and I-Can wire

Forestal diagnosis tool uses a combination of two tools to fully diagnose the Forestal e-drive unit. The I-Can wire tool is specifically developed by Forestal to bridge the connection between the battery, motor, and BESST tool diagnosis box.



I-Can wire



BESST tool

Tools and materials needed:

- PC
- I-Can wire
- BESST tool
- Update files

With this tool you can diagnose and update:

- Battery health status
- Controller (Motor parameters)
- Update Battery management system (BMS)
- Update Controller (Motor software)



BESST tool software is available only for PC.

# Diagnosis process

How to connect the tools and choose the right diagnosis process

Before starting, firstly charge the bicycle and then connect it to the BESST tool and BESST PC software using I-Can wire following the instructions indicated hereby. After a successful connection, you can access the diagnostic and update the system.

## Step 1

Open the charging port.



## Step 2

Connect the I-Can wire to the integrated battery and charging port as indicated.



## Step 3

## Diagnosis process

Power ON the bike through the Trigger and wait for the bike to boot completely.



Fully charge the bicycle before connecting the BESST tool!

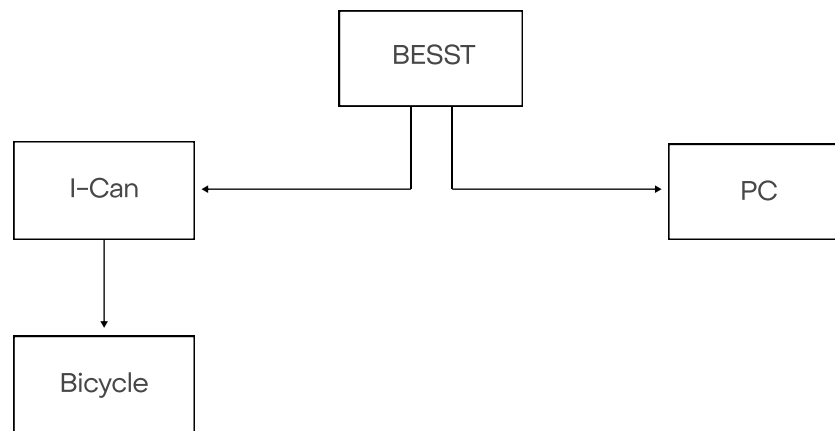


If the trigger is not working and the bicycle can't be turned on, please proceed to replace the trigger before continuing the diagnosis or update process.

## Step 4

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Connect the BESST tool to a PC via the USB provided with the tool, and connect it to the I-Can wire as shown on the diagram.



## Step 5

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## Diagnosis process

Open BESST tool software on your PC.



Icon of the software



BESST tool software is available only for PC.

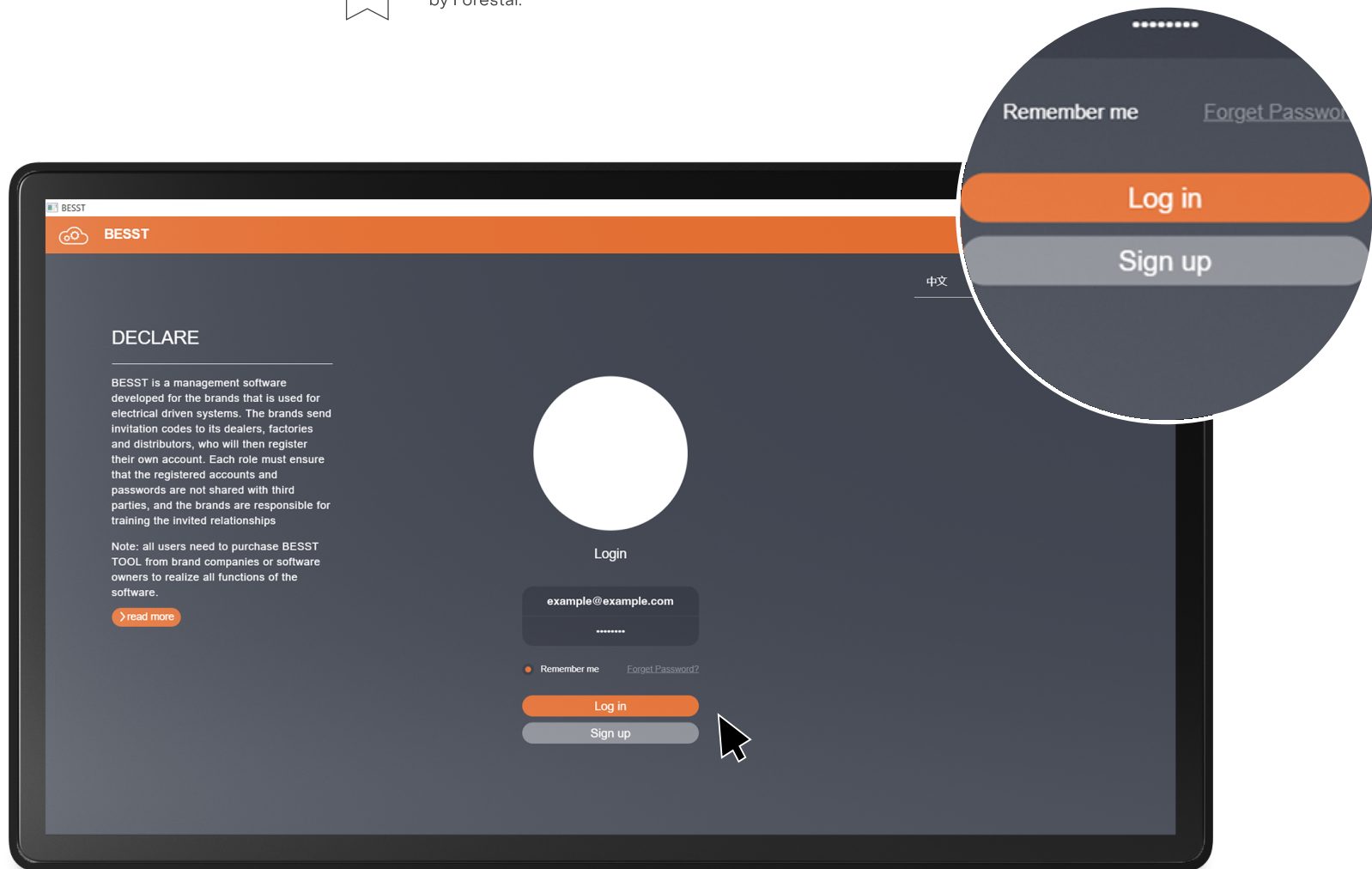
## Step 6

## Diagnosis process

Log in to your account.



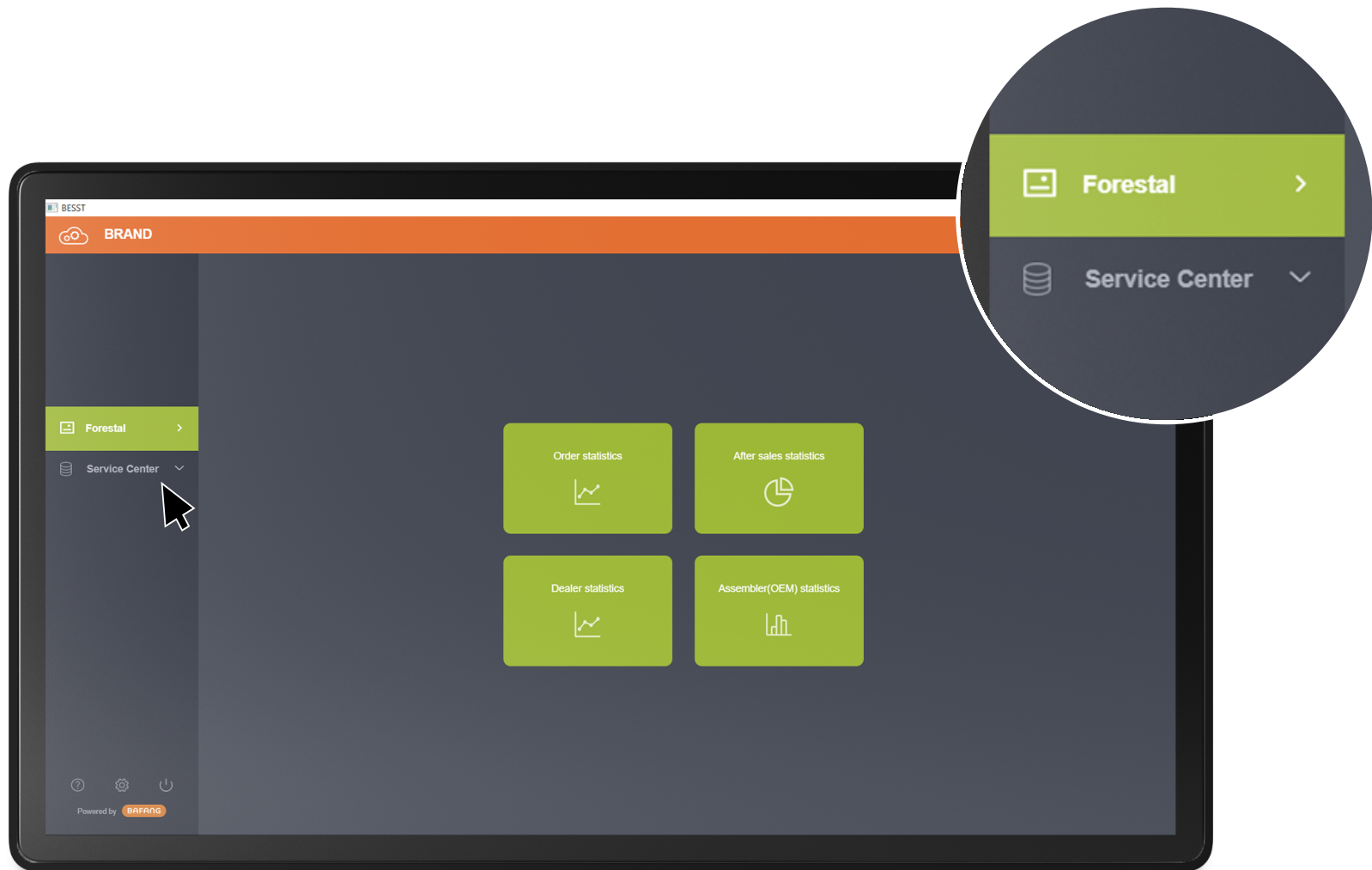
Every dealer/user has an individual account provided by Forestal.



## Step 7

## Diagnosis process

Once you are logged in, you can find a menu with different functions on the left side of the screen.

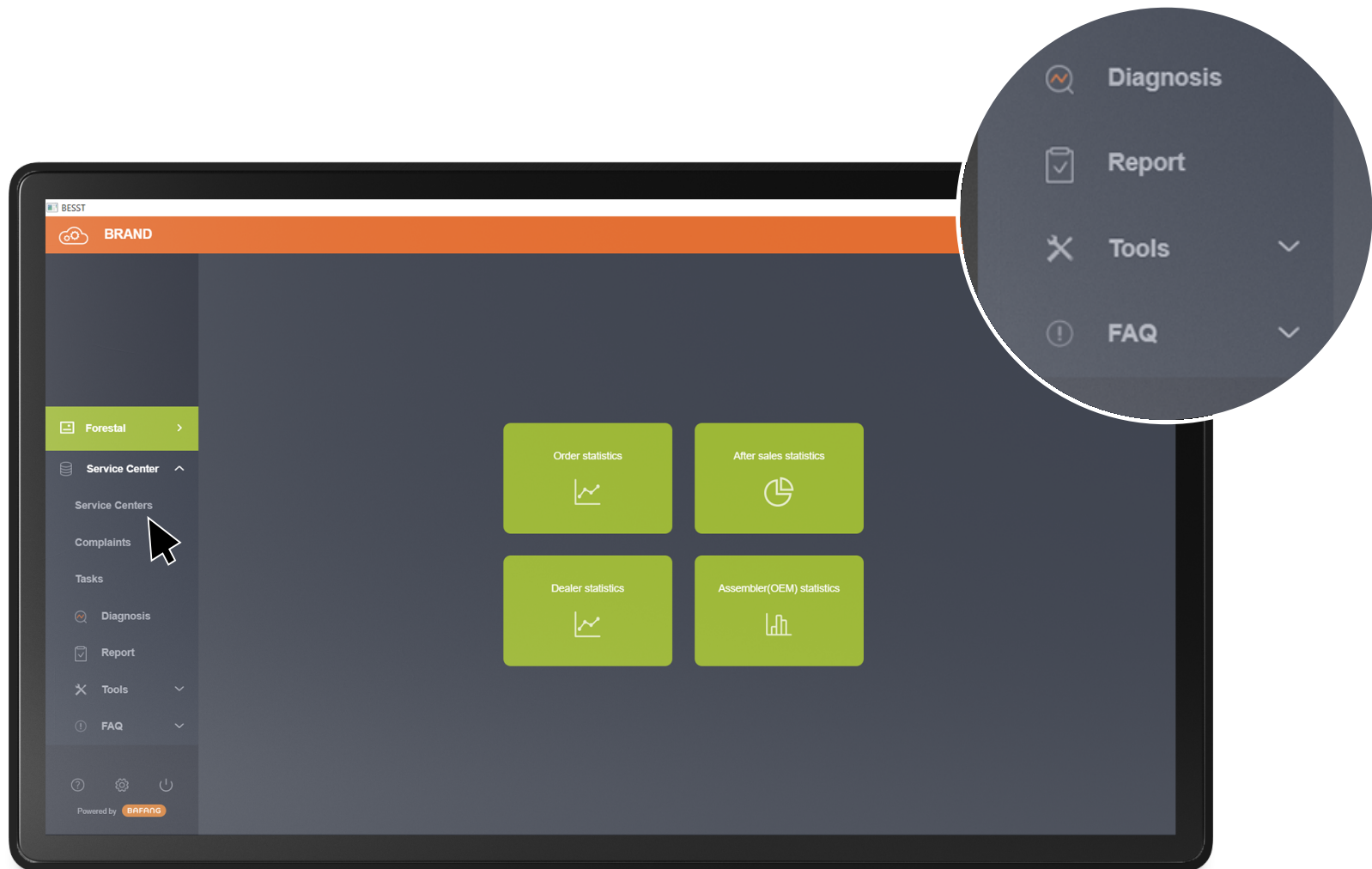




## Step 8

## Diagnosis process

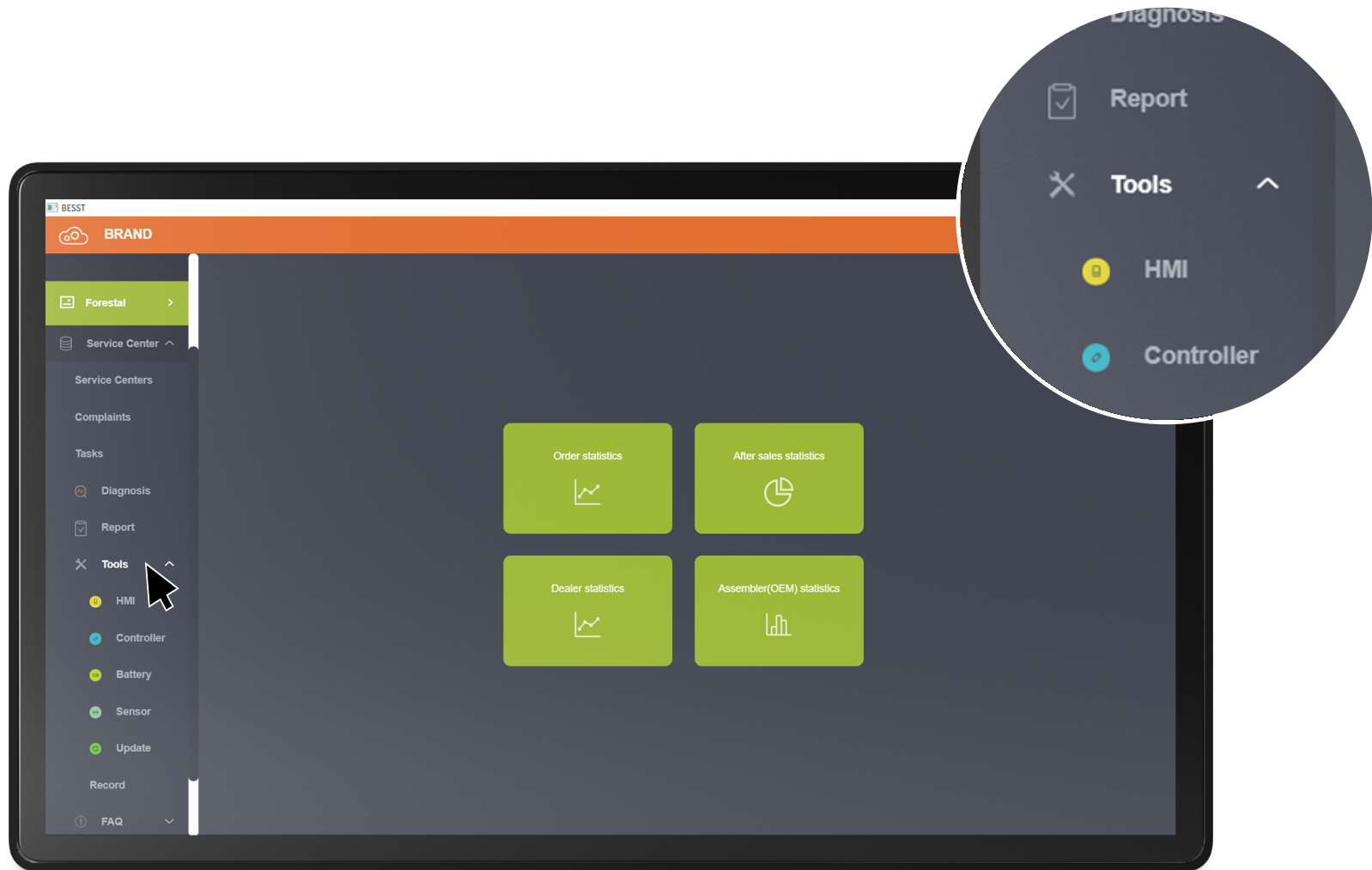
Find the "Service center" icon and from there enter the "Tools" area.



## Step 9

## Diagnosis process

In the “Tools” area, you can choose different sections to diagnose: Battery, Controller (Motor), and Sensors; or Update these components with new software versions.



# Battery diagnosis

Health status check

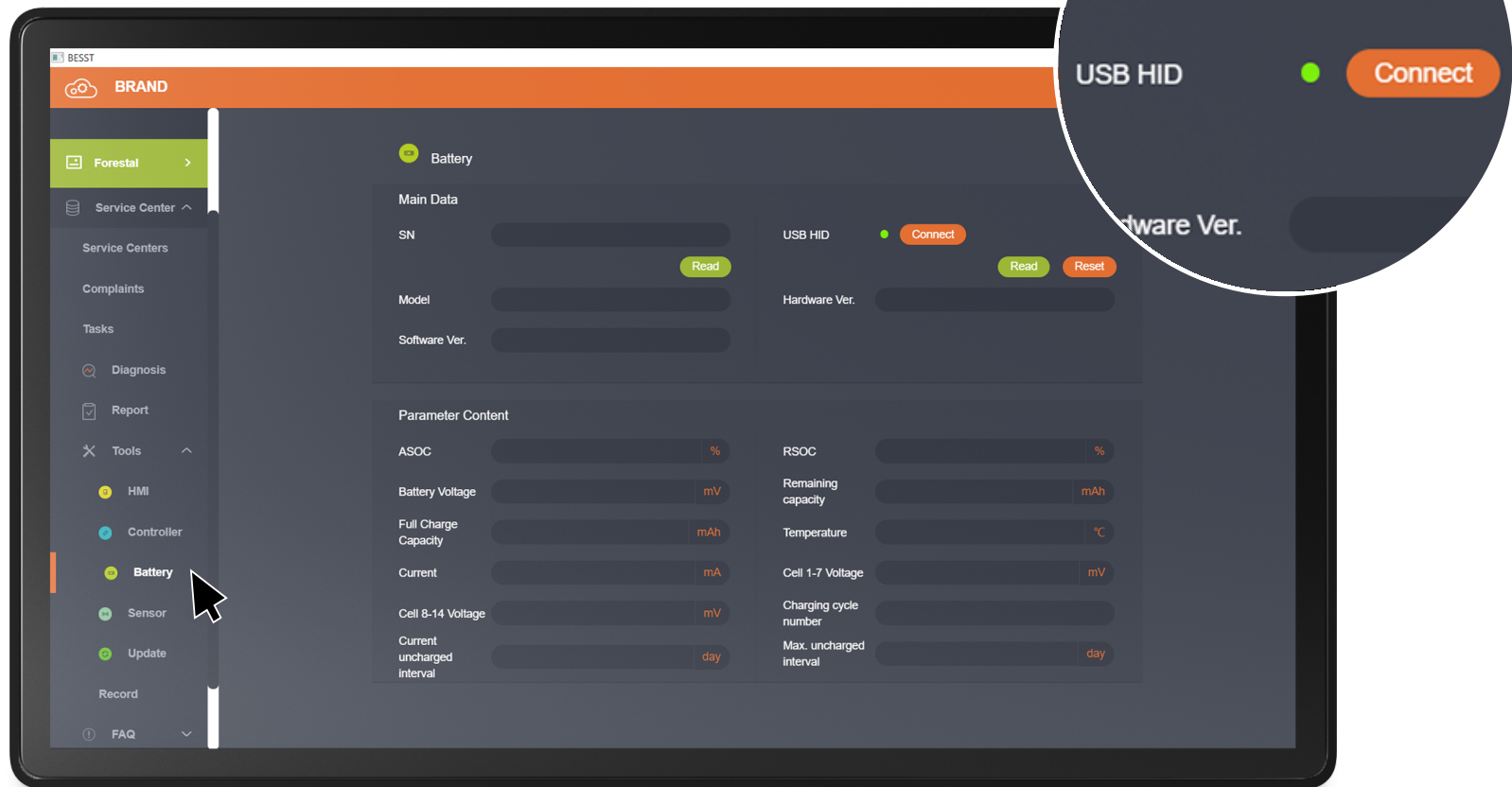
## Step 1

## Battery diagnosis

Click “Connect” on the USB HID field. Values will refresh and you may start reading them.



If you are not able to read any of the values after this step, this means that communication with the battery is broken. This directly leads to a battery replacement. If values are displayed, please continue to the next steps.



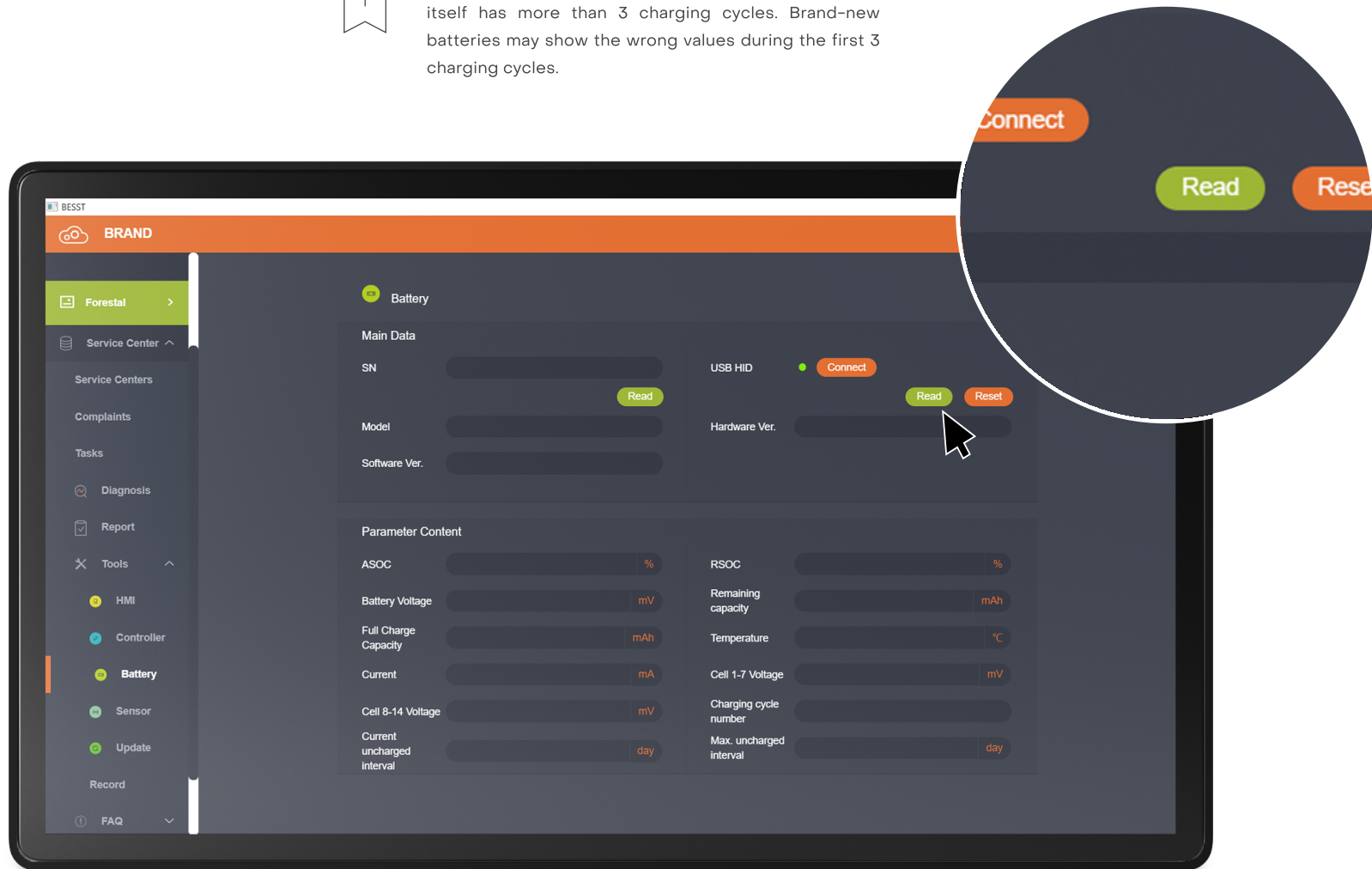
## Step 2

## Battery diagnosis

When everything is connected like in the previous step, click the “Read” button and the tool will refresh the battery and show the values.



Before checking the battery, make sure that the battery itself has more than 3 charging cycles. Brand-new batteries may show the wrong values during the first 3 charging cycles.





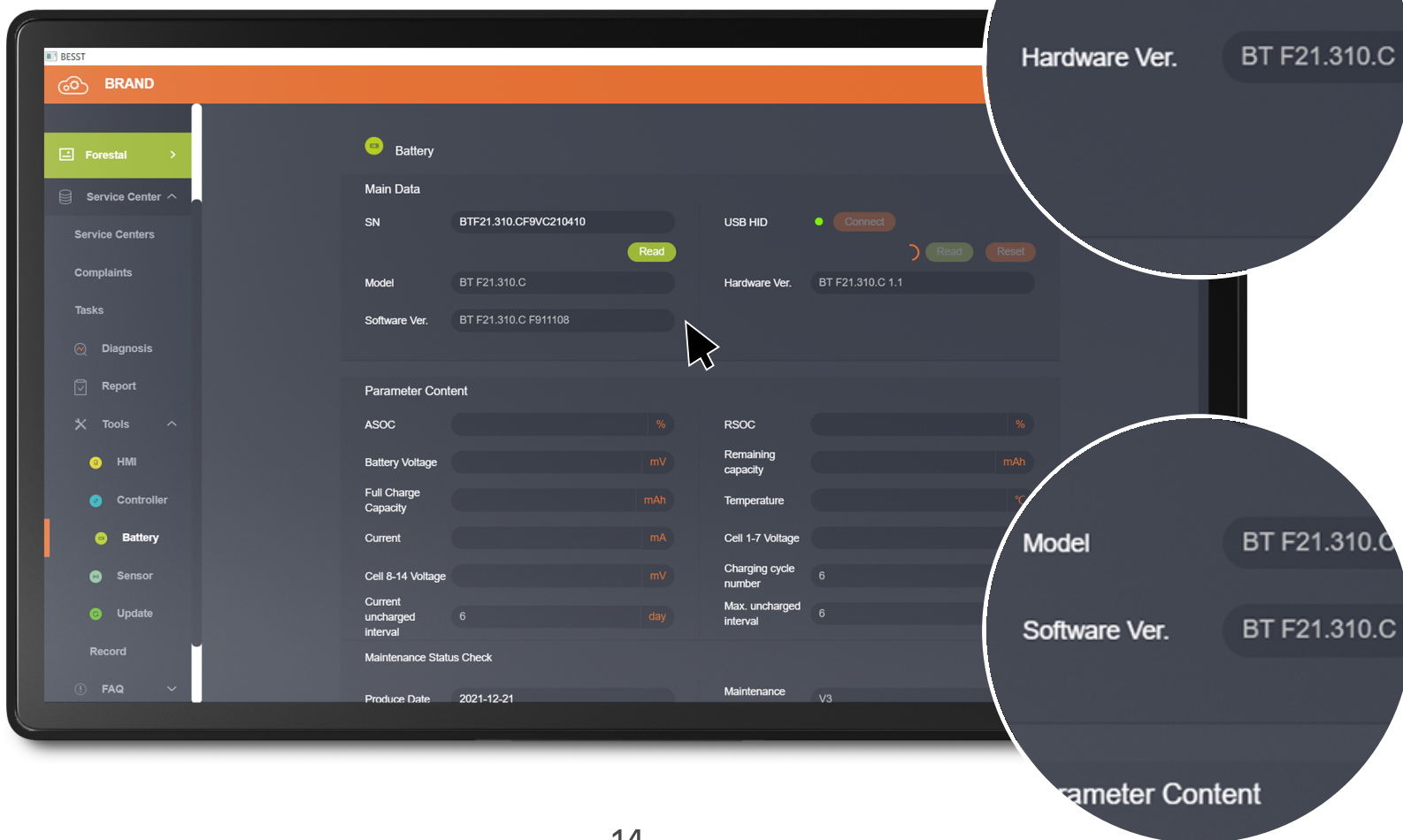
## Step 3

## Battery diagnosis

Check software and hardware version.



If the software version doesn't match the hardware version, then the battery needs a software update (see page 33 on how to update the battery). If software and hardware versions match, proceed toward checking the battery cells and other parameters.





If the software version doesn't match the hardware version, then the battery needs a software update (see page 33 on how to update the battery). If software and hardware versions match, proceed toward checking the battery cells and other parameters.

**Software end number**

**Corresponding hardware**

**.BIN file name**

104

1.0

APP\_F21\_20220907V109M\_aaa1.bin

108

1.1

APP\_F21N\_20220907V109M\_95c9.bin

## Step 4

## Battery diagnosis

Inspect battery cells value in the “Cel 1-7” and “Cell 8-14” rows. Values should be the same for every cell. If the difference is more than  $\pm 50\text{mV}$ , the battery is not fit for use and requires replacement.

The screenshot shows the BESST Battery diagnosis interface. The left sidebar contains a menu with options: Forestal, Service Center, Complaints, Tasks, Diagnosis, Report, Tools, HMI, Controller, Battery (selected), Sensor, Update, and Record. The main area displays the Battery status and various parameters.

**Main Data:**

- SN: BTF21.310.CF9VC210410
- Model: BT F21.310.C
- Software Ver.: BT F21.310.C F911108
- USB HID: Connect
- Hardware Ver.: BT F21.310.C 1.1

**Parameter Content:**

Parameter	Value	Unit
ASOC	90	%
Battery Voltage	57450	mV
Full Charge Capacity	6400	mAh
Current	-90	mA
Cell 1-7 Voltage	4105,4104,4104,4103,4103,4104,4104	mV
Cell 8-14 Voltage	4105,4103,4103,4104,4103,4103,4103	mV
Current uncharged interval	6	day
Max. uncharged interval	6	day
RSOC	94	%
Remaining capacity	5800	mAh
Temperature	22	°C
Charging cycle number	6	

**Maintenance Status Check:**

- Produce Date: 2021-12-21
- Maintenance: V3

Two circular callouts highlight specific data points:

- Top Callout:** Remaining capacity: 5800, Temperature: 22, Cell 1-7 Voltage: 4105,4104,4104, Charging cycle number: 6, Current uncharged interval: 6.
- Bottom Callout:** Full Charge Capacity: 6400, Current: -90, Cell 8-14 Voltage: 4105,4103,4103, Current uncharged interval: 6, Maintenance Status Check.



## Step 5

## Battery diagnosis

If all cells are balanced, please compare the RSOC “Real State Of Charge” row with the battery level displayed on the Dashboard. If RSOC values are matching, please go to the next step. If not, the battery is not functioning properly and it requires replacement.



Fully charge the battery before comparing these values.

The screenshot displays the BESST interface for battery diagnosis. The left sidebar shows a navigation menu with options: Forestal, Service Center, Complaints, Tasks, Diagnosis, Report, Tools, HMI, Controller, Battery, Sensor, Update, and Record. The main content area shows the following data:

Parameter	Value	Unit
Model	BT F21.310.C	
Hardware Ver.	BT F21.310.C 1.1	
Software Ver.	BT F21.310.C F911108	
ASOC	90	%
Battery Voltage	57440	mV
Full Charge Capacity	6400	mAh
Current	-90	mA
Cell 8-14 Voltage	4105,4103,4103,4104,4103,4103,4103,4103	mV
Current uncharged interval	6	day
RSOC	93	%
Remaining capacity	5797	mAh
Temperature	22	°C
Cell 1-7 Voltage	4105,4104,4104,4103,4103,4104,4103	mV
Charging cycle number	6	
Max. uncharged interval	6	day
Produce Date	2021-12-21	
SOH	100	%
Maintenance Stage	V3	
Result	Under Maintenance	

On Stage V3: If Cycle Count is less than 250 and the SOH bigger than 80%, the battery is Under Maintenance.

A circular callout highlights the following values:

- RSOC: 93
- Remaining capacity: 5797
- Temperature: 22

## Step 6

## Battery diagnosis

If the RSOC values are ok and match the displayed battery level, check the battery voltage. When RSOC = 100%, the voltage should be between 57.4 V and 58.3 V. If values are lower than this, the battery is undervolted and needs replacement. If the voltage is between these values, please proceed to the next steps.

The screenshot displays the BESST diagnostic interface for a battery. The left sidebar shows navigation options: Forestal, Service Center, Complaints, Tasks, Diagnosis, Report, Tools, HMI, Controller, Battery, Sensor, Update, and Record. The main area shows the 'Parameter Content' section with various battery metrics. A circular callout highlights the 'Parameter Content' section, showing the following values:

Parameter	Value	Unit
ASOC	90	%
Battery Voltage	57440	mV
Full Charge Capacity	6400	mAh
Current	-90	mA
Cell 8-14 Voltage	4105,4103,4103,4104,4103,4103,4103,4103	mV
Current uncharged interval	6	day
RSOC	93	%
Remaining capacity	5797	mAh
Temperature	22	°C
Cell 1-7 Voltage	4105,4104,4104,4103,4103,4104,4103	mV
Charging cycle number	6	
Max. uncharged interval	6	day

The interface also shows a 'Maintenance Status Check' section with the following information:

Parameter	Value	Unit
Produce Date	2021-12-21	
SOH	100	%
Maintenance Stage	V3	
Result	Under Maintenance	

On Stage V3: If Cycle Count is less than 250 and the SOH bigger than 80%, the battery is Under Maintenance.

## Step 7

## Battery diagnosis

Check maintenance status by determining how many charging cycles the battery has. Forestal batteries are covered with a warranty of up to 200 charging cycles or 2 years of use, whichever comes first.

The screenshot displays the BESST diagnostic interface for a Forestal battery. The interface is divided into a left sidebar with navigation options (Forestal, Service Center, Complaints, Tasks, Diagnosis, Report, Tools, HMI, Controller, Battery, Sensor, Update, Record, FAQ) and a main content area. The main content area shows various battery parameters and a maintenance status check.

**Model:** BT F21.310.C **Read** **Hardware Ver.:** BT F21.310.C 1.1 **Read** **Software Ver.:** BT F21.310.C F911108

**Parameter Content**

Parameter	Value	Unit
ASOC	90	%
Battery Voltage	57440	mV
Full Charge Capacity	6400	mAh
Current	-90	mA
Cell 8-14 Voltage	4105,4103,4103,4104,4103,4103,4103,4103	mV
Current uncharged interval	6	day
RSOC	93	%
Remaining capacity	5797	mAh
Temperature	22	°C
Cell 1-7 Voltage	4105,4104,4104,4103,4103,4104,4104	mV
Charging cycle number	6	
Max. uncharged interval	6	day

**Maintenance Status Check**

Parameter	Value
Produce Date	2021-12-21
SOH	100 %
Maintenance Stage	V3
Result	Under Maintenance

On Stage V3: If Cycle Count is less than 250 and the SOH bigger than 80%, the battery is Under Maintenance.

A circular callout on the right side of the interface highlights the following parameters:

- Temperature: 22
- Cell 1-7 Voltage: 4105,4104,4104,4103,4103,4104,4104
- Charging cycle number: 6
- Max. uncharged interval: 6

## Step 8

## Battery diagnosis

Check maintenance status by determining how many charging cycles the battery has and what is the SOH (State Of Health). Forestal batteries are covered with a warranty of up to 200 charging cycles or 2 years of use, whichever comes first. Please see the detailed Maintenance stage table on the next page for detailed information.

The screenshot displays the BESST battery diagnosis interface. The left sidebar contains navigation options: Service Center, Complaints, Tasks, Diagnosis, Report, Tools, HMI, Controller, Battery, Sensor, Update, and Record. The main content area shows the following data:

Parameter	Value	Unit
Model	BT F21.310.C	
Software Ver.	BT F21.310.C F911108	
Hardware Ver.	BT F21.310.C 1.1	
ASOC	90	%
Battery Voltage	57440	mV
Full Charge Capacity	6400	mAh
Current	-90	mA
Cell 8-14 Voltage	4105,4103,4103,4104,4103,4103,4103,4103	mV
Current uncharged interval	6	day
RSOC	93	%
Remaining capacity	5797	mAh
Temperature	22	°C
Cell 1-7 Voltage	4105,4104,4104,4103,4103,4104,4103	mV
Charging cycle number	6	
Max. uncharged interval	6	day

**Maintenance Status Check**

Parameter	Value
Produce Date	2021-12-21
Maintenance Stage	V3
SOH	100
Result	Under Maintenance

On Stage V3: If Cycle Count is less than 250 and the SOH bigger than 80%, the battery is Under Maintenance.

Two circular callouts provide additional details:

- Top Callout:** Temperature 22, Cell 1-7 Voltage 4105,4104, Charging cycle number 6, Max. uncharged interval 6.
- Bottom Callout:** Produce Date 2021-12-21, SOH 100, On Stage V3: If Cycle Count is less than 250 and the SOH bigger than 80%, the battery is Under Maintenance.



- The warranty date is counted from the date the bike was sold to the end user
- All of these numbers are read from BESST
- Spec.: Specifications
- DC: Design capacity
- FCC: Full charger capacity
- SOH: State of health

Stage	Warranty	Spec.	DC	FCC	SOH	Cycle	Content
V1	0 Months	All	–	–	< 95%	0	Free replace
V2	0 – 6 Months	310 Wh	6,5 Ah	< 5,9 Ah	< 90%	< 50	Free replace
V3	6 – 18 Months	310 Wh	6,5 Ah	< 5,2 Ah	< 80 %	< 250	After maintenance SOH > 80%
V4	18 – 30 Months	310 Wh	6,5 Ah	< 4,8 Ah	< 60 %	< 500	After maintenance SOH > 60%
V5	> 30 Months	All	–	–	–	–	Paid maintenance or paid renewal

# Controller (Motor) diagnosis

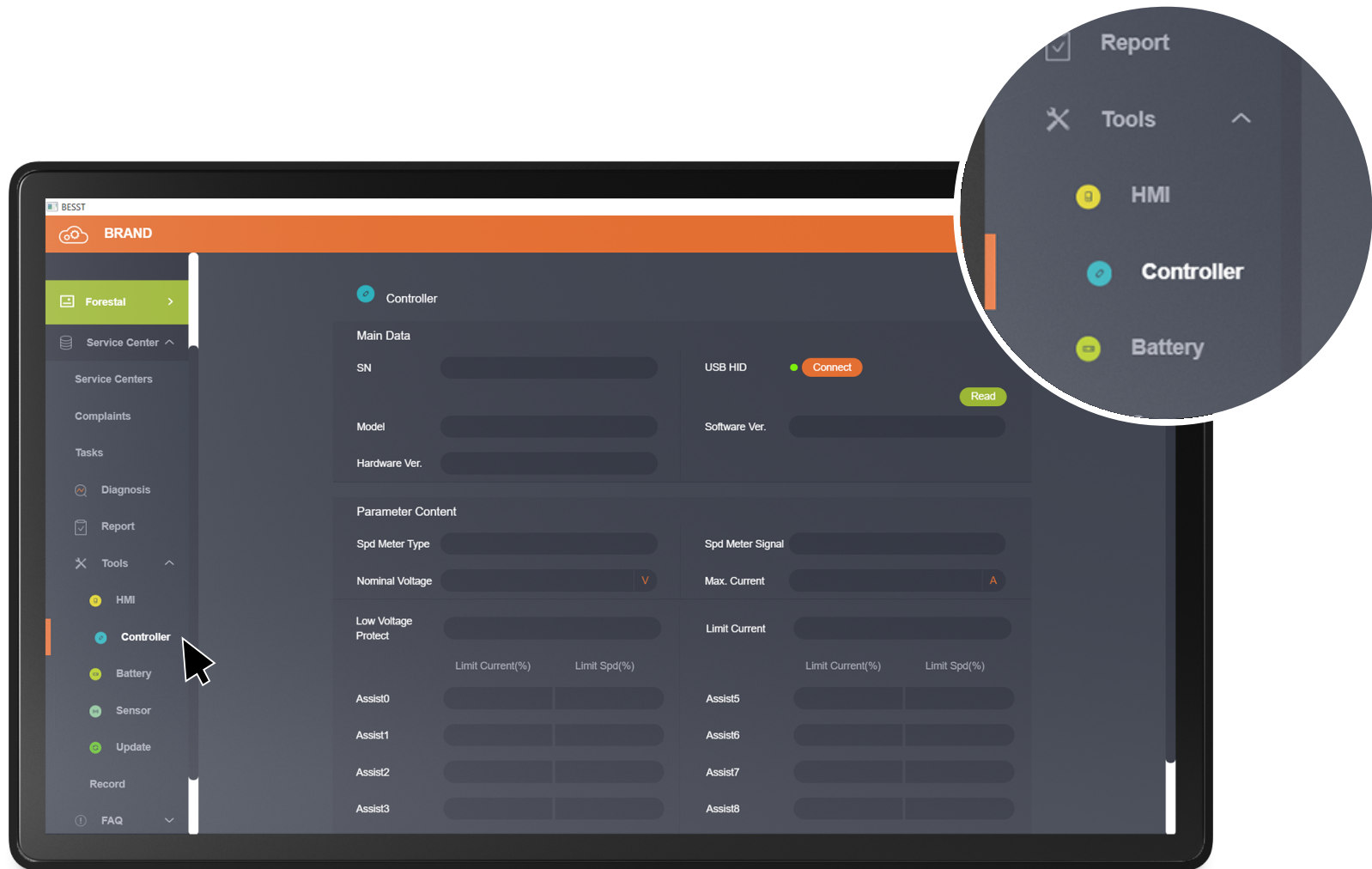
Health status check



## Step 1

## Controller (Motor) diagnosis

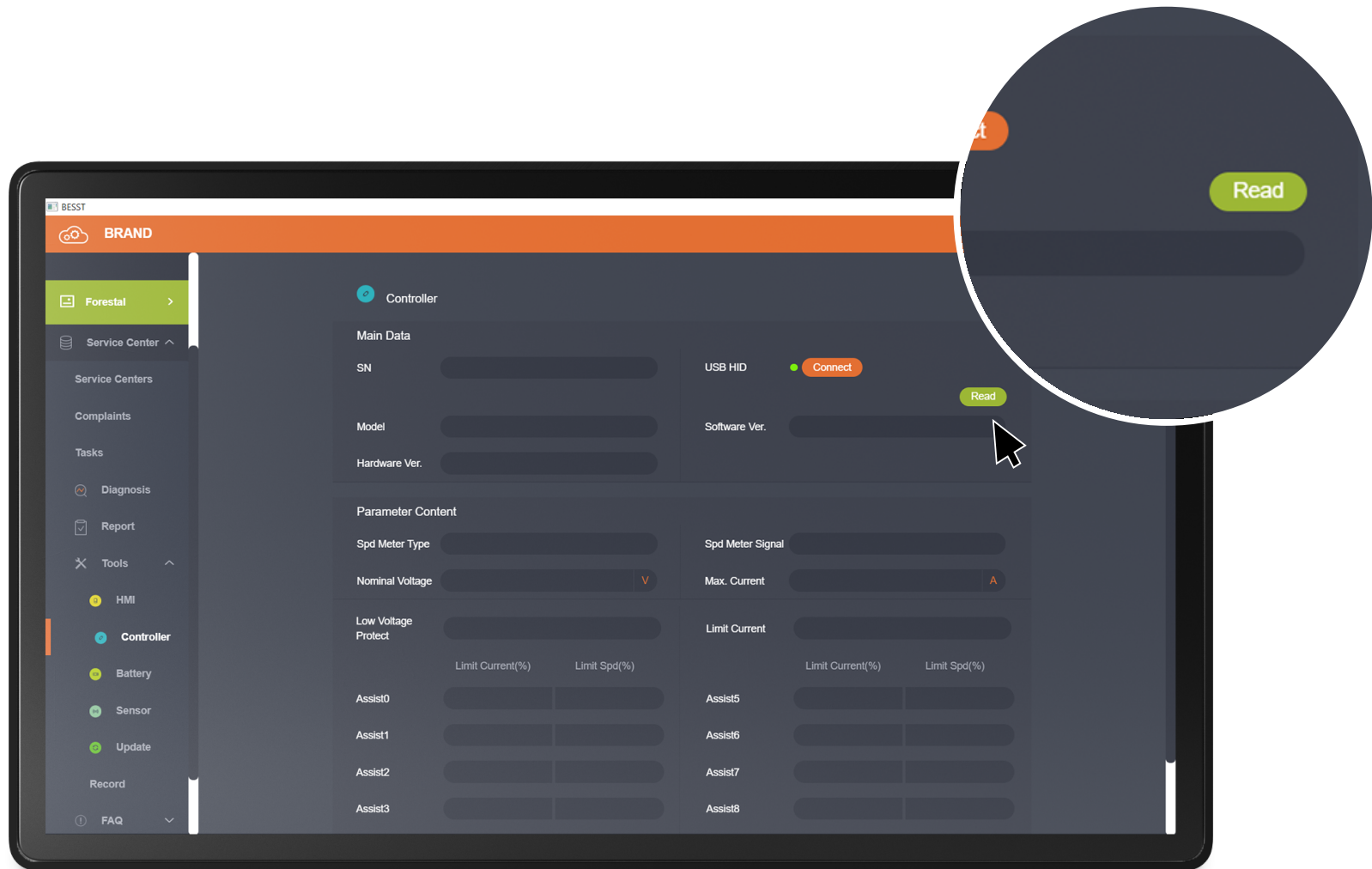
When everything is connected like shown in pages 5 and 6, from the home screen click “Tools” and then find the “Controller” menu.



## Step 2

## Controller (Motor) diagnosis

Click the “Read” button and the values will refresh. If there is no value after a few refresh cycles, the motor controller is broken or damaged and the motor unit needs replacement. If there are values available for reading, please proceed toward the next steps.





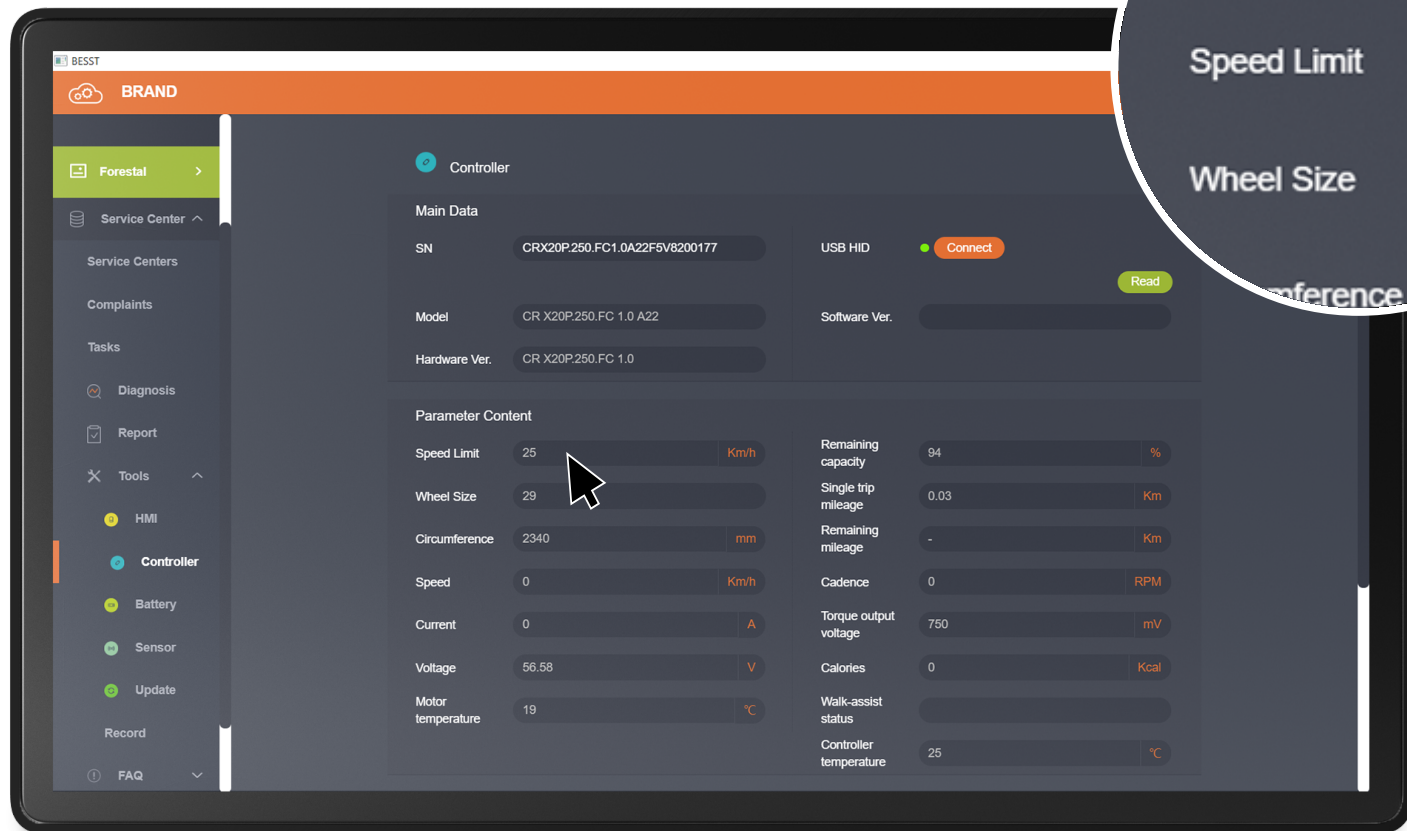
## Step 3

## Controller (Motor) diagnosis

Check the speed limit.



The speed limit should be within the legal speed limit of the area you are riding or selling the bicycles. If you need to modify the speed limit, please scroll down to the settings section at the bottom of the Controller menu and chose the right parameters.



## Step 4

## Controller (Motor) diagnosis

Check the wheel size values. It should match the wheel size of your bicycle.

The screenshot shows the BESST diagnostic software interface. The sidebar on the left contains navigation options: Forestal, Service Center, Complaints, Tasks, Diagnosis, Report, Tools, HMI, Controller, Battery, Sensor, Update, and Record. The main area displays the 'Controller' diagnosis screen. It includes a 'Main Data' section with fields for SN, Model, Hardware Ver., USB HID, and Software Ver. Below this is the 'Parameter Content' section, which lists various parameters and their values. A circular callout highlights the 'Wheel Size' parameter, which is set to 29. The callout also shows the 'Speed Limit' (25) and 'Circumference' (2340) parameters.

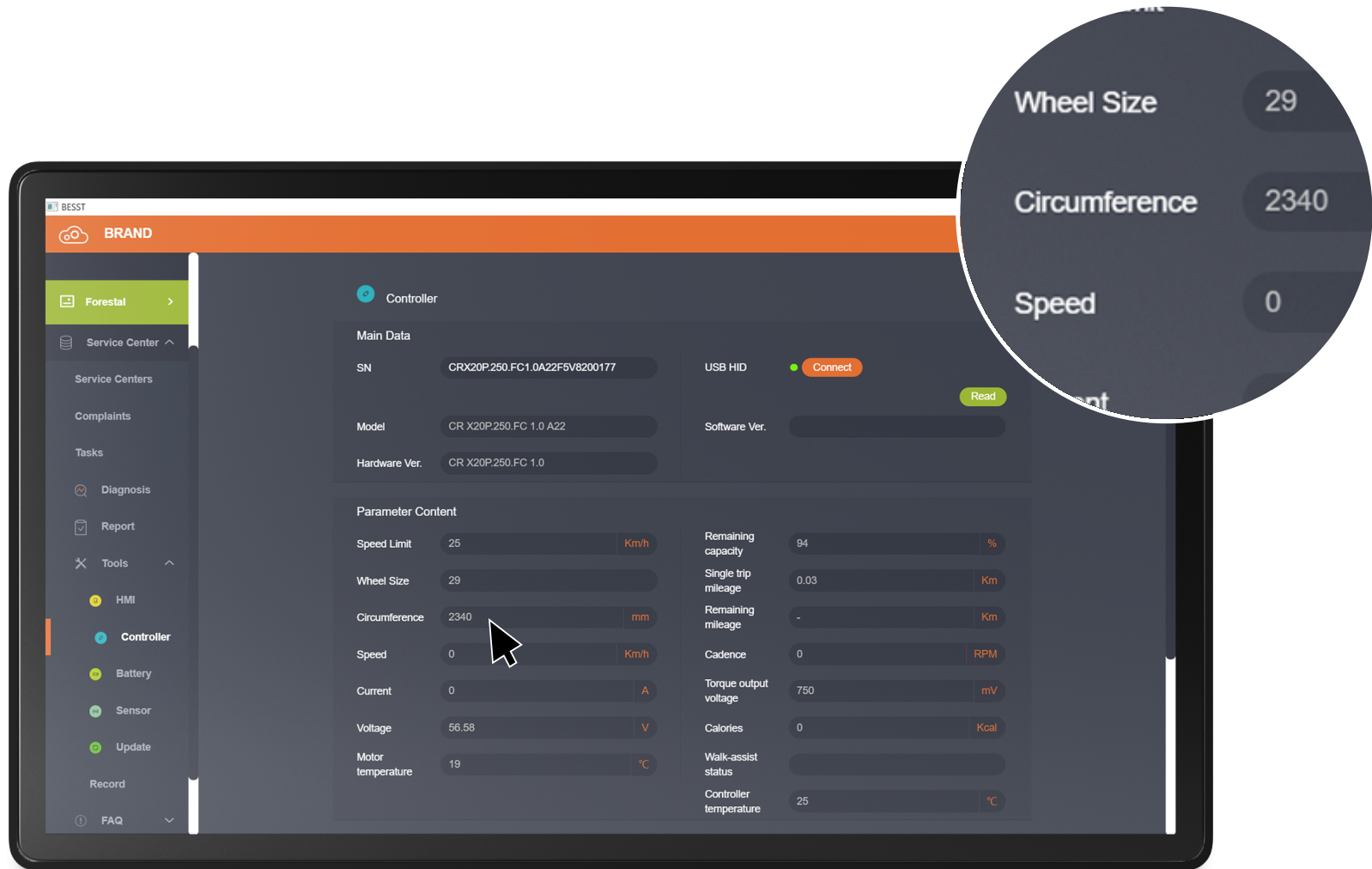
Main Data	
SN	CRX20P.250.FC1.0A22F5V8200177
Model	CR X20P.250.FC 1.0 A22
Hardware Ver.	CR X20P.250.FC 1.0
USB HID	Connect
Software Ver.	Read

Parameter Content	
Speed Limit	25 Km/h
Wheel Size	29
Circumference	2340 mm
Speed	0 Km/h
Current	0 A
Voltage	56.58 V
Motor temperature	19 °C
Remaining capacity	94 %
Single trip mileage	0.03 Km
Remaining mileage	- Km
Cadence	0 RPM
Torque output voltage	750 mV
Calories	0 Kcal
Walk-assist status	
Controller temperature	25 °C

## Step 5

## Controller (Motor) diagnosis

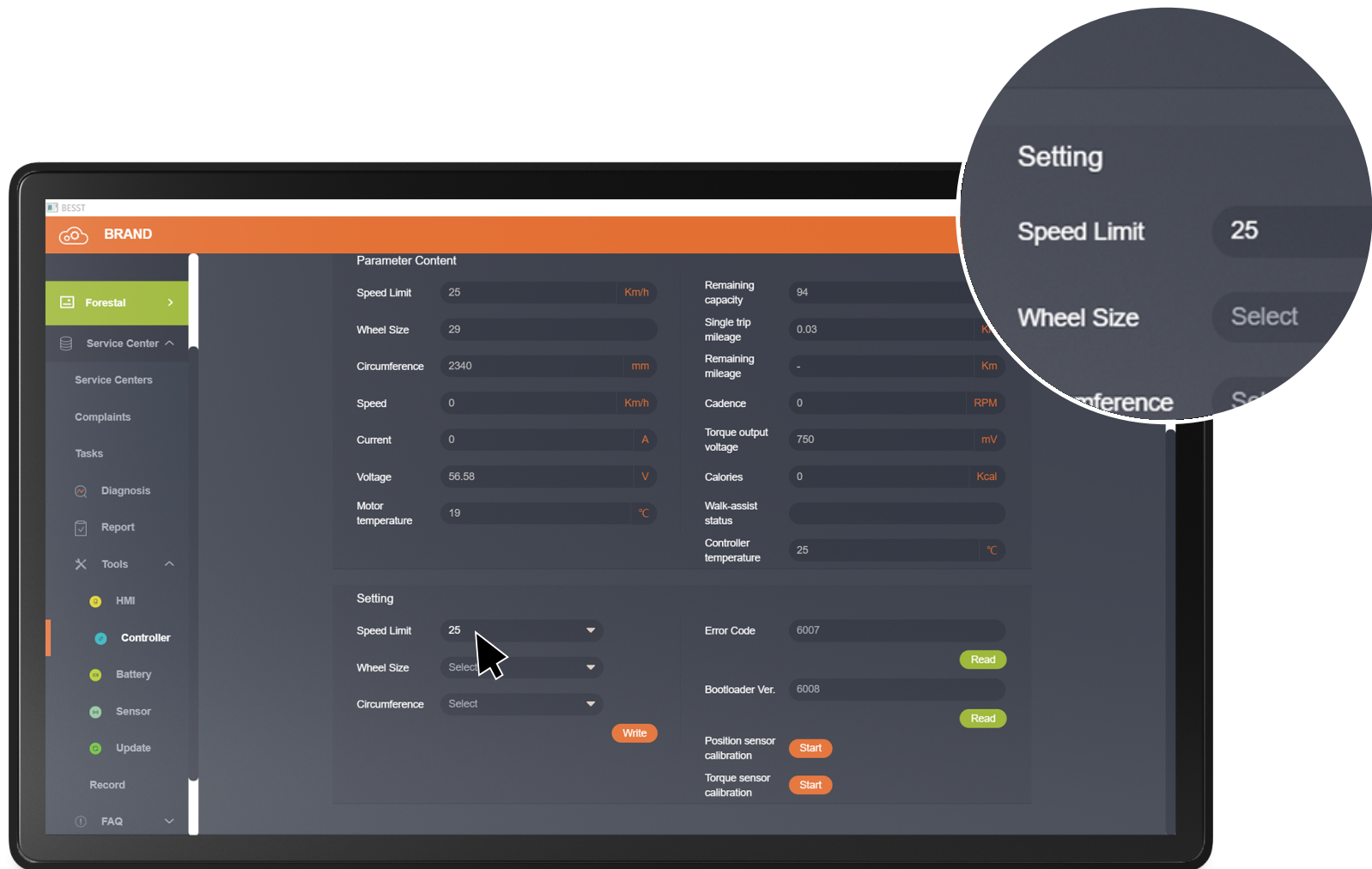
Check the wheel circumference. It should be 2340 mm for 29" wheels. If the values are different, please scroll down to the settings section at the bottom of the Controller menu and choose the right parameters as shown on the next page.



## Step 6

## Controller (Motor) diagnosis

Look at the settings section at the bottom of the Controller menu and adjust to the right parameters.





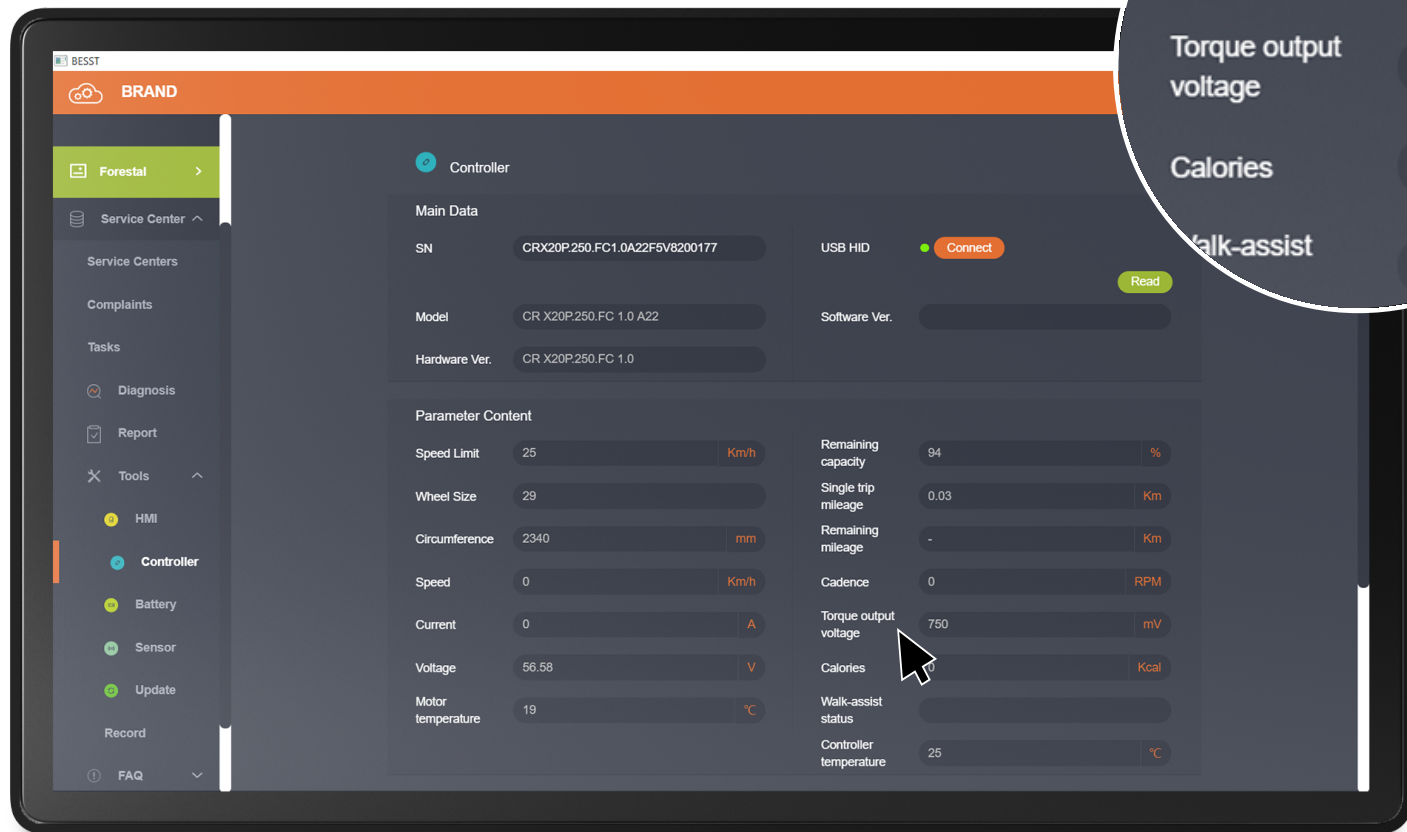
## Step 7

## Controller (Motor) diagnosis

Check the torque sensor. Apply force to one pedal and read/follow the values in the “torque output voltage” window. If the values are present, the torque sensor is working correctly. The values range from 750 mV to 3000 mV.



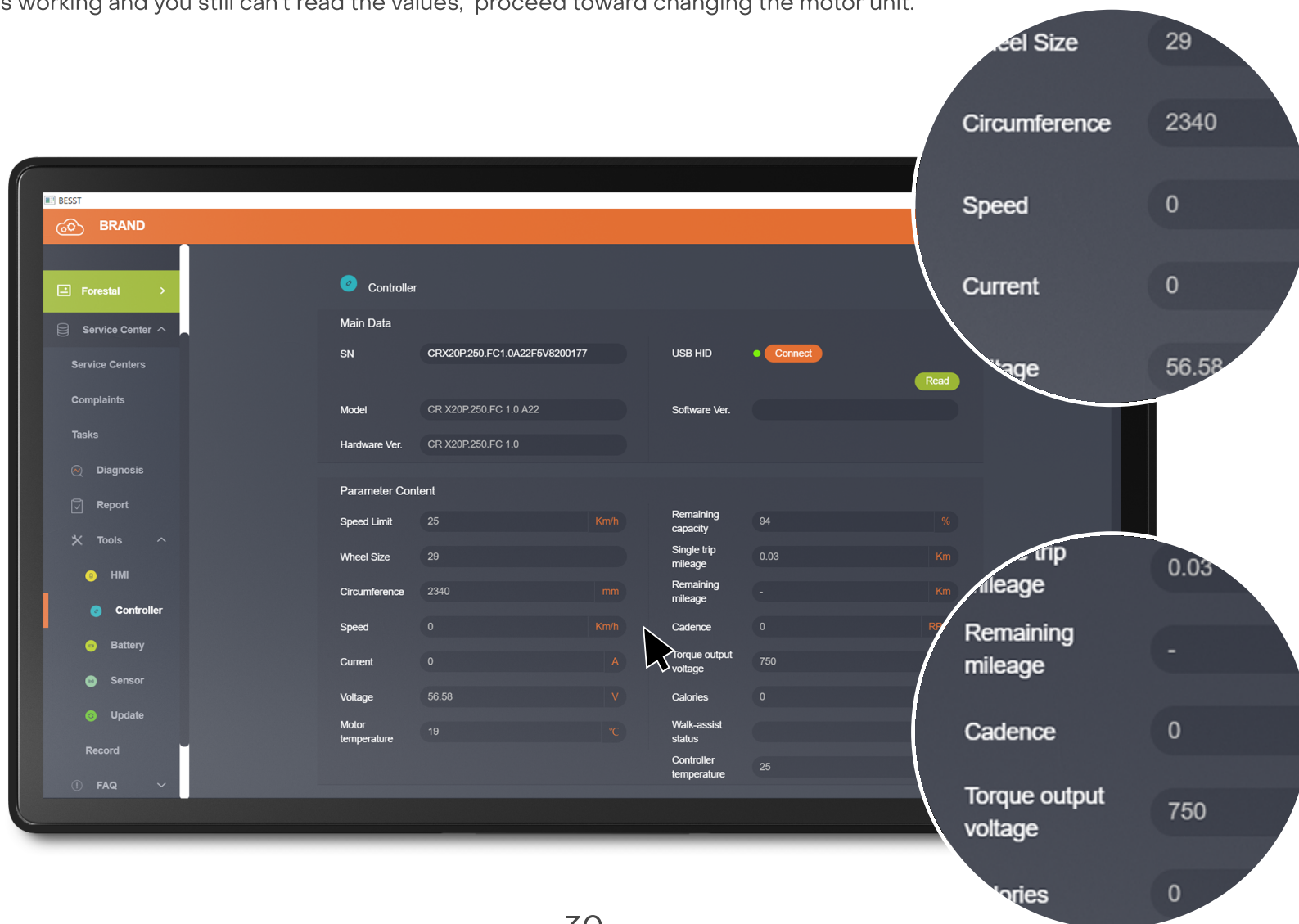
5kg of force is required to be applied to the pedal for a sensor to work. If you can't see changing values while pressing on the crank, this means the torque sensor is broken and you need to replace the Motor unit.



## Step 8

## Controller (Motor) diagnosis

Check cadence and speed sensor: Mount the bicycle to the bicycle repair stand and start spinning the pedals. Simultaneously follow the values in the "cadence" and "speed" sections. If the Speed is the same as the speed value shown on the display of the bicycle and if you can read the current cadence, mentioned sensors are working correctly. If you can't read speed or cadence, make sure that a physical speed sensor or magnet is present and working. If that is working and you still can't read the values, proceed toward changing the motor unit.



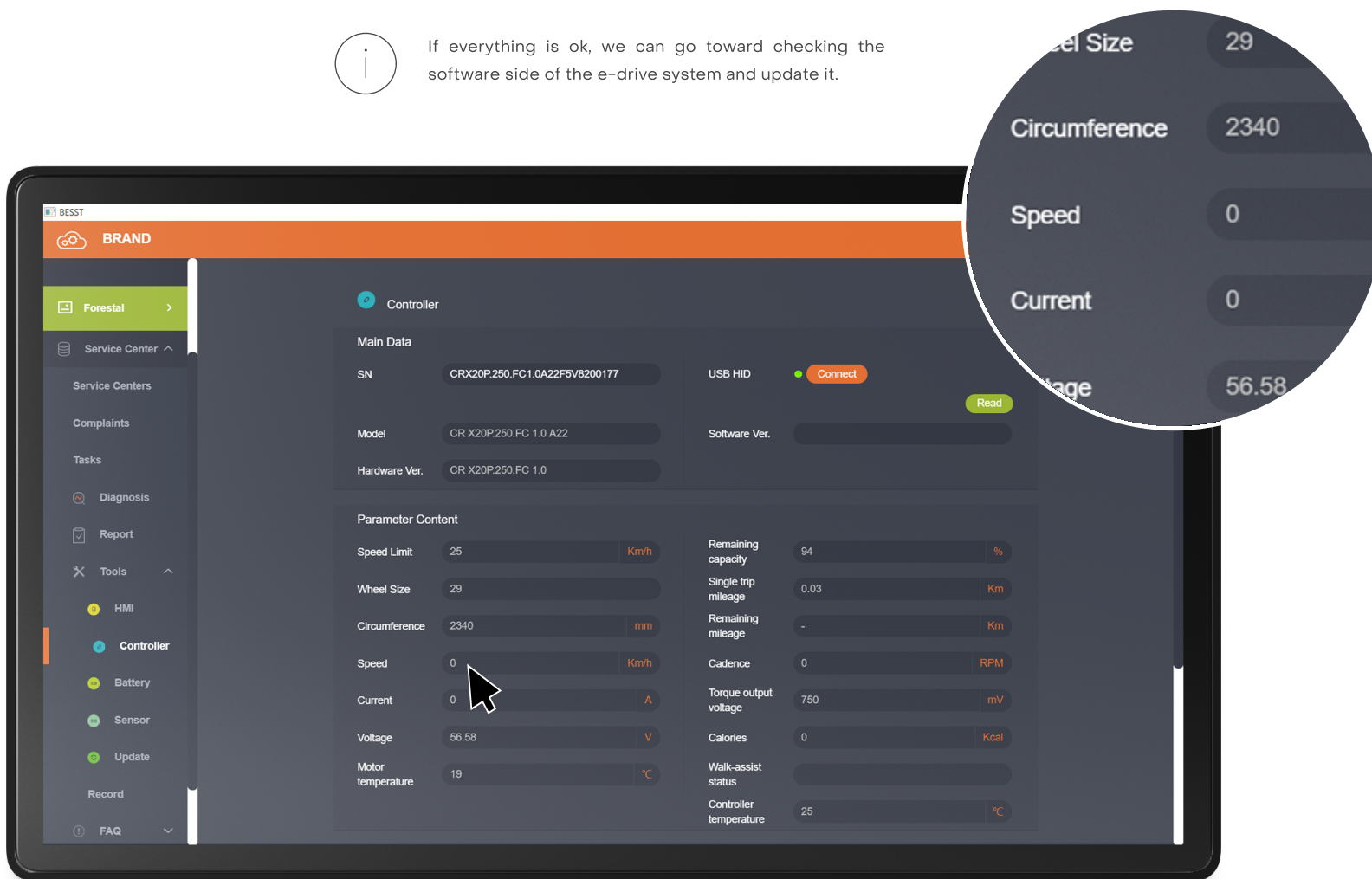
## Step 9

## Controller (Motor) diagnosis

Check the Walk assist: While the bicycle is on the repair stand, switch the assist mode to the "Walk assist" mode and follow the results in the walk assist section. Press the “–” button for a few seconds and check that the walk assist is responding. At the same time, the speed shall be displayed on the “speed” field. Walk assist must cut the assistance at 5 km/h.



If everything is ok, we can go toward checking the software side of the e-drive system and update it.



# Updates

How to update Forestal's e-drive system software

After the bicycle is connected to the BESST tool and you are in the "update" menu, you will be able to upload the latest file and update the software to the latest version either for Battery or Motor/controller.

Go to Service center / Tools / Update.

From there you can update:

- Battery
- Controller/Motor
- Service Tool



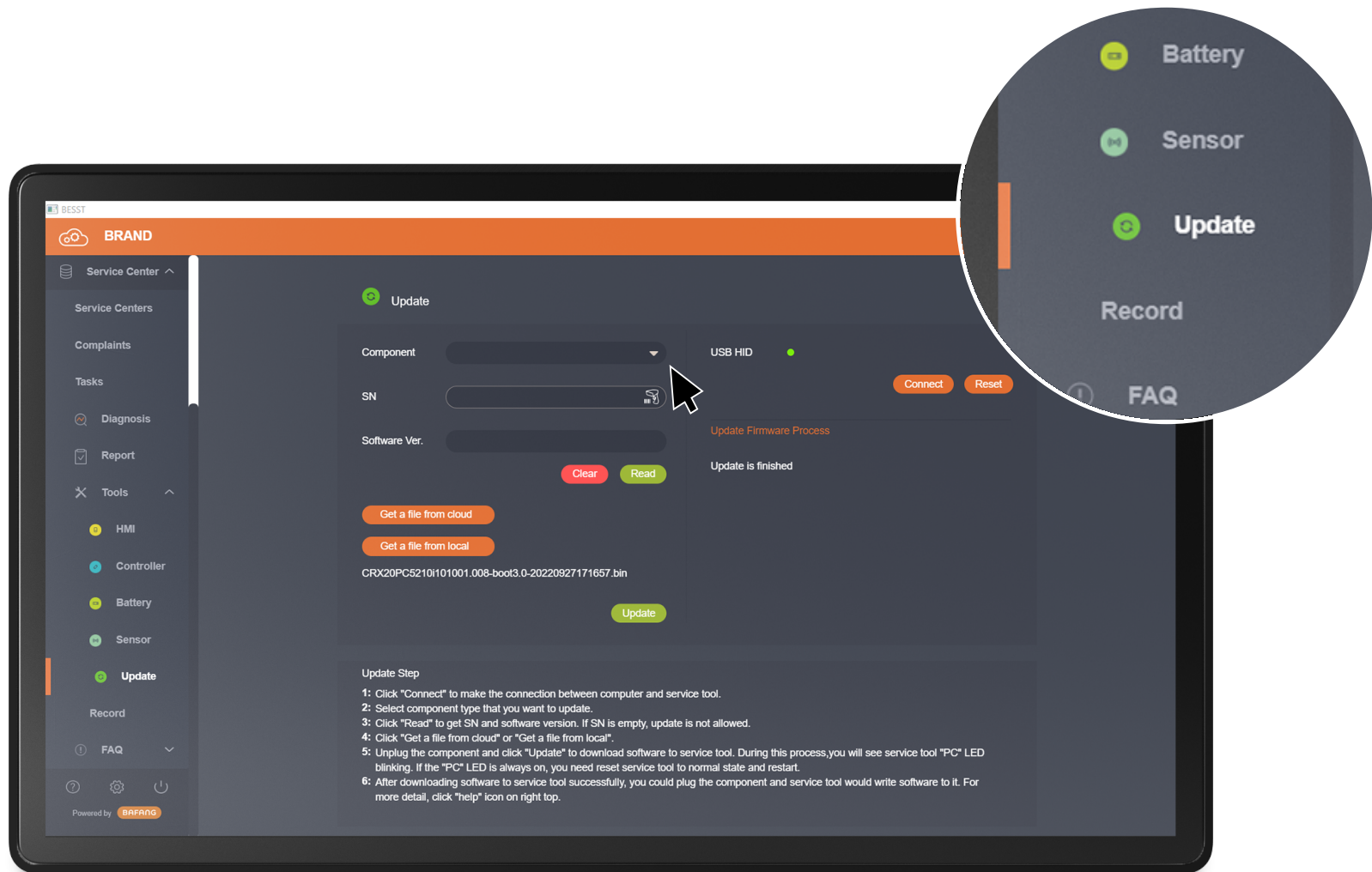
# Battery update

How to update Forestal's e-drive system software

## Step 1

## Battery update

In the “Tools” menu, select “Update”.



## Step 2

## Battery update

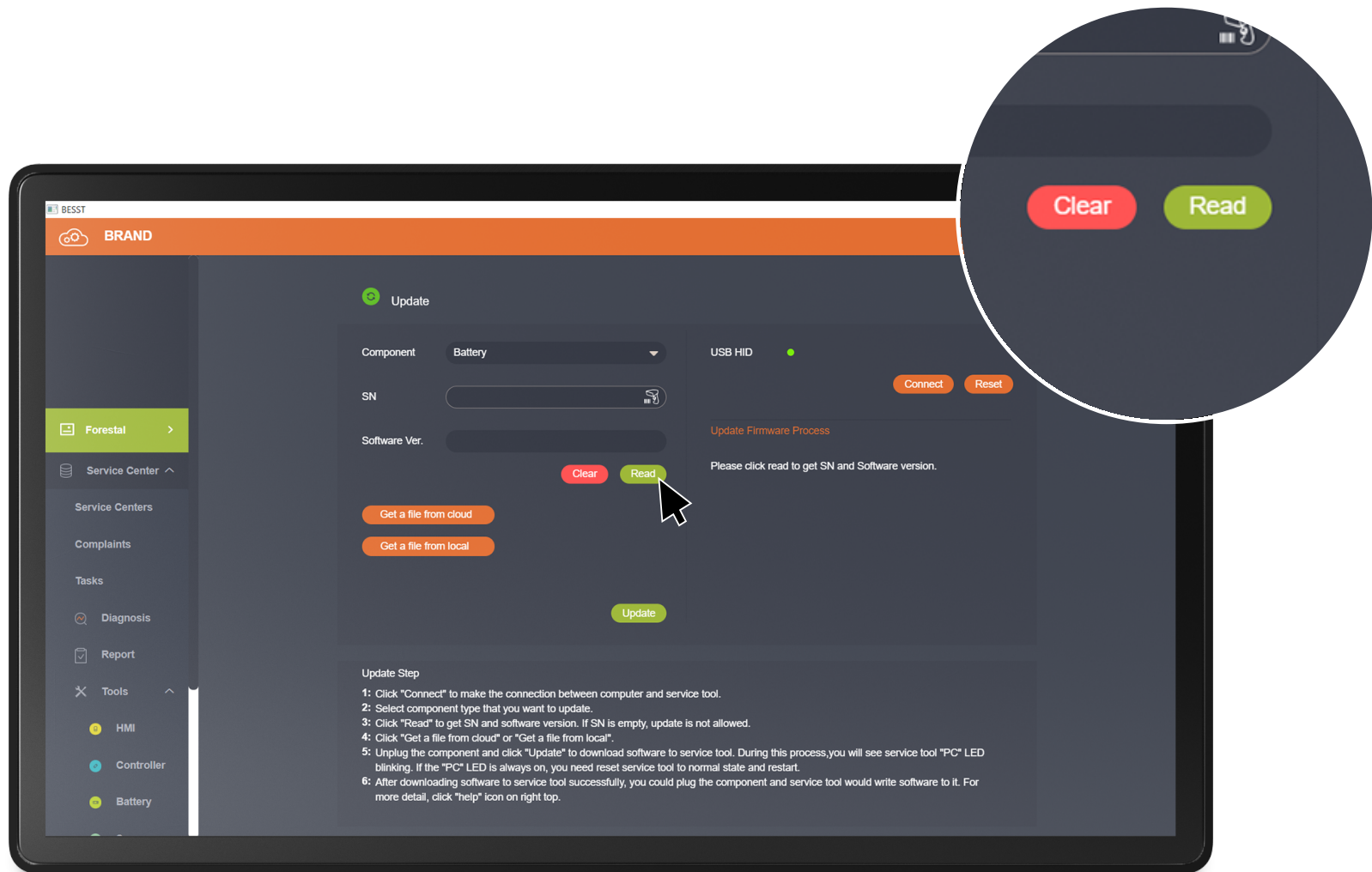
From the "component" section choose "Battery".



## Step 3

## Battery update

Click the “read” button. In this step, you will see Battery SN (Serial Number) and software version.



## Step 4

## Battery update

Inspect the software and hardware version. If the software version doesn't suit the hardware version or if the software version is outdated, it will be required an update to maintain proper function.



Check software and hardware version.



If the software version doesn't match the hardware version, then the battery needs an update and you can proceed toward the next steps. If the software and hardware versions are matching, you can quit the process or finish with the update anyway.

Software end number	Corresponding hardware	.BIN file name
104	1.0	APP_F21_20220907V109M_aaa1.bin
108	1.1	APP_F21N_20220907V109M_95c9.bin



## Step 6

## Battery update

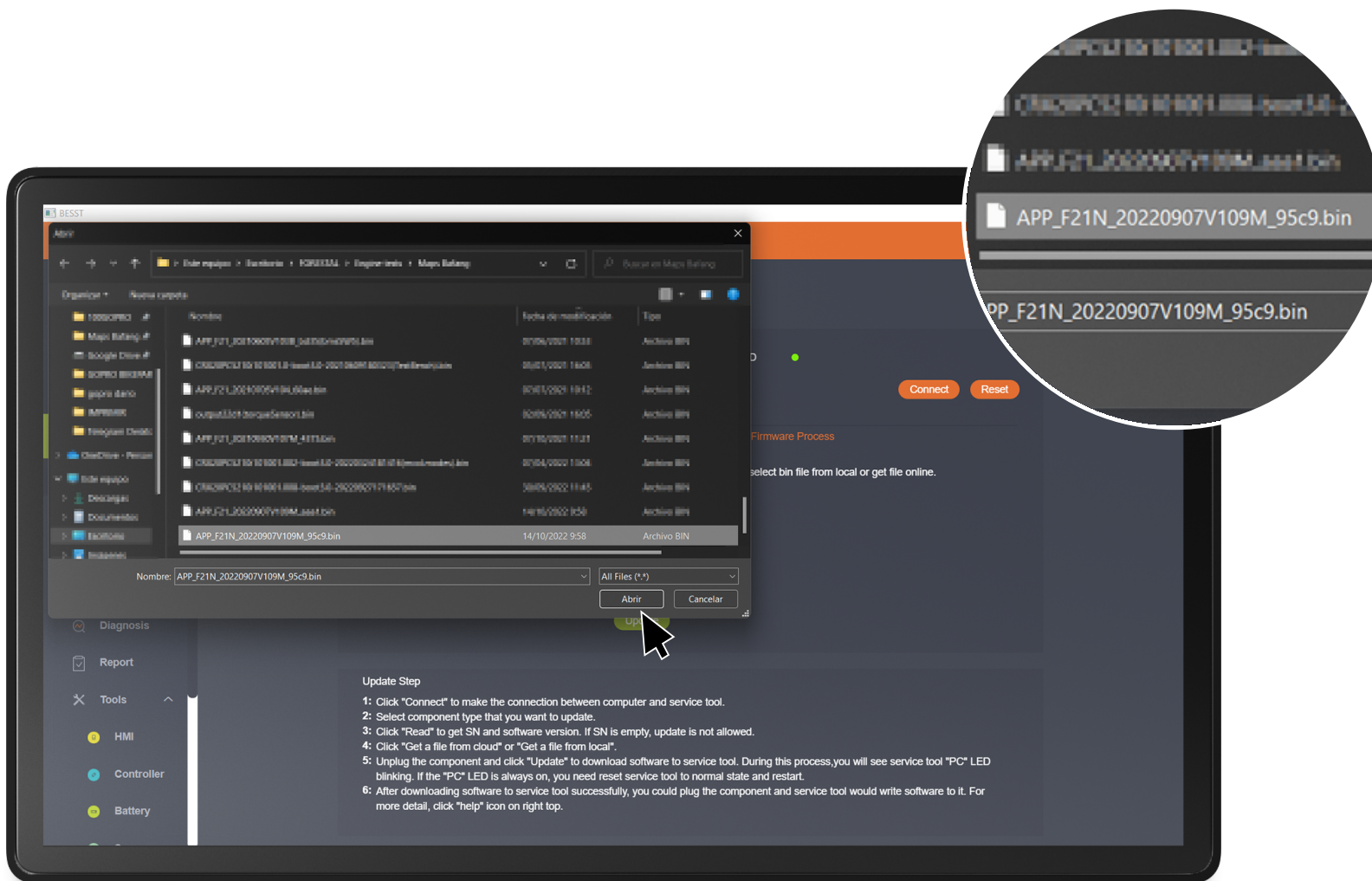
Click the “get a file from local” and choose the correct file version that suits the corresponding hardware version.



## Step 7

## Battery update

Select the .bin file from the folder where you have saved the software versions.





## Step 8

## Battery update

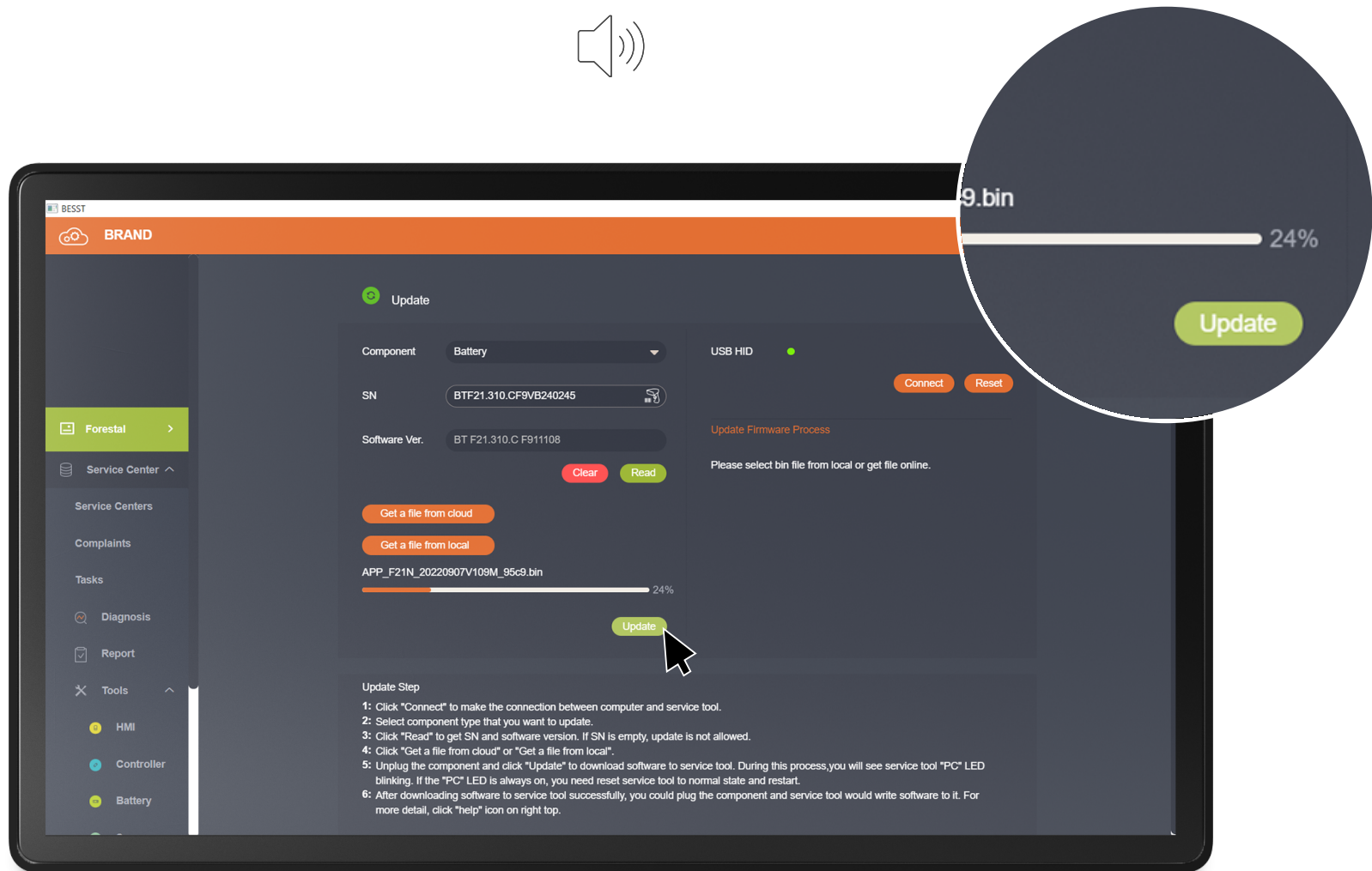
Check that the file is the same as you have chosen.



## Step 9

## Battery update

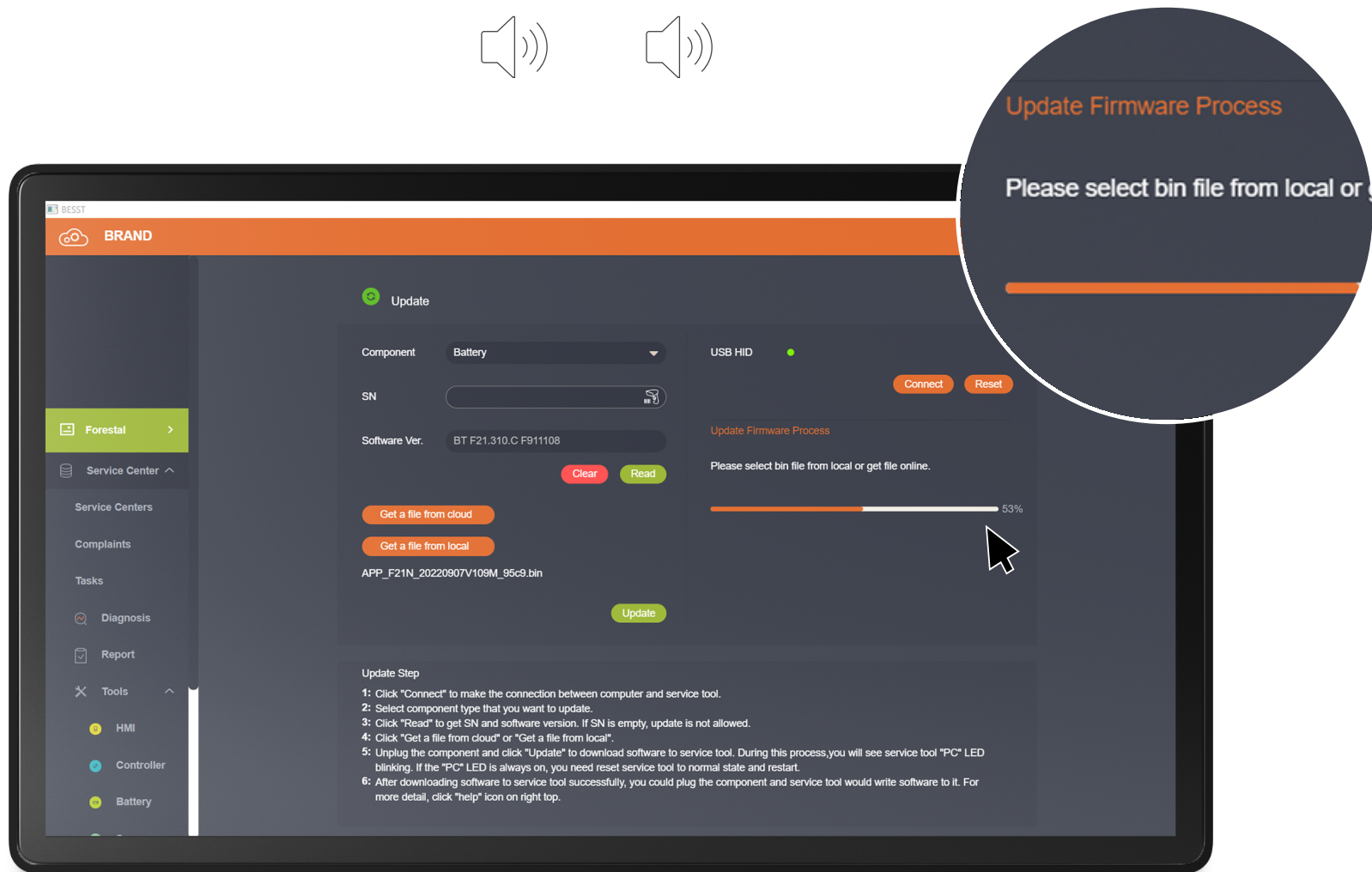
Once a file is selected and verified, you can click the “Update” button. A progress bar will appear underneath the file name. Once it reaches 100% you will hear one “beep” sound signal which means the software is uploaded to the BESST box tool.



## Step 10

## Battery update

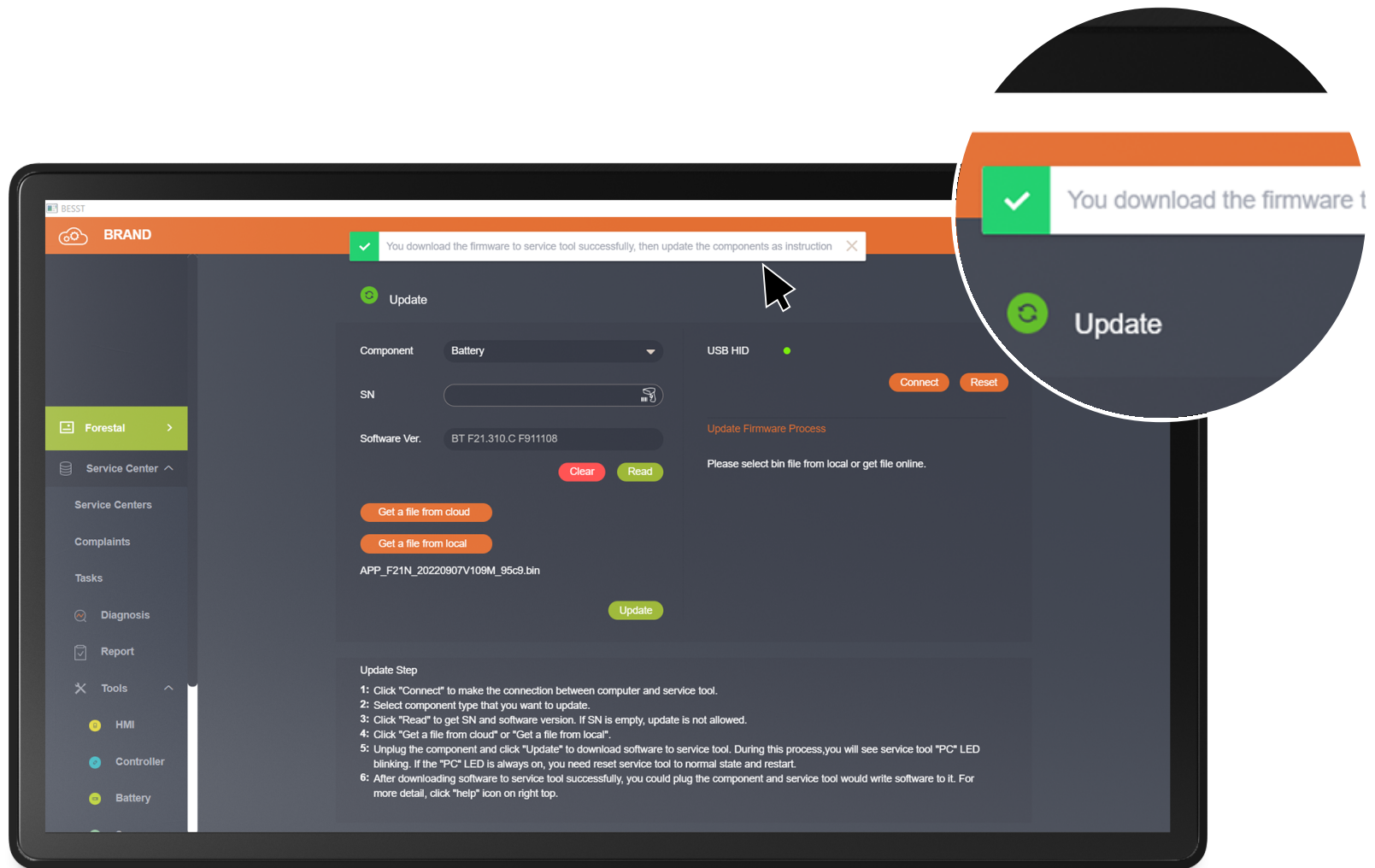
From this point, another loading bar will appear on the right side under “Update firmware process”. Once it’s finished you will hear a 2x “beep” sound signal which means the update process is finished.



## Step 11

## Battery update

As soon as the battery is updated, a green confirmation message will appear on the top of the BESST tool software.





## Step 12

Disconnect the I-Can wire and BESST tool and close the charging port.



## Step 13

## Battery update

Reset the bicycle through the trigger on the handlebar.



With this last step, the update process is finished and the system should run in optimal conditions.



If the update process fails for any reason, it's required to press the reset button on the BESST tool and repeat the full process for updating the given component.



# Controller (Motor) update

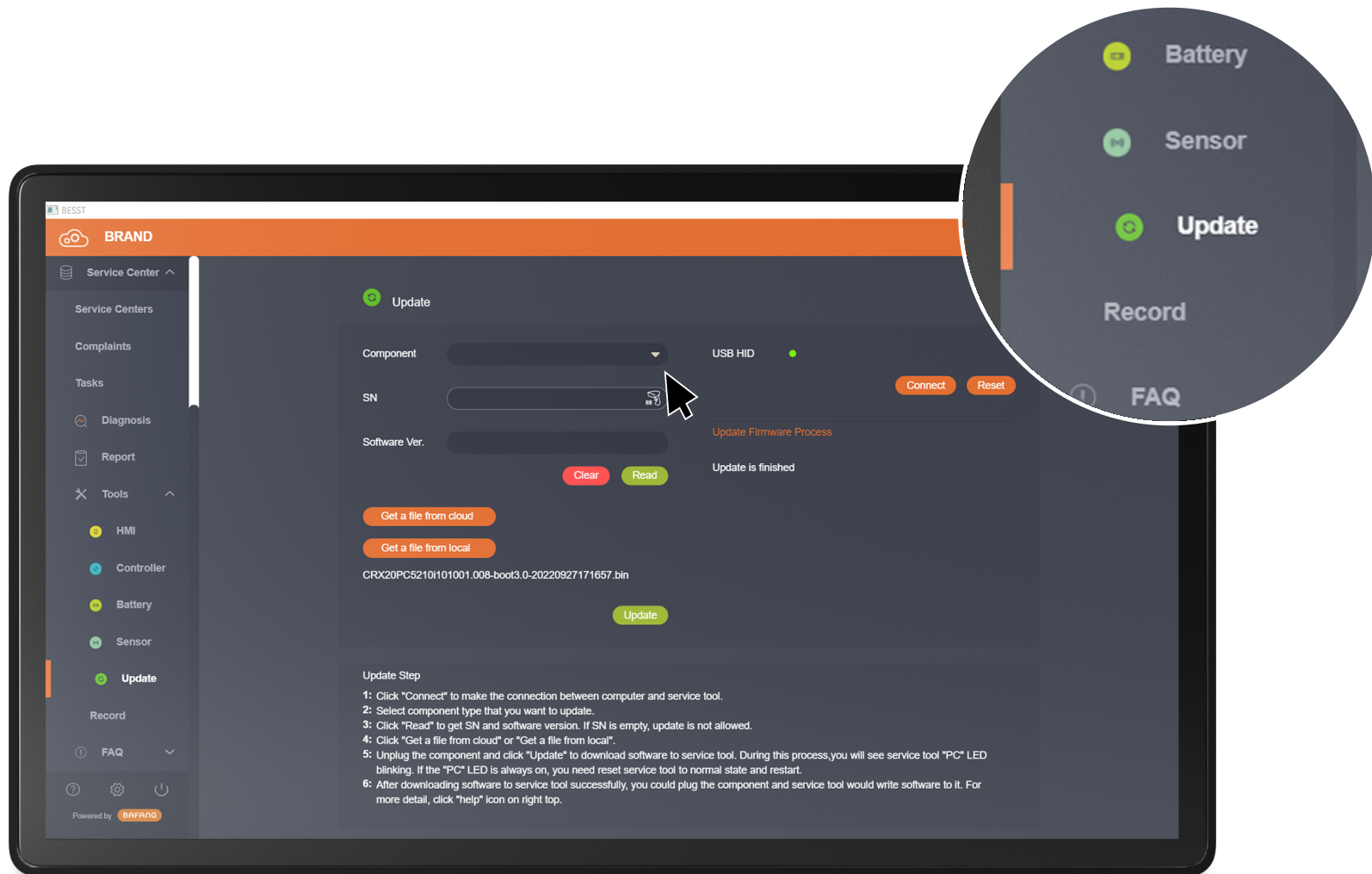
How to update Forestal's e-drive system software



## Step 1

## Controller (Motor) update

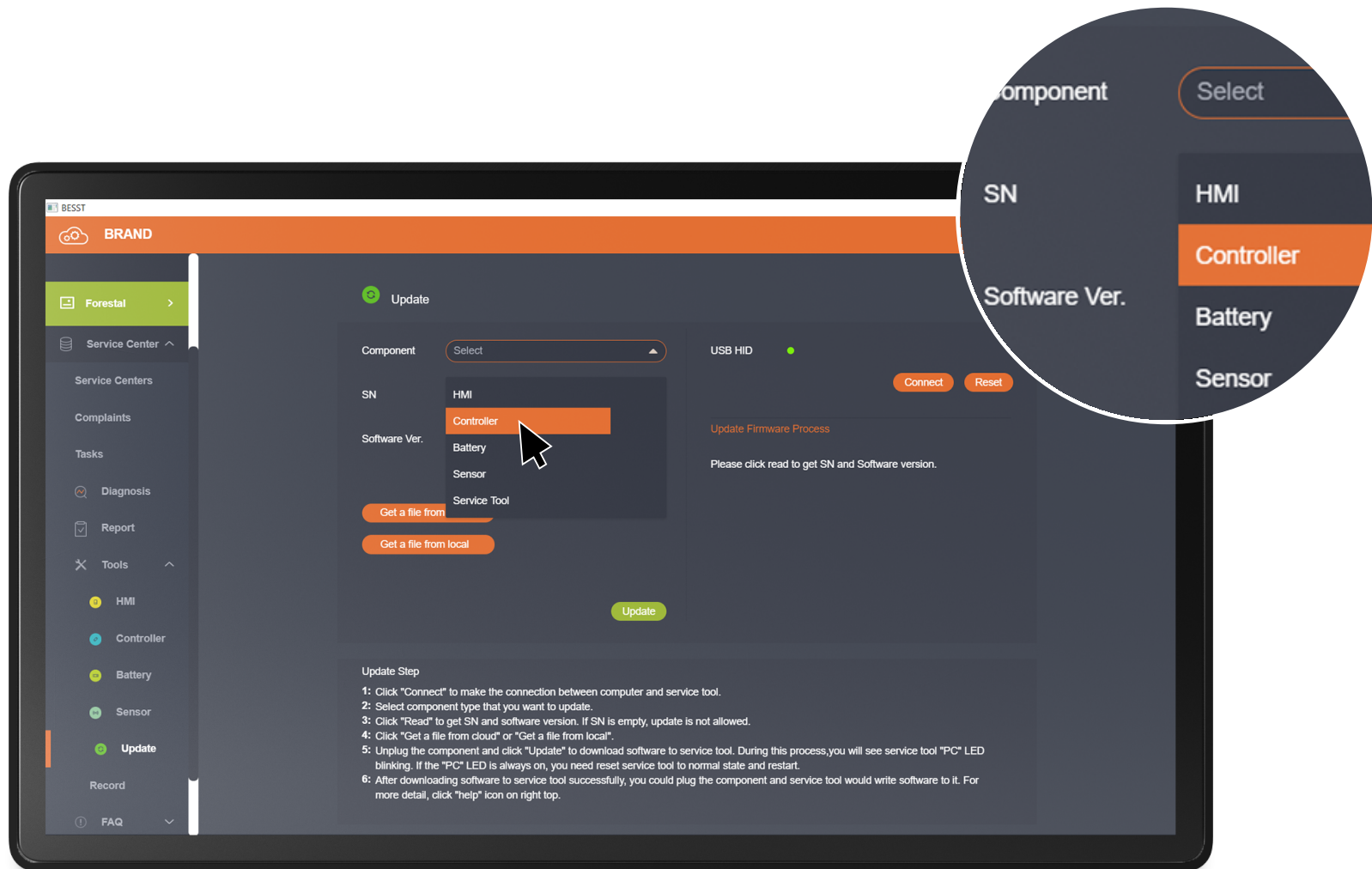
In the “Tools” menu, select “Update”.



## Step 2

## Controller (Motor) update

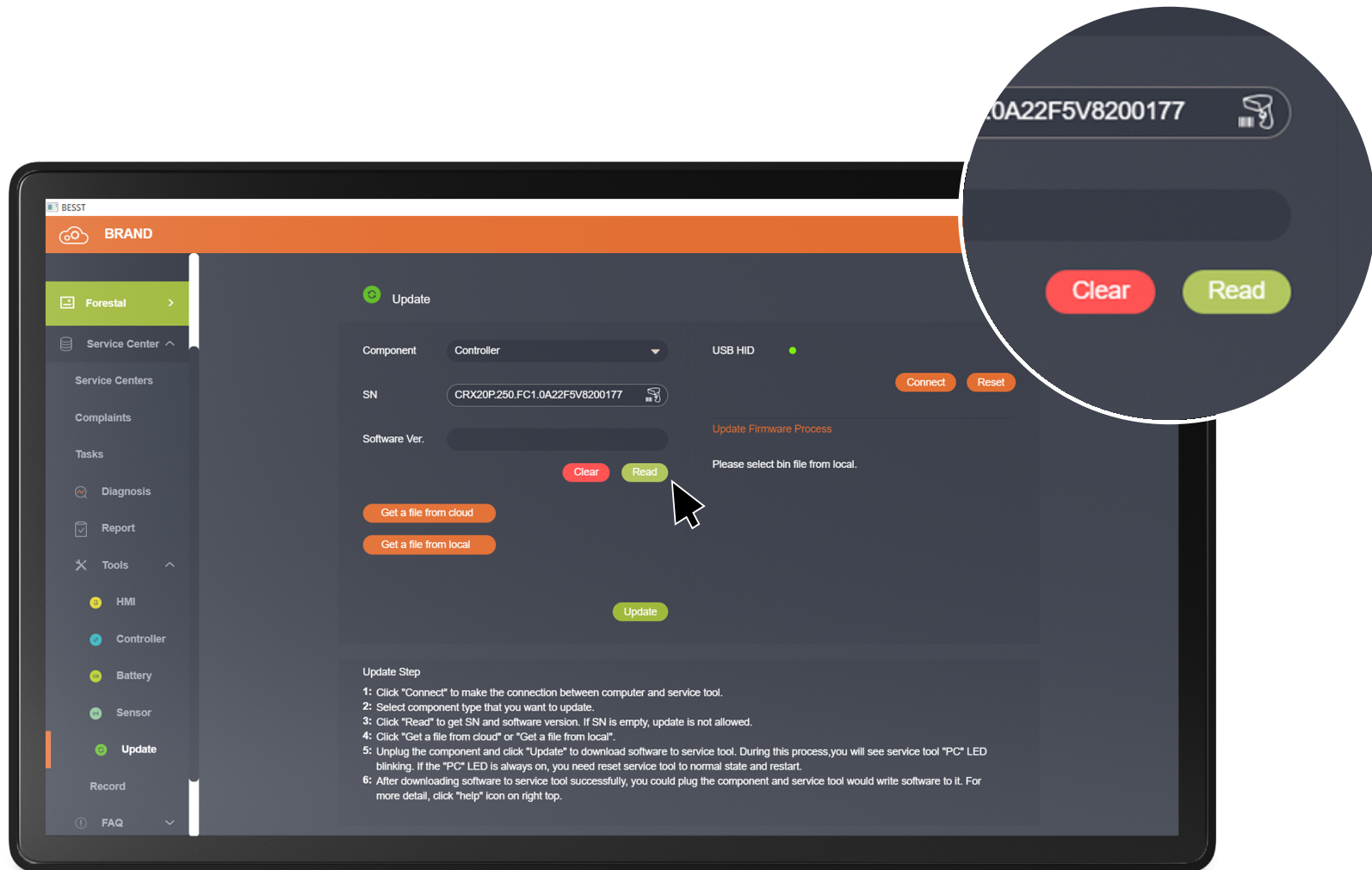
From the component section choose “Controller”.



### Step 3

### Controller (Motor) update

Click the "Read" button. In this step, you will see Motor SN and Software version.



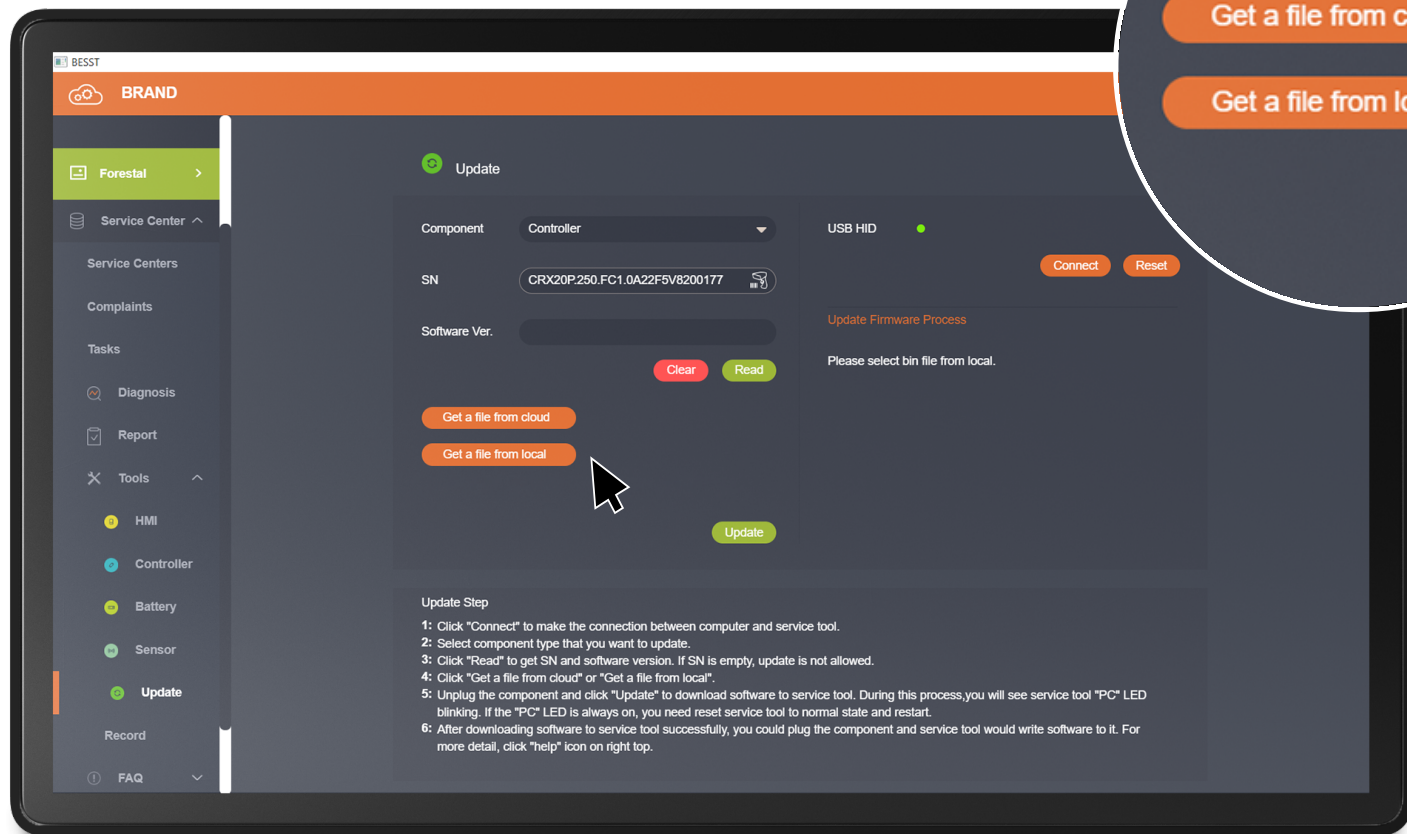
## Step 4

## Controller (Motor) update

To update Controller software you need to click the “Get file from local” button.



Files will be sent to you by Forestal upon delivery of your BESST tool account. Once the file is selected, you will be able to see its name underneath the “get file from local” button:

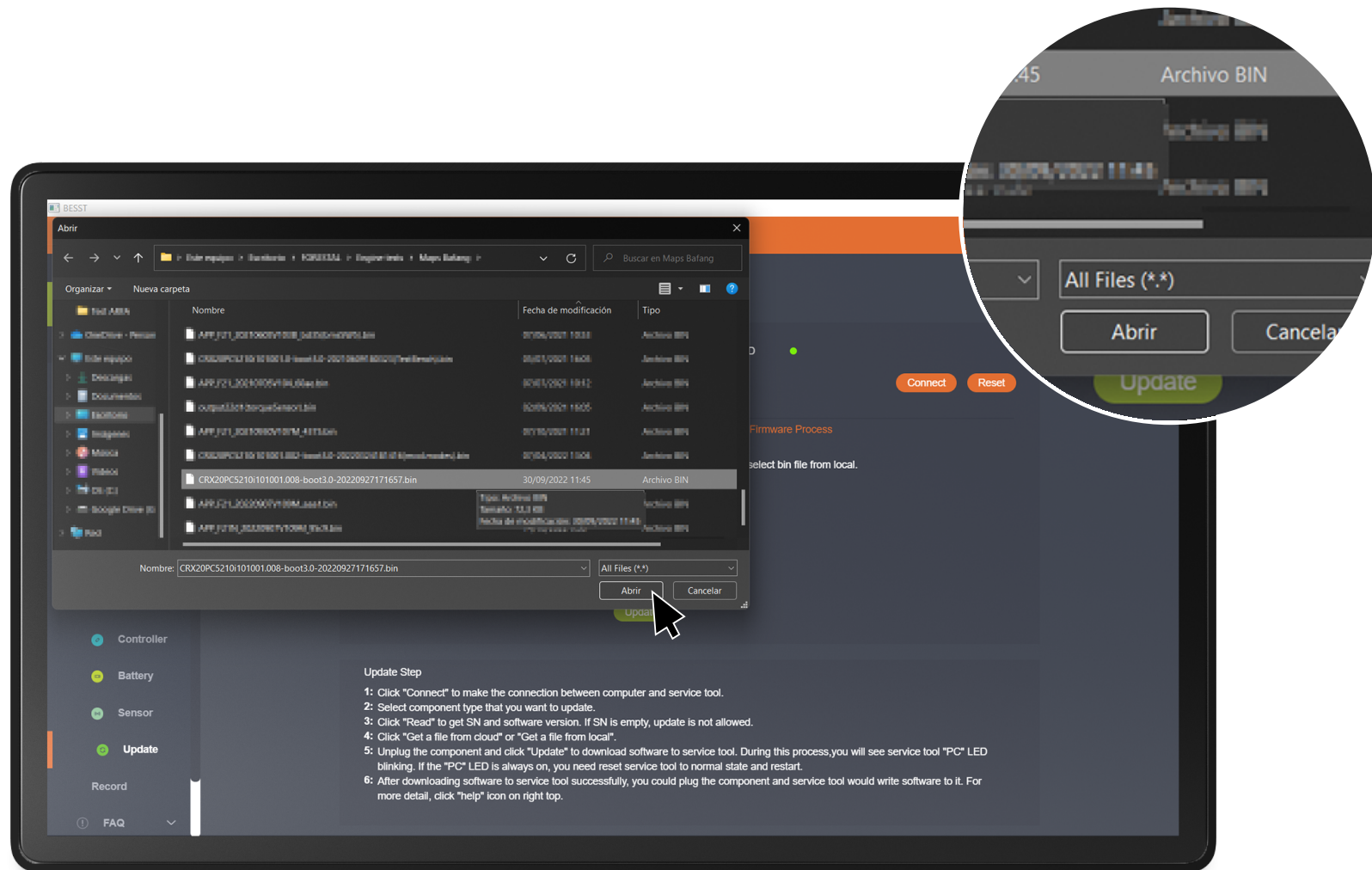




## Step 5

## Controller (Motor) update

Chose the corresponding Controller file from your PC.



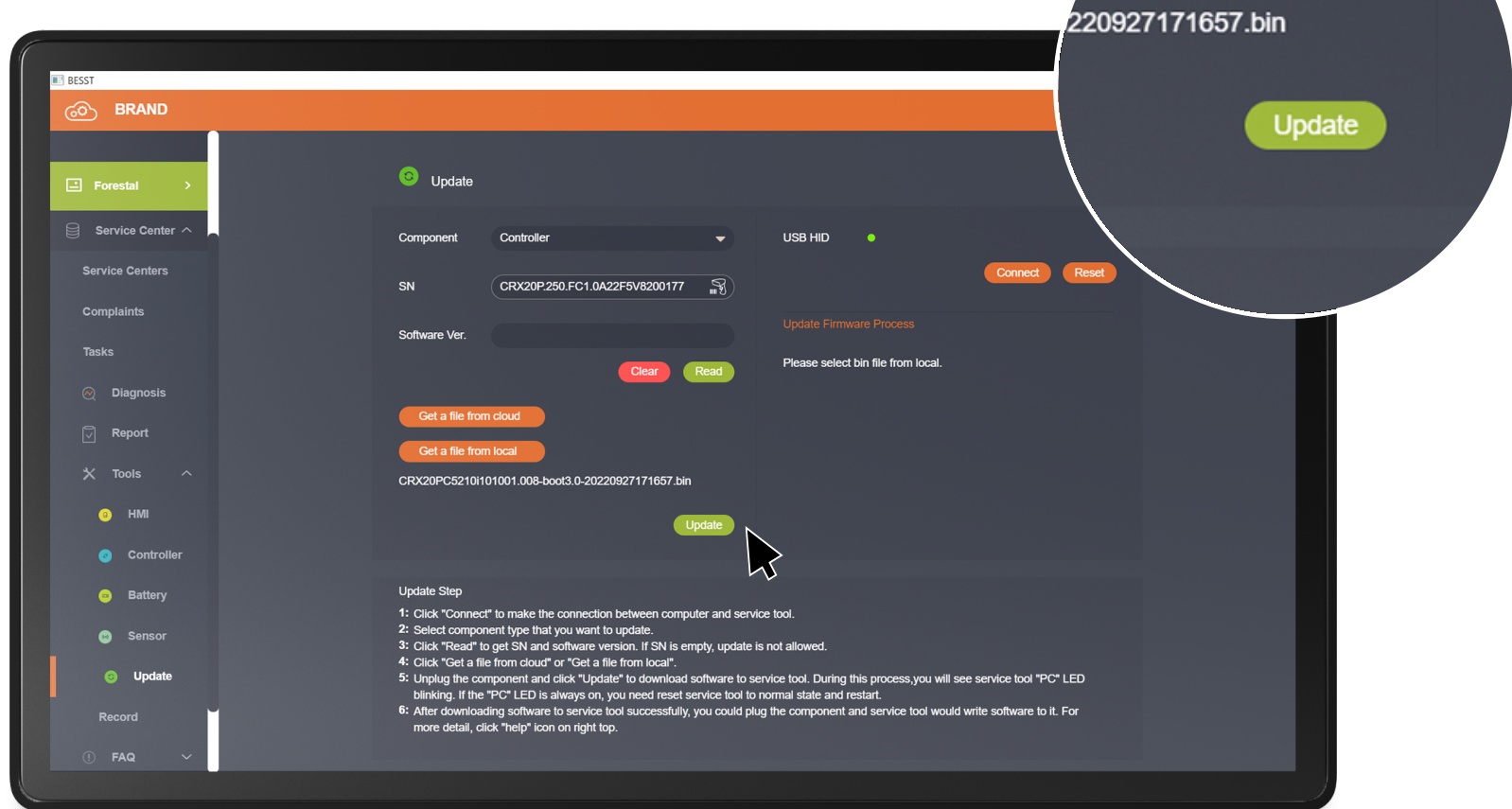
## Step 6

## Controller (Motor) update

As soon as you have checked the software version click on the “Update” button.



Files will be sent to you by Forestal upon delivery of your BESST tool account. Once the file is selected, you will be able to see its name underneath the “get file from local” button:

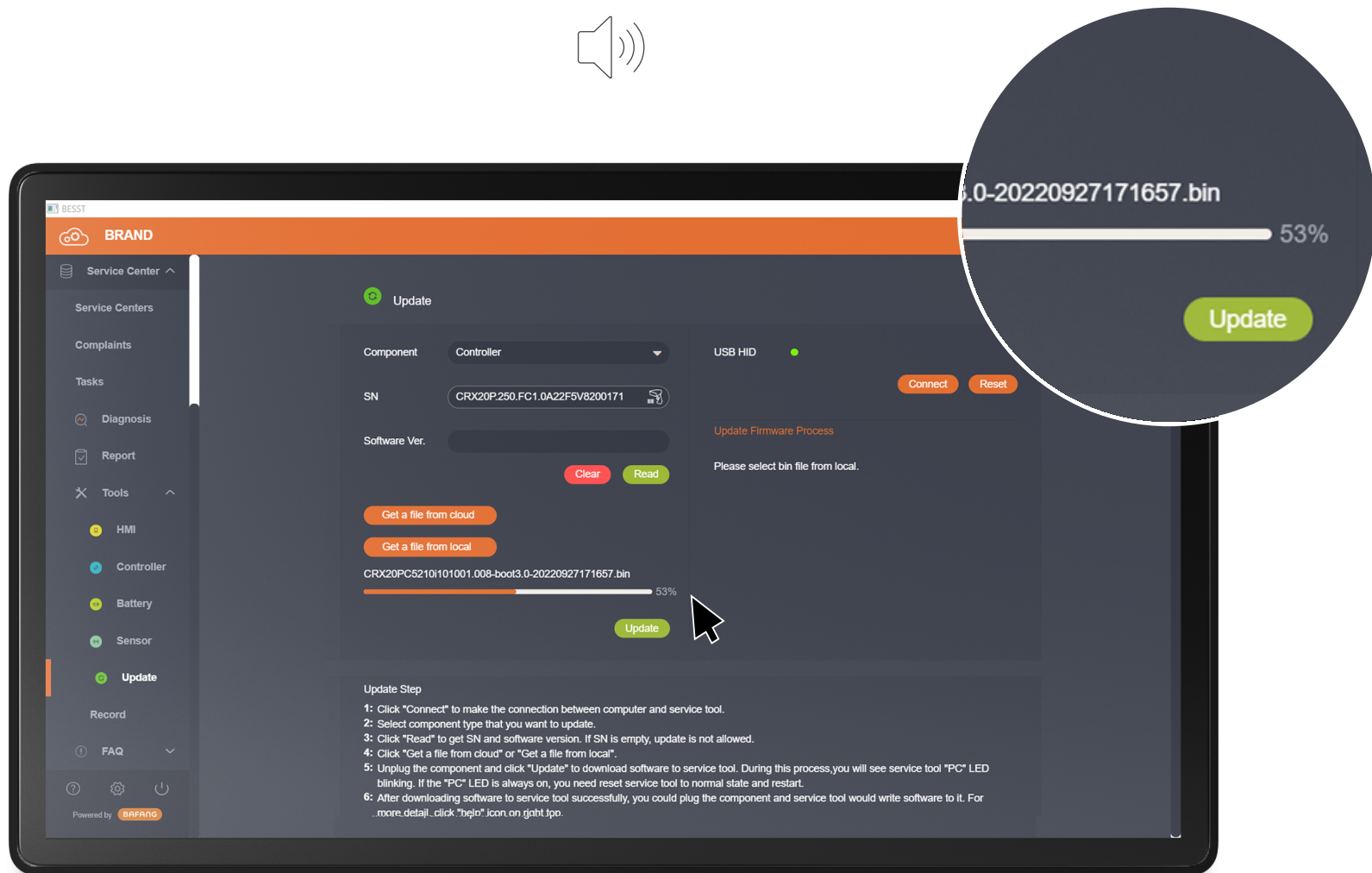




## Step 7

## Controller (Motor) update

Once a file is selected and verified and you clicked the “Update” button, a progress bar will appear underneath the file name. Once it reaches 100% you will hear one “beep” sound signal which means the software is uploaded to the BESST box tool.



## Step 8

## Controller (Motor) update

Disconnect the I-can wire from the Rosenberger battery port and connect it again.

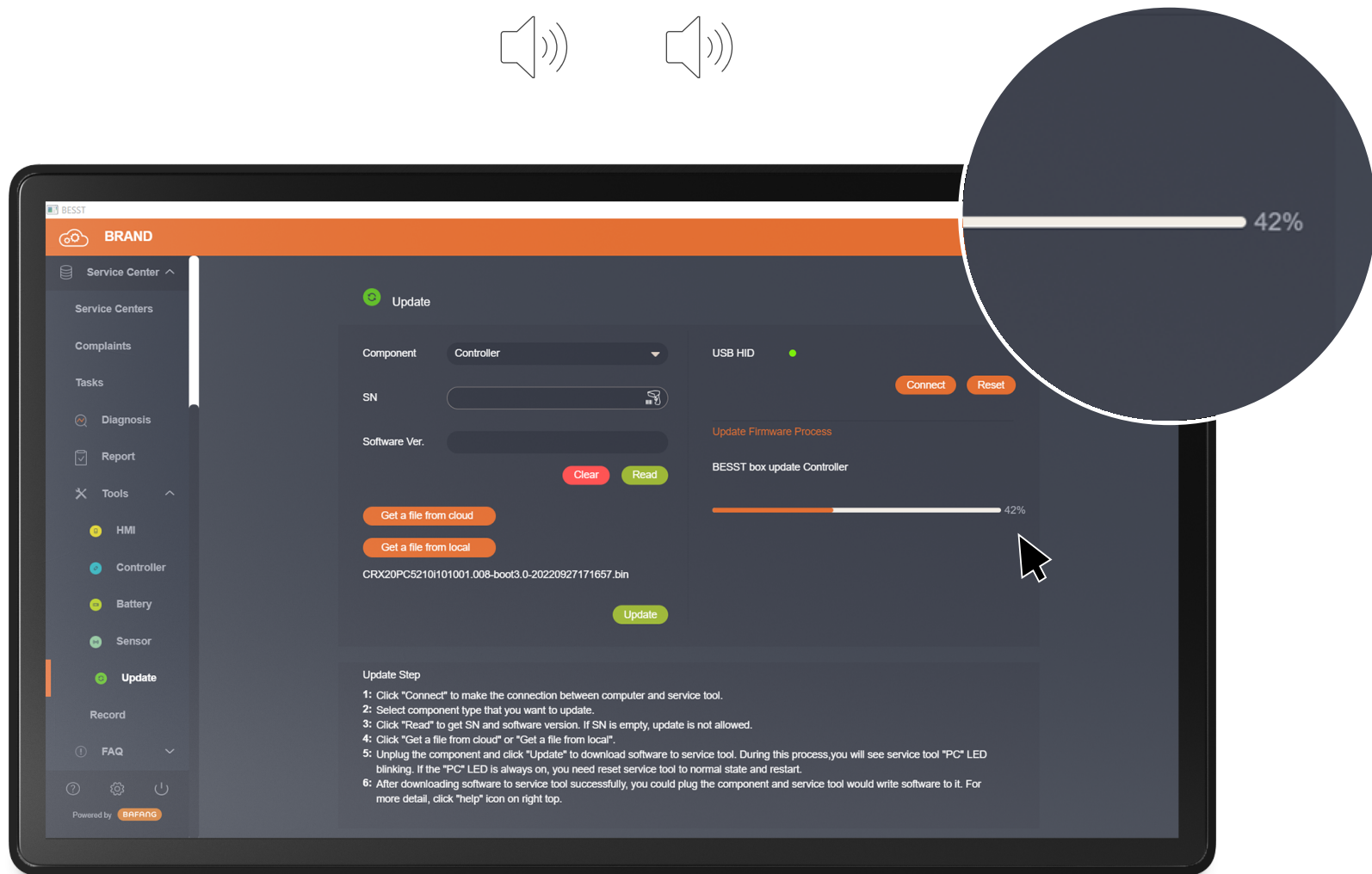


Disconnect the I-can wire only from the Rosenberger connector lid, not the battery or bicycle itself!

## Step 9

## Controller (Motor) update

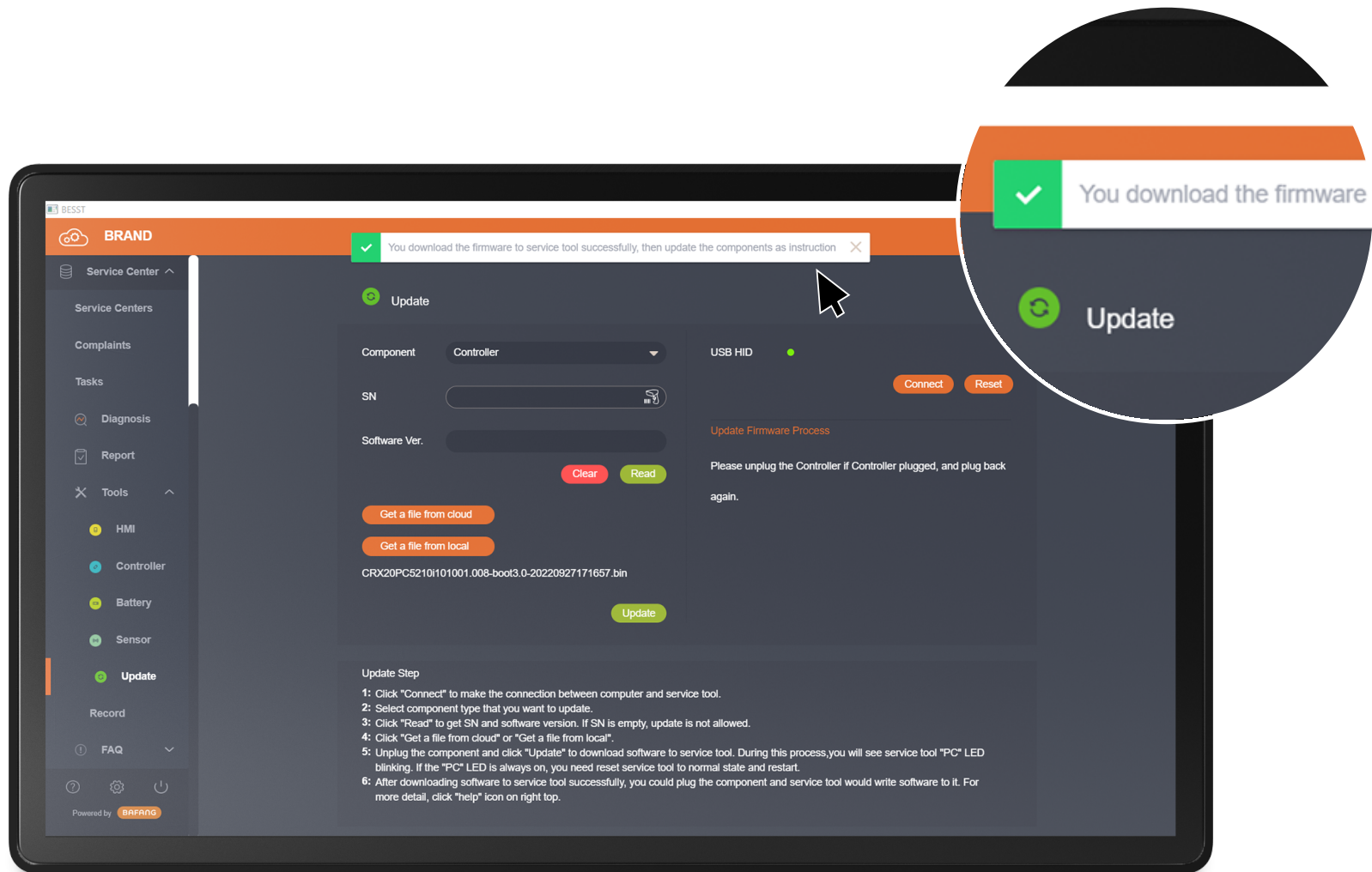
From this point, another loading bar will appear on the right side under the “Update firmware process” area. Once it’s finished you will hear a 2x “beep” sound signal which means the update process is finished.



## Step 10

## Controller (Motor) update

As soon as the battery is updated green confirmation message will appear on the top BESST tool software.





## Step 11

Disconnect the Motor from the I-Can wire and BESST tool and close the charging port.



## Step 12

## Battery update

Reset the bicycle through the trigger on the handlebar.



With this last step, the update process is finished and the system should run in optimal conditions.



If the update process fails for any reason, it's required to press the reset button on the BESST tool and repeat the full process for updating the given component.



If you have any questions,  
please do not hesitate to contact us.

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