ENGLISH

USER MANUAL & INSTALLATION GUIDE

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H1 Introduction

Thank you for purchasing GRAVAA wheels! This wheelset with GRAVAA system – sometimes referred to as the GRAVAA kinetic air pressure system (KAPS) – will give you an all-new experience of cycling: Roll smoother, ride better!
This user manual is intended for the user and retailer of GRAVAA and includes all information with respect to the installation and usage, along with the provisions of warranty.

Users must use this product with care and must have read and understood the manual before first use. Third-party users must also be informed about the following provisions. Please retain the accessories and tools included for future use.

After correct installation, your new GRAVAA wheelset with KAPS technology enables you to adapt your tire pressure while riding. Controlling the tire pressure is easy: just use a GRAVAA shifter and visualize your tire pressure on your bike computer or smartphone.

For further information and answers to frequently asked questions, please visit https://gravaa.com/faq

1.1 Product versions & intended use

The GRAVAA product comes in multiple product versions and must be used only according to the following ASTM classification (ASTM F2043-13 (2018)). Please check which classification is applicable for your product:

Product	Model type	Hub width	Description of conditions	ASTM classification
GRAVEL (GR)	**1**	**Non-BOOST**	Conditions for the operation of a bicycle that includes Condition 1 (i.e., road riding only) as well as unpaved and gravel roads and trails with moderate grades. In this set of conditions, contact with irregular terrain and loss of tire contact with the ground may occur. Drops are intended to be limited to 15cm (6") or less.	
ROAD (RD)	**2**	**Non-BOOST**	Conditions for the operation of a bicycle that includes Condition 1 (i.e. road riding only) as well as unpaved and gravel roads and trails with moderate grades. In this set of conditions, contact with irregular terrain and loss of tire contact with the ground may occur. Drops are intended to be limited to 15cm (6") or less.	

NOTE

- If you are not sure which product you have, please check the serial number (S/N) which is visible on the non-drive side of the hub.
- The product version/model type M (1, 2, ..) can be found in the serial number: Front: GRA-F-YYWW-M-#### | Rear: GRA-R-YYWW-M-####).

CAUTION

- It is prohibited to use the product for any other purpose than those indicated in this manual, the safety indications or other safety documents accompanying the product. Otherwise, the user shall assume responsibility. Any modification to the product may affect its safety and warranty!

1.2 Guidelines & symbols

The steps described in this manual must be carried out in the order they are shown. If steps are ignored or executed in a wrong order, the function of the product cannot be guaranteed.

The safety instructions are classified as follows:

WARNING

Indicates a hazardous situation that, if not avoided, will result in death or serious injury or damage to the product.

CAUTION

Indicates a hazard with a medium level of risk which, if not avoided, may result in minor or moderate injury or damage to the product.

NOTE

Provides additional information that is helpful to do a task or to avoid problems.

Next to the safety instructions, the following indication lists the tools (if any) to be used to complete a certain task.

TOOLS

Provides a list of tools which must be used to complete a certain task.

1.3 Environmental protection

The statutory regulations shall apply. Whenever possible, avoid creating waste. Waste, especially carbon, lubricants, cleaners and any other fluids must be disposed in an environmentally compatible manner. Only print this manual if electronic usage is not possible. Regarding the recycling of this product, see section H11.

1.4 Exclusion of liability

The activities listed in this manual may only be carried out by persons with sufficient specialist knowledge. GRAVAA is not liable for any damage or consequential damage caused by wrongly maintained or installed components.
If you have doubts, please contact us via support@gravaa.com or contact your region's official GRAVAA retailer.

1.5 GRAVAA manuals

The GRAVAA manuals are split into the following types of manuals:

- **User Manual** (this document): Information for the end user on how to install, use and maintain their GRAVAA wheelset(s), and
- **Technical OEM/Service Manual**: Detailed information for the GRAVAA retailers, professional end users and dealers on how to service GRAVAA wheelsets and how to build GRAVAA hubs into their bikes or wheels.

1.6 Abbreviations

The following abbreviations are used in this manual:

KAPS	Kinetic Air Pressure System
TA	Trough axle
PRV	Pressure relief valve
PCB	Printed circuit board
LED	Light Emitting Diode
USB	Universal Serial Bus
OEM	Original Equipment Manufacturer
FAQ	Frequently Asked Questions

H2 Safety

2.1 Safety precautions

WARNING

- The user shall comply with all provisions within this document. This is a prerequisite for safe use and faultless performance.
- The GRAVAA wheelset must be used only in accordance with their intended use. Otherwise, the user shall assume responsibility.
- You must use inner tubes!
- The use of tubeless tire sealant or any other liquid substances inside the tire is strictly prohibited!
- The maximum system weight must not be exceeded. See Specifications.
- Both the maximum pressure of the tire and the rim must not be exceeded in any case
- The user remains responsible for choosing the right tire and pressure settings via the GRAVAA app. See also: Specifications.
- You must check if your bicycle is compatible with GRAVAA. More information on compatible devices is found in section Compatibility
- Only use original GRAVAA spare parts – delivered in the box you have received with the product or ordered separately via www.gravaa.com or ordered at one of our official retailers.
- The hubs may never be opened and the GRAVAA system may not be changed or modified. There is a high risk of system malfunction when opening and disassembling the GRAVAA system. Damage to the hub and serious injuries may occur.
- Check that both wheels are correctly mounted in your frame before each ride, and regularly check the spoke tension, dish and wear of the wheels.
- Check the wheels and tires for damage before and after each ride. The wheels or tire must not be used if they are damaged or if there are any signs of damage. If in doubt, contact GRAVAA or your local retailer.
- Assembly and maintenance of the wheels requires a basic knowledge of handling bicycle components. If in doubt, contact GRAVAA or your local retailer.
- GRAVAA is designed to cope with outdoor conditions and can withstand riding in rainy weather conditions well. However, do not submerge the GRAVAA wheels in water and do not clean it using a high-pressure cleaner. Damage to the GRAVAA system may occur, leading to serious injuries as a result of incorrect usage and maintenance.
- As well as the intended and prohibited use, the maintenance requirements must be fully complied with. Failure to comply correctly may result in bad performance and/or defects such as the freehub or the chain breaking. This may cause serious injuries.
- Be sure that the building installation has dedicated means for over-current and short-circuiting. The GRAVAA system is charged by mains voltage, which is hazardous when touched.

CAUTION

- Always deflate your tire before unmounting the GRAVAA valve adapter.
- Wear safety glasses when working with pressurized air.
- Installation and servicing must be done in a clean working space.
- Read the user manual before using the product! Retain this user manual for future reference. Also retain the accessories and tools included for future use.

NOTE

- Non authorized servicing of internal hub parts is not allowed. In such case, GRAVAA will not be liable and the user's warranty will become void.
- Never open or disassemble the GRAVAA hubs, as warranty will be voided.
- In case of any critical system error, contact GRAVAA or your local retailer directly.

2.2 Hazardous substances

The product contains:

- A rechargeable lithium-ion battery with a capacity of 380 mAh (in each hub)
- A replaceable button cell battery CR1632 (only in the GRAVAA sprint shifter)
- A rechargeable lithium-ion battery with a capacity of 40 mAh (only in the GRAVAA ring shifter).

More information on how to recycle and dispose this product is found in section H11.

H3 / Installation instructions

The following chapters provide the instructions to start using your GRAVAA wheelset for the first time. This guide helps you to start riding soon. Please read and follow the steps below:

After you have unpacked all your new stuff, it's time to get your wheels ready to go! The sections 3.1 to 3.8 will guide you through all the assembly and configuration steps.

NOTE

- Some steps may already be done at delivery: these can be skipped.
- Installation, assembly and maintenance of the wheels requires a basic knowledge of handling bicycle components. In case of doubts, please contact GRAVAA or your local retailer.

3.1 Unpacking

Your GRAVAA wheelset comes in a reusable, durable packaging, specially designed to protect your product during transport. Time to unpack!

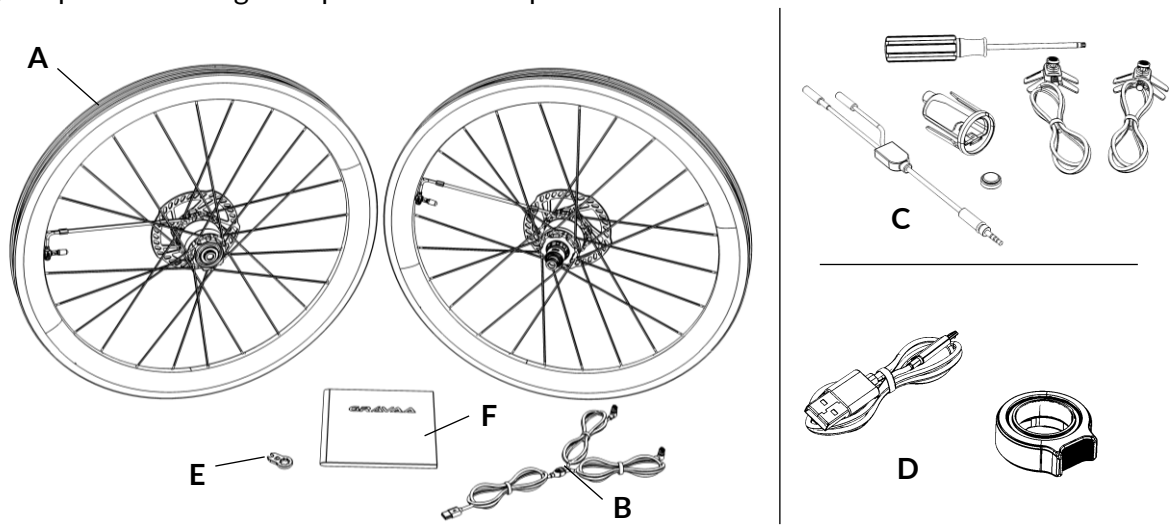


Figure 1: The scope of supplies

In your box, you will find the following components and accessories:

	Components	Boost[1]	Non-boost[2]
A	GRAVAA wheelset (front and rear), with already mounted:	●	●
	- DT Swiss ratchet freehub of choice mounted [rear]	●	●
	- End cap of choice mounted (depending on thru axle size)	●	●
	- GRAVAA disc brake rotors of choice	●	●
	- Spoke-hose fixation	●	●
	- GRAVAA valve adapter	●	●
B	GRAVAA USB-A charging cable with 2 magnetic connectors [1x]	●	●
C	GRAVAA sprint shifter		●
	- Shifter's head unit [1x]		●
	- Shifter's head unit mount [1x]		●
	- Shifter button with long cable [1x]		●
	- Shifter button with shorter cable [1x]		●
	- Splitter cable [1x]		●
	- Spare coin cell battery CR1632 [1x]		●
	- Torx T5 screwdriver [1x]		●
D	GRAVAA ring shifter	●	
	- Shifter [1x]	●	
	- USB charging cable [1x]	●	
E	GRAVAA valve tool [1x]	●	●
F	Quick start guide [1x]	●	●

[1] Boost hubs are standard for mountain bikes (width: 110 mm front, 148 mm rear). These will be available for sale later.
[2] Non-boost hubs are standard for road and gravel bikes (width: 100 mm front, 142 mm rear).

NOTE

- Check that all parts are present and undamaged. Please contact GRAVAA or your local retailer if that is not the case.
- A bike computer is not part of the standard scope of supplies. For the use of our product, it is highly advised to use a compatible bike computer. A list of compatible devices can be found in section 7.5.

3.2 Required tools for installation

CAUTION

- To ensure a damage-free mounting and dismounting of the components, only use the tools which are mentioned in this manual.
- Damage-free mounting and dismounting of the components can only be ensured if the tools are working properly and if the condition of the tools is perfect.
- The use of different tools is at the discretion of the user. If the GRAVAA wheelset is damaged by the usage of differing tools, GRAVAA will not be liable and the user's warranty will become void.
- Always keep the tools in their original packaging or adequate devices to prevent damage.
- Please retain all GRAVAA product accessories and tools included for future use.
- **Never use metal tire levers**. Use plastic tire levers instead. Metal levers can damage the rim surface and consequently the tire and/or inner tube.
- Wear safety glasses when working with pressurized air.
- Wear safety gloves.

The following tools are generally required for the installation:

- GRAVAA charging supplies
- GRAVAA valve tool (included in the box)
    - Alternatively, a plastic Presta core removal tool may be used
- **Plastic** tire levers
- Bicycle pump or compressor with Presta interface
- Cassette tool
- Chain whip
- Torque wrench (up to 40Nm)

And, in case of the GRAVAA sprint shifter only:

- Torx T5 screwdriver (comes with the GRAVAA sprint shifter)
- Cutter or scissors

And, in case of the GRAVAA ring shifter only:

- Allen wrench 2mm

For each task, the required tools are listed in the next sections.

3.3 Mounting GRAVAA wheels

This section provides the mounting instructions of a GRAVAA wheelset for the first time:

- Step 1: Preparing tires and rims
- Step 2: Mounting tires, inner tubes and GRAVAA valve adapter
- Step 3: Pressurizing your tires
- Step 4: Mounting cassette
- Step 5: Mounting the wheels in your bike
- Step 6: Charging (and turning on)

CAUTION

- Your GRAVAA wheelset may only be used in combination with compatible tires and inner tubes. See section 7.2.
- GRAVAA offers no functional guarantee for parts which are not listed in H7 compatible parts.

3.3.1 Step 1: Preparing tires and rims

WARNING

- You must use inner tubes!
- Only use compatible tires! You can find a list of compatible tire sizes for your GRAVAA wheelset in section 7.2 or in Table 10.

TOOLS

- No tools required for this step

Before mounting the tires, the user must:

1. Inspect the rims for any defects (e.g., sharp edges or failures). In case of any doubts, do not use the rim and contact GRAVAA or a local retailer.
2. Make sure that the rim tape is mounted correctly (no gaps or loose parts).
3. Inspect the rim for any particles (dirt, moisture) on the rim bed. In case of any contamination, please clean it with a soft cleaning cloth.
4. Inspect the tire for any defects (e.g., protruding particles) or excessive wear. Remove any particles from the tire and do not use worn out tires.
5. Remove the protective material from the GRAVAA valve adapter.

3.3.2 Step 2: Mounting tires, inner tubes and GRAVAA valve adapter

TOOLS

- GRAVAA valve tool (or standard Presta core removal tool)
- **Plastic** tire levers

1. First, mount the tire and inner tube on the rim.
2. If possible, fixate the Presta valve stem (from the inner tube) securely to the rim, by means of the locknut supplied with your inner tube (1), see Figure 2. Do not pressurize the tire at this point.
3. Remove the valve cap (2) and remove the standard Presta valve core (3) from the stem of your inner tube, using the middle opening in the GRAVAA valve tool (4). See Figure 2. You do not need this Presta valve core anymore. Please store it for later or dispose it appropriately.
4. Place the GRAVAA valve adapter (5) on the valve stem and place the GRAVAA valve tool (4) onto the GRAVAA valve adapter as shown in Figure 3.
5. Assemble the GRAVAA valve adapter onto the valve stem, by screwing/rotating clockwise until the connection is hand tight. Hold the GRAVAA valve adapter firmly in place during rotation, please read the caution below.
6. Repeat this step for the second wheel. To inflate your tires, go to the next step.

CAUTION

- Make sure to hold the GRAVAA valve adapter with one finger to prevent the hose from rotating during step 5. This will protect the tube (attached to the spoke) from strain, leakage or other failures. Make sure the tube stays aligned with the spoke.

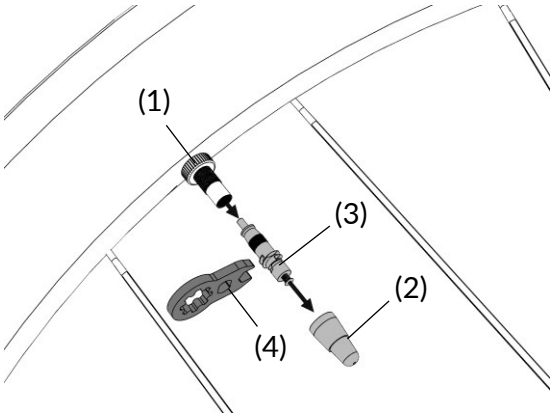


Figure 2: Remove Presta core + valve cap

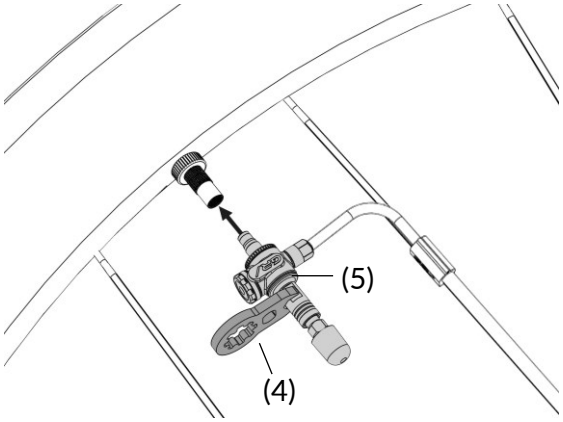


Figure 3: Install GRAVAA valve adapter + valve cap

3.3.3 Step 3: Pressurizing your tires

To (manually) inflate your tire, follow the next steps:

CAUTION

- Both the rims and the tires each can have a **maximum allowable pressure**. The lowest value of these shall be applied; make sure you never exceed this value!
  For example:
  - The maximum allowable pressure stated on the rim is 4.0 bar, and
  - The maximum allowable pressure stated on the tire is 4.5 bar, then:
  - ➢ The lowest maximum value is 4.0bar. Do not inflate beyond this limit value!

TOOLS

- Bicycle pump or compressor with Presta interface

1. Unmount the valve cap from the GRAVAA valve adapter such that the Presta valve is accessible.
2. Open the Presta valve.
3. A standard bicycle pump or compressor with Presta valve interface can be connected now to inflate the tire.
4. Inflate to the maximum approved pressure (see caution above) and check the tire seat on the rim. The tire must contact the rim evenly around its entire circumference.
5. Disconnect your pump or compressor, close the Presta valve and remount the valve cap.

NOTE

Tip: after pressurizing your tire, you can apply some soap on the valve adapter to detect if the GRAVAA valve adapter is installed correctly. In case you observe air bubbles (leakage), tighten the Presta valve core inside the GRAVAA valve adapter and/or tighten the GRAVAA valve adapter on the inner tube's valve stem using the GRAVAA valve tool.

3.3.4 Step 4: Mounting cassette

CAUTION

- Make sure you have the correct DT Swiss Ratchet Freehub Body installed which matches your cassette.

TOOLS

- Cassette tool
- Chain whip
- Torque wrench (up to 40Nm)

The following steps describe how to mount the cassette on your rear wheel:

1. Make sure the cassette is new or cleaned and ready for usage.
2. Assemble the cassette according to the manufacturer's specifications.
3. Use a tightening torque of 30-40 Nm.

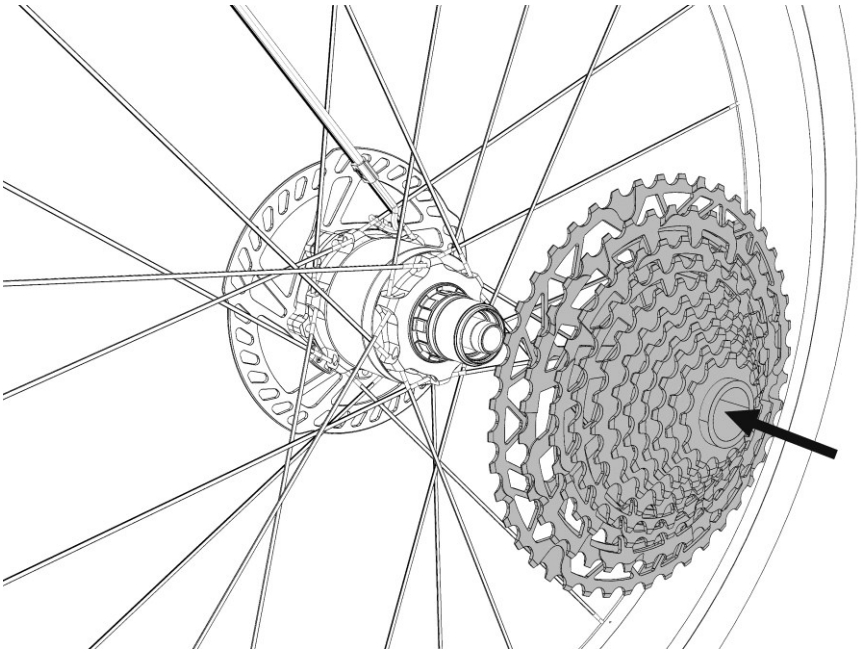


Figure 4: Mount cassette.

3.3.5 Step 5: Mounting the wheels in your bike

Now your tires and cassette are mounted, it's time to get your GRAVAA wheels in your bike!

WARNING

- Before each ride, check that wheels are mounted correctly. See section H4 Final check.
- Ensure the thru axle is tightened according to the specified value, these values can be found in your bike frame manufacturer's manual, at the bike frame and/or at the thru axle (TA).
- Depending on your bike, your front wheel has a thru axle diameter of 12mm or 15mm. Make sure your GRAVAA front wheel is equipped with the correct end caps (available in 12 and 15mm).

NOTE

- When spinning the wheels for the first time, you may hear some noise and experience a little friction. This is due to the pump which is active. The pump is deactivated automatically at speeds below 10km/h (6.2mph), but – the first time only – you must activate the wheels by means of the charging supplies, see Step 6: Charging (and turning on)
- After first time activation, the wheels will also turn on by rotation automatically.

TOOLS

- No tools required for this step (unless your thru axle requires tools)
- Allen or torx wrenches (in case you need to reposition the disc brake caliper)

Front wheel assembly

1. If fitted, remove the old front wheel by loosening and removing the thru axle (TA). See Figure 5. Typically, this can be done without tools or by using an Allen wrench, depending on your bike. Do not push your brake levers once no wheel is fitted.
2. Place the GRAVAA front wheel in the dropout of the fork/frame. Make sure the disc brake rotor moves in smoothly between your brake pads.
3. Push the TA through the dropout and then through the hub until it stops. Make sure it has gone through all the way.
4. Mount the TA by turning it clockwise until it is tight. Make sure the thru axle is tightened according to the frame manufacturer specifications.

5. Spin the wheels to check if everything runs smoothly, e.g. no friction between disc brake pads and rotor occurs. In case of friction, reposition your disc brake calliper on your bike frame according to the manufacturer's instructions.

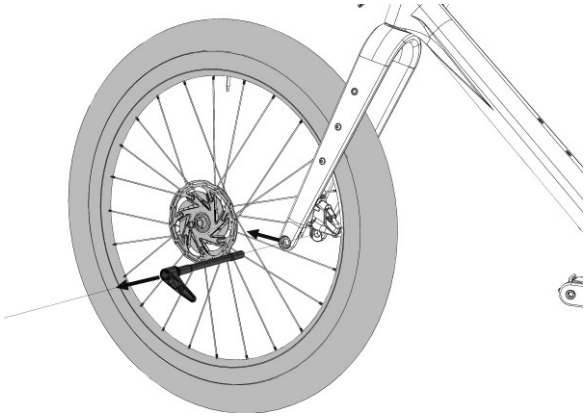


Figure 5: Remove front wheel from bicycle.

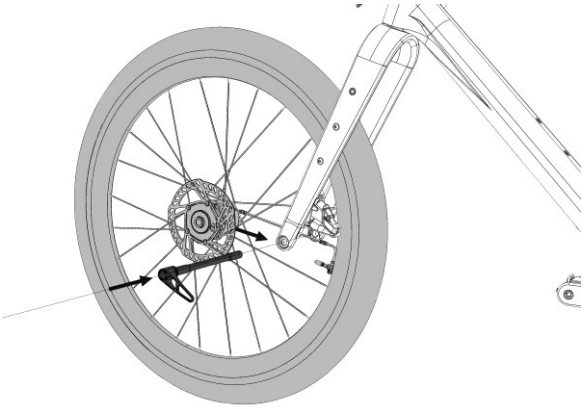


Figure 6: Mount GRAVAA front wheel in bicycle.

Rear wheel assembly

1. If fitted, remove the old rear wheel. Make sure the chain is on the smallest cog. If present on your bike, use the switch on the rear derailleur by setting the switch to Off. Then, push the rear derailleur backwards and carefully remove the wheel from the bicycle, see Figure 7. Typically, this can be done without tools or by using an Allen wrench, depending on your bike. Do not push your brake levers once no wheel is fitted.
2. Place the GRAVAA rear wheel. Push the rear derailleur backwards and carefully place the wheel into the chain loop, with the chain on the smallest cog. Make sure the disc brake rotor moves in smoothly between your brake pads.
3. Guide the GRAVAA rear wheel into the dropout of the fork/frame.
4. Push the TA through the dropout and then through the hub until it stops. Make sure it has gone through all the way.
5. Mount the TA by turning it clockwise until it is tight. Make sure the thru axle is tightened according to the frame manufacturer specifications.
6. Spin the wheels to check if everything runs smoothly, e.g. no friction between disc brake pads and rotor occurs. In case of friction, reposition your disc brake calliper on your bike frame according to the manufacturer's instructions.

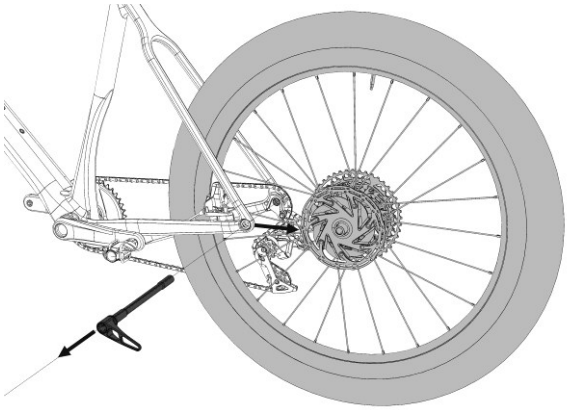


Figure 7: Remove rear wheel from bicycle.

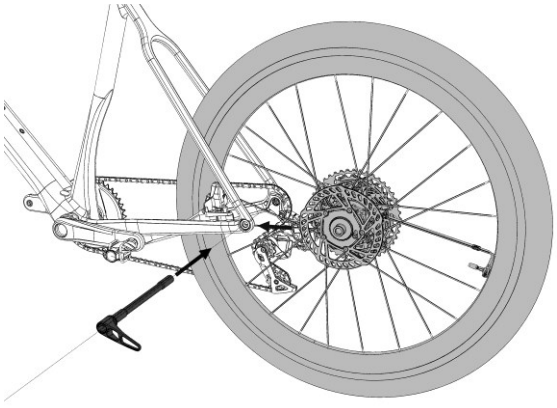


Figure 8: Mount GRAVAA rear wheel in bicycle

3.3.6 Step 6: Charging (and turning on)

Before first use, you must charge the rechargeable batteries inside the GRAVAA wheel hubs. These batteries are used for wireless communication and control of your system.

TOOLS

- GRAVAA USB-A charging cable
- USB-A charger (5V)

NOTE

By connecting the charger for the first time, your wheels will also get active. The next time, GRAVAA wheels will turn on automatically by spinning them (as long as there is sufficient battery power left). GRAVAA will turn off automatically after a period of inactivity, which is by default 15 minutes.

Both wheels can be charged simultaneously. The batteries can be charged from the side of the hub, using the GRAVAA charging supplies. The charging supplies consist out of a cable with one USB-A end and with two magnetic pogo pin connector. The pogo pins each fit to an interface on the side of each hub flange, as indicated in Figure 9.

WARNING

- Only use original GRAVAA charging supplies – delivered in the box, ordered separately via www.gravaa.com or one of our retailers.
- Use of non-authorized charging supplies may result in damage of equipment and malfunctioning of the product. In such case, GRAVAA will not be liable and the user's warranty will become void.

CAUTION

- Before charging, make sure the charging connectors on the hubs are free from dust and particles. Use a soft cloth to clean it.

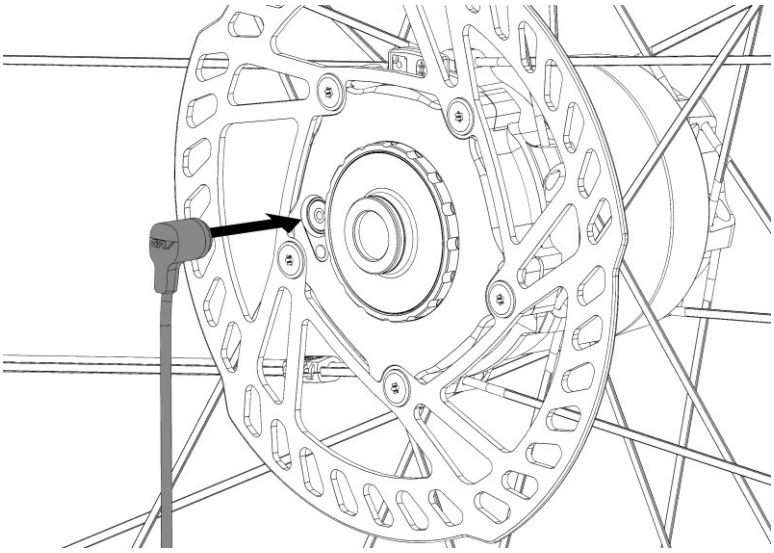


Figure 9: charge the wheels

The following steps describe how to charge your hubs easily. You can leave your wheels on the bike:

WARNING

Only use USB chargers that are compliant with IEC/UL 60950-1 or IEC/UL 62368-1 standards.

1. Place your bicycle close to a wall socket or use an extension cord to place your charger close to your bicycle.
2. Spin your wheels such that the pogo pin interface on the hub is visible and easily accessible. See Figure 9.

   Pro Tip: the pogo pin interface on the hub is aligned with the GRAVAA valve adapter. When you rotate the wheel such that the Presta valve is in the lowest position, the charging interface on the hub is always accessible!

3. Take the cable and connect the ends with the magnetic pogo pins to the interfaces on the hub. By design, they can only be mounted in 1 way. A magnet will hold the cable in place in case the cable is moved. See Figure 9: charge the wheels.
4. Put the USB cables into a USB charge block and connect the charger to a suitable wall socket.
5. When plugged in correctly, a green LED will start flashing, indicating that the battery is charging but that the battery level is not full yet.
6. When fully charged – with the charger device still connected – the LED on the hub turns solid green and is continuously on. Now, the charger and USB cable can be removed.
7. The level of charging can also be displayed via the GRAVAA app (see section 3.6)

NOTE

- Charging can only be done between 0°C and +45°C (+32°F and +113°F)
  The batteries in your hub will not charge outside these temperatures.
- By default, charging takes up to 5 hours (from empty to full).
- It is normal that your front wheel runs out of battery power faster than your rear wheel, since the front wheel acts as the wireless communication hub of the GRAVAA wheelset.

NOTE

As you're probably waiting now until the batteries are fully charged, here some tips:

- Continue to install your GRAVAA shifter on your handlebars (section 3.4 or 3.5)
- Continue to download GRAVAA app on your phone to use your new wheels and get most out of it (section 3.6).
- Prepare your bike computer: make sure it is ready for use (section 3.7)

3.4 Mounting the GRAVAA sprint shifter (drop bar)

NOTE

- GRAVAA advises to mount the GRAVAA sprint shifter's head unit into the right-sided end of the drop bar, since most people will lay down their bikes on the left side (i.e., non-drive side) to prevent damage of the rear derailleur. This way, the shifter does not get damaged easily either. The following instructions are written down accordingly.
- If this is not possible, you can revert the installation of the head unit to the left-sided end and place the button with the longest cable on the right side of the handlebars.

TOOLS

- Torx T5 screwdriver
- Cutter or scissors
- New handlebar tape (optional)
- Tape (e.g., electrical insulation tape)

To install the GRAVAA sprint shifter buttons on your handlebars, you need handlebars with cable guides or Di2-compatible handlebars. Those have holes drilled in, so that the wires of the GRAVAA sprint shifter can go through. The wires of the shifter's button must be plugged into the splitter cable, which goes into the head unit that will be plugged into the *right* bar end. The shifter's buttons can be installed anywhere on the handlebars, completely tailored to the rider's preferences in a spot that is easy to reach while riding.

1. If fitted, remove any handlebar tape from the handlebar.
2. Note the difference in cable length. The shifter button with the longest cable must be placed on the left side of the handlebar. This cable is marked with a yellow tape on/near the connector.
3. Place the shifter buttons on the desired place on your handlebar. Eventually, use tape to fix the buttons to the handlebar.
   Typically, the shifter button is positioned close to the edge of the rubber lever hood, on the inner side of the handlebars, see Figure 10.
4. Guide the cables from the shifter buttons through your handlebars, starting with the left one (longest cable). Make sure they come out of the *right* end of your handlebars.
5. Connect the shifter buttons to the splitter cable. Match the yellow-taped wire with the yellow-taped splitter entry.
6. Unscrew the head unit from the head unit mount, using the Torx T5 screwdriver. Keep the screws.
7. Guide the splitter cable through the head unit mount and position the head unit mount over your *right* end of your handlebars. Note the correct orientation; the screws must be level at the bottom. Fix the head unit mount with tape to the handlebar.
8. Then, plug the splitter into the head unit.

Pro Tip: before continuing with the next steps, check if the shifter buttons function correctly. When pressing any of the two buttons, the LED on the head unit of the shifter must turn on GREEN!

9. Move the head unit of the sprint shifter into the head unit mount at the right-sided drop bar end. Fix the head unit back by the two Torx T5 screws, using the screwdriver.
10. Place your preferred handlebar tape, while making sure the shift buttons are not covered and remain reachable.

NOTE

- If desired: secure the shift buttons and wires with tape during installation.
- You can cut a small hole in the rubber hood for the button to stick through, which offers a seamless look in the end.

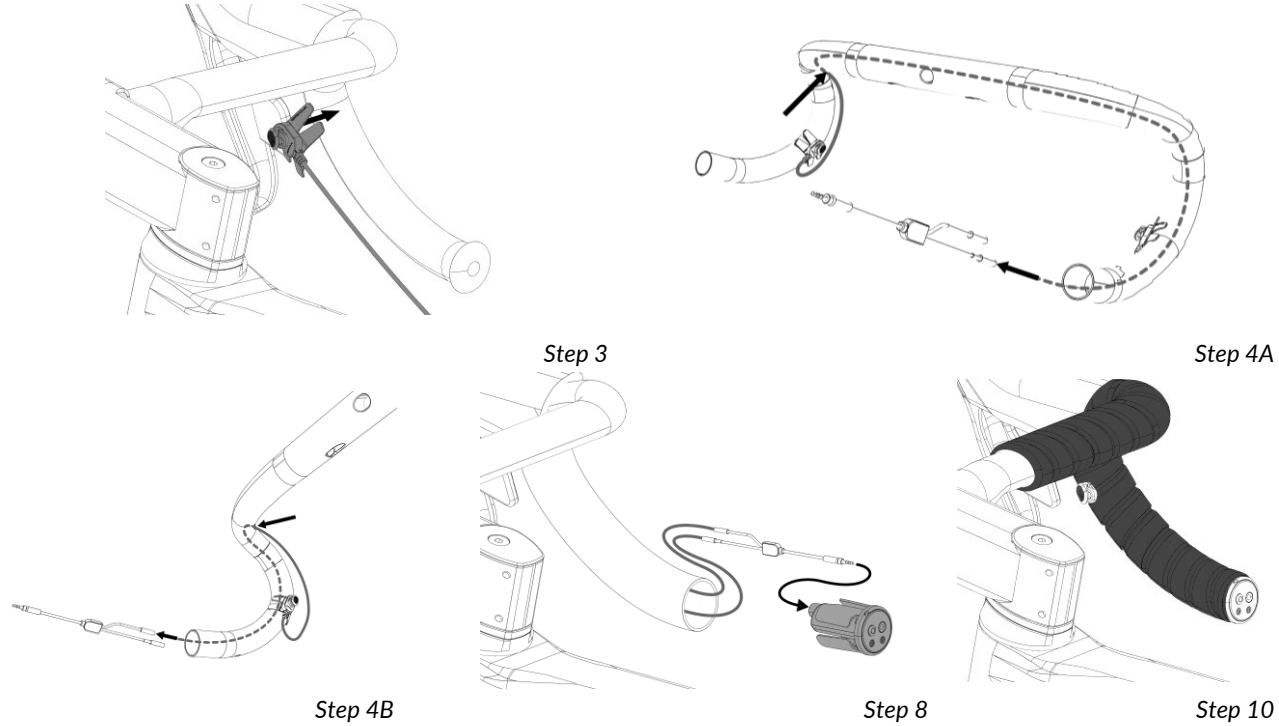


Figure 10: Mounting the GRAVAA sprint shifter

3.5 Mounting the GRAVAA ring shifter (flat bar)

NOTE

- You can mount the GRAVAA ring shifter on the left- or the right-hand side of your handlebar, according to your personal preferences.
- We suggest placing the ring shifter directly next to the hand grip, for best access.

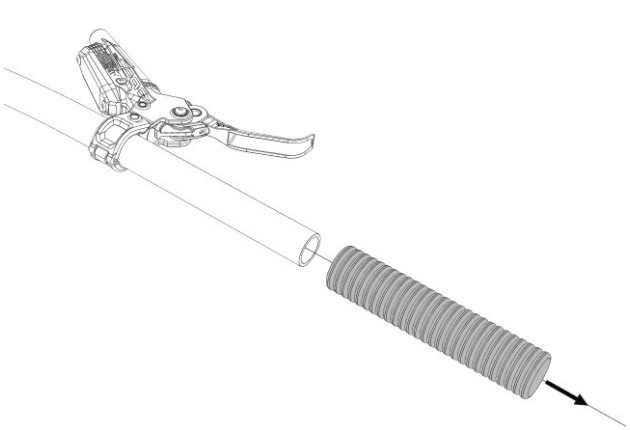
TOOLS

- Allen wrench 2mm
- (optional) Allen wrench set

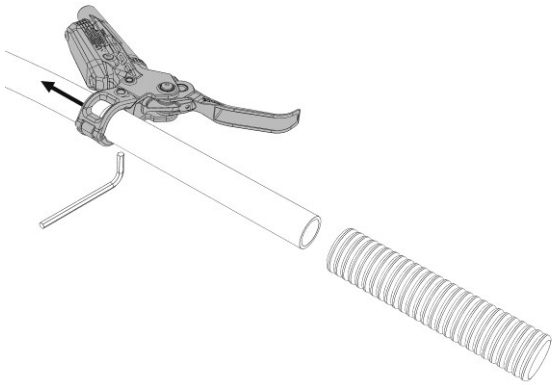
The wireless GRAVAA ring shifter can be used on flat bars with a diameter of 22 mm. Please follow the steps below to install the ring shifter. The steps are visualized in Figure 11.

Pro Tip: before installing the ring shifter, mark the position where your hand grips end, for example by using tape.

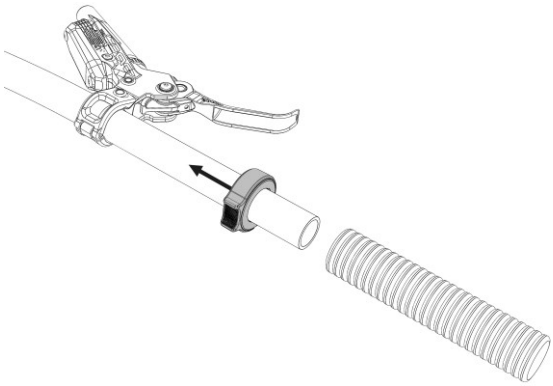
1. If fitted, remove one of the handlebar grips (left or right one) by pulling it off sideways.
2. If necessary, loosen the brake lever and/or shifter mounts on your handlebars and move them slightly towards the middle of your handlebars.
3. Slide the ring shifter over the handlebar
4. Tighten the ring shifter with an Allen wrench, size 2. Apply a maximum torque of 0.9Nm
5. Place the handgrip back.
6. You're all set!



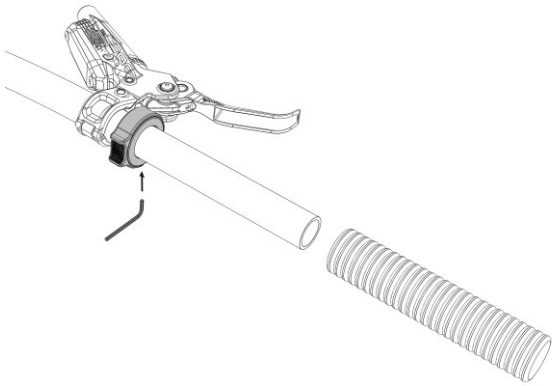
Step 1



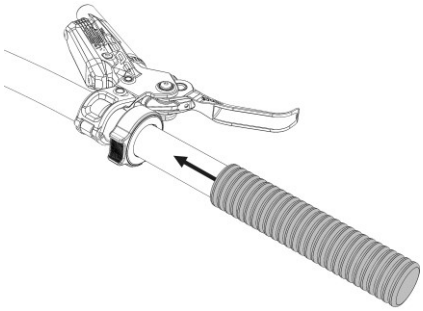
Step 2



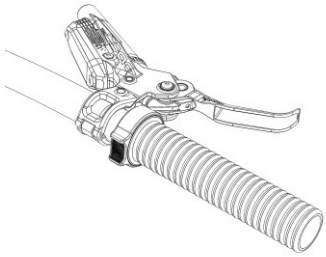
Step 3



Step 4



Step 5



Step 6

Figure 11: Mounting the GRAVAA ring shifter

3.6 Product activation (using the GRAVAA app)

NOTE

- To download and use the GRAVAA app make sure your phone has an internet connection and allow Bluetooth.

Now you have done all the hard work, it's time to download and install the GRAVAA app and activate your GRAVAA wheelset! In the GRAVAA app, you can create and login with your My GRAVAA account. In this account, you can add and configure all your GRAVAA wheelsets. You can also display the tire pressures in the App and configure product settings; this is explained in section 3.8.

As a first step, the GRAVAA app will guide you through the following steps to complete your product activation. These steps are required only once.

A. Connect your GRAVAA front wheel.
B. Connect your GRAVAA rear wheel.
C. Connect your GRAVAA shifter
D. Enter your tire specifications and pressure limits

The App will automatically update your GRAVAA product to the latest firmware at the end of these steps.

3.6.1 Download and install the GRAVAA app

Scan one of the QR codes below and follow the instructions to download and install the GRAVAA app. You can also find the GRAVAA app in your App store by searching for 'GRAVAA'. You can use these links to access the App stores: Apple App Store and Google Play Store

Apple iOS

Scan the following code:
to access the GRAVAA app in the App Store

Android

Scan the following code:
to access the GRAVAA app in the Play Store

3.6.2 Create and log in with My GRAVAA

Open the App and log in with your personal My GRAVAA account (or create one if you do not have one yet). Your product can only be activated (and configured) with your unique My GRAVAA account.

The App will guide you through the activation process, but the following instructions may be helpful.

3.6.3 Enter personal information

The first time you log in, the App asks you to enter personal information: your weight and favourite unit system. This is used to optimize the user experience and to set safe limits for the tire pressure later.

NOTE

Before connecting your wheels, make sure your wheels get out of sleep mode: spin the wheel for at least 1 full rotation to wake it up, or connect the charging cable. You must connect with the cable the first time you use your wheels. The LED on the hub shall now turn on. After 15 minutes of inactivity (by default), the wheel will return to sleep mode. This sleep timer can be adjusted via the GRAVAA app.

3.6.4 Add your GRAVAA wheelset, starting with your GRAVAA front wheel (Step A)

Click in the App on *Add wheels* and follow the instructions in the App to add your GRAVAA wheelset.

After clicking *Continue*, the App starts searching for your front wheel. Click on the wheel which shows the serial number (S/N) from your front wheel.
Make sure the wheel is turned on, either by using the charging cable or by spinning the wheels. The first time the wheels are used, the cable must be used.

NOTE

- The S/N of a GRAVAA wheel is visible on the (non-drive) side of the hub
- The front wheel has the following serial number format:
  GRA-F-YYWW-M-####
- The rear wheel has the following serial number format:
  GRA-R-YYWW-M-####
- Note that each GRAVAA wheel (or hub) has a unique serial number and that the numbers of the front and rear wheel do not necessarily match. The version/model type M of a front and rear wheel must match, however.

3.6.5 Connect your GRAVAA rear wheel (Step B)

After connecting your front wheel, you will automatically continue in the App to connect your rear wheel (with your front wheel). Please note that we have paired your front and rear wheel in the factory, only make sure also your rear wheel is turned on.

Once the rear wheel is connected with the front wheel, the LED on the rear hub will blink green. See also section 9.3.1.

3.6.6 Connect your GRAVAA shifter (Step C)

As a third step in the App's wheel activation process, your shifter will be added (Step C).

NOTE

- The GRAVAA sprint shifter has 1 head unit (mounted into the end of the drop bar), and 2 wired satellite buttons mounted on the handlebar. The right-hand side button increases the setpoint (tire inflate), the left-hand side button decreases it (tire deflate).
- The GRAVAA ring shifter has 1 head unit, which can turn/move in two directions. Turning it up results in a setpoint increase (tire inflate), turning it down in a decrease (tire deflate)

You will be prompted to select which type of shifter you have: a GRAVAA sprint shifter or GRAVAA ring shifter:

1. **GRAVAA sprint shifter**
   To put your sprint shifter in pairing mode, push the right button on the head unit (mounted inside the bar end) for 5 seconds. You may use the rear of the included Torx screwdriver, but make sure you do not use a sharp object. After that the LED (on the left side next to it) will start blinking green for 60 seconds. Once the sprint shifter is in pairing mode, you can find it in the GRAVAA app and select it to pair.

2. **GRAVAA ring shifter**
   To put your ring shifter in pairing mode, push the up button for 5 seconds. After that, within 5 seconds after releasing, push the down button and hold it for 1 second. Now the shifter is in pairing mode and the LED (just below the down button) will start blinking green for 60 seconds. Once the ring shifter is in pairing mode, you can find it in the GRAVAA app and select it to pair.

Once the shifter is – together with the rear wheel – connected with the front wheel, the LED on the front hub will also blink green. See also section 9.3.1

NOTE

- The S/N of a GRAVAA shifter is not visible on the shifter
- The sprint shifter has the following serial number format:
  GRA-S1-abcdefgh
- The ring shifter has the following serial number format:
  GRA-S2-abcdefgh
- The S/N of both shifters can be found by putting them in pairing mode. Scan for nearby Bluetooth devices with your phone and you'll see the shifter's S/N between your Bluetooth devices.

3.6.7 Enter tire specifications and pressure limits (Step D)

You are almost there! You have almost completed installation by connecting your GRAVAA front wheel, rear wheel and shifter to each other using the GRAVAA app. The last step of the product activation is to enter and check the correct tire and rim settings. This will lead to an optimal and safe product performance!

WARNING

The use of tubeless tire sealant or any other liquid substances inside the tire is strictly prohibited!

CAUTION

Tires all vary in terms of volume (the amount of air it can store) and allowable tire pressures. Therefore, some information must be communicated to your wheels to function optimal. The user is responsible to enter this information and communicate it to the app. For a list of compatible tires and inner tubes, see section 7.1.

WARNING

- Many different tires and rims may be used together with the GRAVAA system. For safety reasons, it is important that the user enters the correct tire type, tire size, and pressure limits for both the rim and tire. Your GRAVAA wheelset will respect these limits and control the tire pressure within these limits.
- Entering incorrect values in the GRAVAA app may result in serious damage or lead to injuries or even death.
- The user must comply to the tire sizes which are valid for their product version/model. See also Table 10.
- The user must check if the advised PRV is installed in the GRAVAA valve adapters. If not, this must be exchanged by the user. See section 5.6.

NOTE

- You can't skip this product configuration step in the GRAVAA app. The activation is only completed after completing this step.

Based on the product version/model, the user can select from a pre-selected range of tires (see Table 10) – which belongs to that product category and usage only.

In this final step of the product activation flow in the GRAVAA app, the user must provide the following information about the tire and rim:

1. **Tire type**: tire with inner tube
2. **Tire size**: select the size of the mounted tire. You can read the tire size normally on the side wall of the tire.
3. Check if the PRV colour (mounted inside the GRAVAA valve adapter) is correct (see also section 5.6 or Table 10).
4. **Maximum pressure of tire**: scroll down to select the maximum pressure stated on the tire. You can find this value normally on the side wall of the tire. If not available, select "*No maximum pressure stated"*.
5. **Maximum pressure of rim**: scroll down to select the maximum pressure stated on the rim. You can find this value normally close to the valve hole on the rim. If not available, select "*No maximum pressure stated"*.

After this, a confirmation window will appear in the GRAVAA app, with the explicit question to a user to confirm that the supplied information is correct. Please make sure to read this carefully and adjust the values if not entirely correct. You can go back to the previous page by clicking *Cancel*. Otherwise, click *Confirm* to complete the activation.

Now the wheelset activation is completed, your GRAVAA app will automatically check if the latest firmware is installed on your wheelset and install it accordingly. Hereafter, you may want to continue with your personal tire pressure configuration (section 3.8) and/or connect your bike computer (section 3.7).

3.7 Connect your bike computer

To visualize the tire pressure values on a screen, your GRAVAA wheelset can best communicate with a bike computer. Alternatively, a smartphone[3] with the GRAVAA app can be used. It is highly recommended to connect at least one display device, such that you can display your tire pressures while cycling.

WARNING

Using a bike computer, smartphone or any other monitoring device to display tire pressures is at own risk. The user shall comply to local rules of using such devices in traffic and take care of safe use of such devices.

Your GRAVAA wheels use the ANT+ TPMS and a proprietary tire pressure profile to communicate tire pressure information to your bike computer. This ANT+ profile has not been implemented across all bike computer brands/models, however.
GRAVAA aims to be compatible with most state-of-the-art and popular bike computers, and the instructions for (some) Garmin and Wahoo bike computers are explained below. See section 7.5 for the list of compatible devices.

Below, the pairing procedure is described for Garmin and Wahoo, which differs significantly.

1. For Garmin, your actual tire pressures, setpoints and status information of both wheels can be displayed, using the GRAVAA Connect IQ app (using the proprietary tire pressure profile). Garmin does not (yet) support the standard ANT+ TPMS profile, but the Connect IQ app offers more detailed information about the GRAVAA product.
2. For Wahoo, your actual tire pressures of both wheels (only) can be displayed, using the standard ANT+ TPMS profile.

NOTE

- You can recognize your front wheel by the following ANT+ ID: xx98 where xx are the last 2 digits of the front S/N
- You can recognize your rear wheel by the following ANT+ ID: yy99 where yy are the last 2 digits of the rear S/N

3.7.1 Garmin bike computers

Download and install the GRAVAA Connect IQ app from your Garmin's Connect IQ store to display your tire pressures. The GRAVAA Connect IQ app can be used like a data field in your Garmin.

[3] For direct monitoring of system values, the smartphone must support BLE 4.0 or higher

NOTE

- You can change the unit between [bar] and [psi] via the button “Change unit to bar” or “Change unit to psi” in the GRAVAA Connect IQ app.
- In case the background colour in the GRAVAA Connect IQ app turns blue, the system is active (inflate or deflate action)
- In case the background colour in the GRAVAA Connect IQ app turns red, there is something wrong. Please stop riding and connect your smartphone with GRAVAA app to get more information.

To download and install the GRAVAA Connect IQ app:

- Open the ‘Garmin Connect IQ’ App on your smartphone. You can also open this App from the ‘Garmin Connect’ App.
- Search for: GRAVAA
- Click on install and follow the instructions in the app. Make sure your Garmin is connected to your phone (via Bluetooth).

After installing the GRAVAA Connect IQ App on your Garmin bike computer, you can now add this as a data field to one (or more) data screens. To connect your GRAVAA wheels to your bike computer, add a data screen with only one (1) data field: the GRAVAA Connect IQ app:

- Go to: Activity Profiles > Data Screens > Add New > Data Screen
- Scroll down to: Connect IQ > Check the box: GRAVAA Garmin App
- Go back and acknowledge (check mark)
- Add this as a data screen: click on ‘>’ and confirm.
- Go to this data screen in your Activity Profile. Here you can now select your GRAVAA front and rear wheels:
    - Make sure your front wheel is turned on. The GRAVAA Connect IQ app will search for a 4-digit number, ending with xx98. The first two digits (xx) are equal to the *last* two digits of the front wheel’s serial number – visible at the side of the hub.
    - Repeat this step above for the rear wheel.
- Now, your bike computer will display the front and rear actual tire pressure, as well as the respective setpoints. The GRAVAA Connect IQ app will remember your (last) selected front and rear wheel and display the pressure values once the wheels are active and within reach of the bike computer.
- After this, you can then also add this data field to another screen, for example next to your other values like speed, power and/or next to your map. For this, modify any other data screen of one of your profiles.

3.7.2 Wahoo bike computers (Elemnt Bolt/Roam)

NOTE

You can change the unit between [bar] and [psi] via general or sensor settings on your bike computer.

Your Wahoo Elemnt Bolt/Roam can pair directly to your new GRAVAA wheels, but pairing can also be done using the Elemnt App.

A. Pairing directly on the Elemnt Bolt/Roam
    1. Start by pressing the left side button on the Elemnt Bolt/Roam to access the **settings menu**.
    2. Use the down button on the right side of the Elemnt to scroll to **ADD SENSOR**, then bring the Elemnt near to the front wheel and press **ADD** by using the center button - the sensor with highest signal strength will be displayed.
    3. Select **SAVE** (using the center button) once the correct sensor displays. If an incorrect sensor is displayed, select **BACK** (using the left button). Then, ensure your sensor is awake and closest to your Elemnt Bolt/Roam, and while still in **ADD SENSOR**, reselect **ADD** (using the center button) to search again and click **SAVE** (using the center button) once the correct sensor is shown.
    4. Choose **YES** to add associated data fields to your Elemnt Bolt/Roam's pages.
B. Pairing using the Elemnt App on your smartphone/tablet (this only works when your Wahoo bike computer is on and connected to your smartphone/tablet).
    1. Ensure your Elemnt Bolt/Roam is connected to the Elemnt App
    2. On the **Settings** page of the Elemnt app, select **Set up sensors**.
    3. Hold the device near the front wheel and select the sensor based on signal strength, description, or ANT+ ID.
    4. Select **Save sensor** to confirm the pairing.
    5. Now the Wahoo bike computer is paired with your GRAVAA wheels, you can add the tire pressure of the front and rear wheel to one or more pages of your bike computer. Open the App's **Settings** tab, then **Pages** (under **CUSTOMIZE**) and either **EDIT** (✎) a page (replace existing data fields on a page by data fields for tire pressure), or **ADD** (+) a new page where you select data fields for tire pressure.

3.8 Your tire pressure configuration

After product activation, you can make your own presets or increments in the Pressure modes menu in the GRAVAA app. Make sure to click Save to make sure your new settings get saved into your wheels correctly. You can select setpoints between the minimum and maximum allowed pressure, as explained in section 9.1.

It is possible to change the tire pressure in 2 pressure modes, which can be selected and modified via the GRAVAA app:

Table 1: Pressure modes

Mode	Functionality
Preset	Change tire pressure to certain preset values. *E.g. 1.5 bar for dirt roads, 2.0 bar for cobble stones and 3.5 bar for tarmac.*
Increment	Change tire pressure with chosen, fixed increments. *E.g. increase/decrease pressure with fixed steps of 0.2 bar.*

WARNING

In all cases, the users shall, at all times, assume responsibility to ride with safe tire pressures. If in doubt, contact GRAVAA.

With the GRAVAA shifters you can adjust the tire pressure while riding. By pressing or turning (depending on the type of shifter) a button up/down on the shifter, the GRAVAA system will increase or decrease the pressure in the tire and control it at the desired setpoint. The system reacts in the following, intuitive way on button presses:

Table 2: GRAVAA's response on button presses

Button press/turn	Mode	Functionality
Up	Preset	Go to 1 higher pressure preset
	Increment	Increase pressure by 1 chosen increment
Down	Preset	Go to 1 lower pressure preset
	Increment	Decrease pressure by 1 chosen increment

NOTE

- You must ride above 10 km/h to inflate or deflate. This way, you (i) can check if the wheels run freely at low speeds, and (ii) you do not have any friction when walking with your bike.
- When riding on rough terrain, a user may accidentally push a button more than once in a very short time. To prevent any unwanted actions to happen a debounce timer is used of 2 seconds. This means that the system only reacts once, in case the same button is pressed twice within this period.

H4 Final check!

Now you're all set, it's time to do a final check and hit the road!

WARNING

Before each ride, please check your GRAVAA wheelset and your bicycle are ready and safe to use. Use the checklist provided in this chapter.

1. **Check the status of the batteries.**
   Make sure to charge the wheels by connecting the charging cable to the magnetic pogo connector contact on the side of the hub. This is best done directly after a ride. For further instructions, see section 5.3 and 5.4 of this manual.
2. **Spin the wheels to check if everything runs smoothly.**
   E.g., if no friction between disc brake lever and rotor occurs.
3. **Check the rim and tire for damage.**
   Do not ride your bike if a rim or tire has any signs of damage. E.g., do not ride your bike if a tire shows excessive wear. If in doubt, contact your local retailer.
4. **Check the spoke tension.**
   Do not ride your bike if any of the spokes is loose.
5. **Check the braking behaviour and disc brake rotors.**
   Please check if the rotor does not show excessive wear, and that the brakes function normally. If in doubt, contact your local retailer.
6. **Check the pretension on each trough axle (TA)**
   Use a torque wrench to verify the correct tightening torque.
7. **Check if the rear wheel and shifter are connected.**
   Spin both wheels (by 1 full rotation) or connect the charging cable to turn the wheels on. They will switch off automatically after 15 minutes of inactivity. Push a button of the shifter to turn your shifter on. The shifter turns off automatically after the (front) wheel has switched off. The devices will connect automatically after first-time setup. In the GRAVAA app home menu, you can see the connection status between the wheels and shifter. Once the rear wheel and shifter established the connection with your front wheel (and the GRAVAA wheels are ready to go), the LEDs on both wheels blink green (see Table 16).
8. **Check if the shifter is working correctly (optional).**
   This can be tested best by pressing the up button: if the preset/setpoint goes up everything functions normally.

H5 Maintenance

For proper functionality of your GRAVAA product, some maintenance tasks must be performed by the user. However, compared to a any other, non-GRAVAA wheelset the number of additional tasks and amount of work needed is very limited. The tasks only require standard tools and basic knowledge of handling bicycle components as stated in this chapter.
Other maintenance, service and repair tasks must be done by a GRAVAA-recognized service technician only. For nearby service points, please see our website or contact us.

For each ride, check your GRAVAA wheelset and your bicycle are in proper condition and safe to use. Use the checklist provided in section H4 Final check!

5.1 Required tools for maintenance

See section 3.2 for an overview of the required tools for Maintenance. For each task, the required tools will be listed.

WARNING

- Do not open the hubs. Never unscrew the 2 bolts covered by the GRAVAA brake disc rotor. High risk of system malfunction when opening and disassembling the hubs. Warranty will expire.

WARNING

- Please check our service and warranty conditions. In case you feel uncomfortable about the product and/or in case of issues, please do not hesitate to contact us.
- As well as the intended and prohibited use, the maintenance requirements must be complied with. Failure to comply correctly may result in product failure and may cause serious injuries.

CAUTION

- Installation and servicing must be done in a clean working space.
- Your GRAVAA wheels will have a longer lifetime and perform better if regular maintenance is performed. Please follow the guidelines in this document for optimal product performance.
- The maintenance frequency depends on the use of your wheelset and riding conditions.

5.2 Cleaning

WARNING

- Do not use a high-pressure cleaner or steam washer.
- Do not submerge the GRAVAA hubs in water (or any other liquid).
- Do not use scouring pads, abrasive cleaners, aggressive solutions (such as thinners) or alkaline or acidic solvents (such as rust removers). Damage to the GRAVAA system may occur, leading to serious injuries as a result of defective operation.

TOOLS

- Soft cleaning cloth or soft sponge
- Mild soap
- (optional) tools to unmount/mount your thru axle, like an Allen wrench
- (optional) soft grippers
- (optional) bearing grease

Like any wheelset, regular cleaning will extend the lifetime of your GRAVAA wheels. The product is designed to cope with outdoor conditions. However, regular cleaning reduces wear and tear.

5.2.1 Cleaning of wheels

Cleaning of your wheels can best be done with the wheels removed from your bike. See section 3.3.5. to remove the wheels from your bike. Clean your GRAVAA wheels using a mild soap solution and clean and dry the charging contacts (on the non-drive side of the hub) with a soft cloth.

Tips:

1. Make sure there is no dirt left on the charging contacts, otherwise your wheels may not be able to charge.
2. Handle the spoke-hose connection and the GRAVAA valve adapter gently; do not push or pull too hard on it while cleaning. Although these parts are designed to cope with outdoor conditions, severe handling may cause damage and result into tire leakage or air flow obstructions.

For an optimal result of the maintenance works, every component that will be disassembled must be cleaned. Only use cleaners which do not damage the components. Especially the cleaning of O-rings and seals requires mild cleaners. Observe the instructions for use of the respective cleaner. Use soap water or similar mild cleaners for external cleaning.
Unless otherwise specified, moving parts, threads, O-rings and seals must be greased before assembly.

5.2.2 Cleaning of & behind endcaps

CAUTION

- Make sure the corrugated spring is always mounted behind the left-hand side (non-drive side) endcap!

Optionally, you may want to remove the endcaps from your wheels, to remove any dirt from the endcaps and from the outer sealing of the wheel bearings.

1. Unmount the left-hand side (non-drive side) endcap (1) from the wheel by pulling them off by hand (or by soft grippers). Also unmount the corrugated spring (2) located behind the endcap. Be careful not to lose the corrugated spring located behind the left endcap (2). See Figure 12.
2. Clean the endcap (1), corrugated spring (2) and remove any dirt from the outer sealing of the bearing.
3. Apply some bearing grease to the outer sealing.
4. Remount the corrugated spring (2) and push the correct endcap (1) back on. The end cap should be firmly seated on the axle and fully pushed on.
5. Repeat these steps for the right-hand side (drive side) endcap. Note that these do not have the corrugated spring.

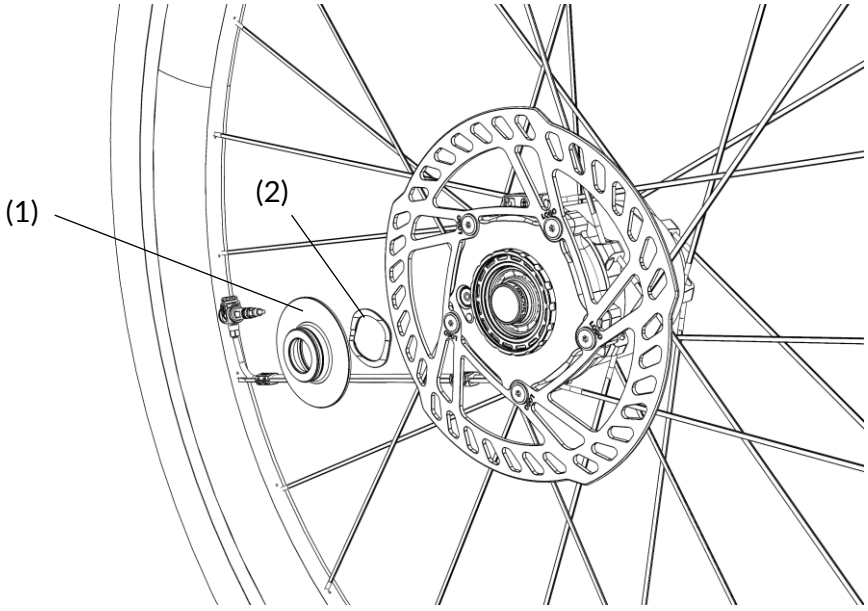


Figure 12: Place endcaps

5.2.3 Cleaning of freehub system

All GRAVAA rear wheels are equipped with a DT Swiss Ratchet System (36 teeth). For cleaning, maintenance and service instructions is referred to the instructions (e.g., Technical Manuals) supplied by DT Swiss[4]. For bearing replacements, the user shall comply to the instructions supplied by GRAVAA (see Technical OEM/Service manual).

[4] https://www.dtswiss.com/en/support/manuals

5.3 Battery of GRAVAA hubs

TOOLS

- GRAVAA USB-A charging cable
- USB-A charger (5V)

5.3.1 Check the battery status of the GRAVAA hubs

Each GRAVAA hub contains a rechargeable battery, to allow for communication, pressure measurement and safe use of the tire pressure control system. In normal use, you can ride up to 40 hours with full batteries. To prevent issues, we recommend charging batteries regularly, e.g., directly after or upfront each use of your wheelset.
You can easily read the battery status of both wheels and the shifter from the GRAVAA app, or check the colour indicated by the LED on the (non-drive) side of the hub, see Table 3.

CAUTION

- When the battery is low, the system will go into Safe mode: the tire pressure will go to the default, safe tire pressure - which cannot be changed until the battery is charged again. The value of this default, safe pressure can be set in the GRAVAA app.
- In safe mode the GRAVAA wheelset responds differently than expected.
- Riding with low batteries for longer periods of time could also lead to increase of wear or even damage of internal components.
- It is the responsibility of the user to charge the battery as soon as possible.

NOTE

- Above a speed of 10 km/h, all LED states on the hubs are switched off. Except for the Critical Error (Error level 1).

Table 3: LED colour indications related to battery power of the hub

Led colour	Blinking	Battery status
Green	Solid	Battery fully charged.
Green	Medium	Charging, battery not full
Green	Slow	System ready to go.
Red	Slow	Battery low. Charge battery.

5.3.2 Recharge battery of GRAVAA hubs

For detailed instructions for charging the batteries of the hubs, see section 3.3.6.

5.4 Battery of GRAVAA sprint shifter

TOOLS

- Torx T5 screwdriver
- Coin cell battery CR1632
- (optional) small flat-head screwdriver

5.4.1 Check the battery status of the GRAVAA sprint shifter

Inside the GRAVAA sprint shifter, there is a *replaceable* coin cell battery (type CR1632), which last for about 6-12 months, depending on usage.
The GRAVAA sprint shifter is equipped with an LED that indicates the battery status. You can check the colour of the LEDs while shifting. However, for safety it is recommended to get off the bicycle and perform the following procedure:

1. Press and hold the button (1) on the GRAVAA sprint shifter for less than 2 seconds. You may use the rear of the included Torx screwdriver, but make sure you do not use a sharp object.
2. Observe the colour of the LED (2) on the GRAVAA sprint shifter.

An alternative way is to check the battery power of the shifter using the GRAVAA app. Once there shows only one bar, we recommend it be replaced.

Table 4: LED colour indications on the GRAVAA sprint shifter

Led colour		Blinking	Battery status
Green		Slow for 3s (6x)	The battery is more than 30% charge.
Red		Slow for 3s (6x)	Battery low, between 20% and 30%. Replace battery, see section 5.4.2.
Red		Fast for 3s (15x)	The battery is below 20% charge. Replace the battery. See section 5.4.2.
None	x	None	The battery is empty. Replace the battery. See section 5.4.2.

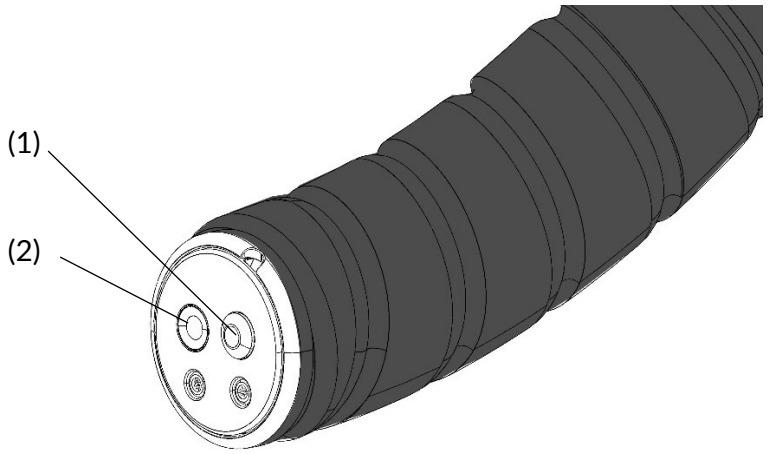


Figure 13: GRAVAA sprint shifter buttons and LEDs

5.4.2 Replace battery of GRAVAA sprint shifter

You can replace the GRAVAA sprint shifter's coin cell battery without removing the tape from your handlebar. The steps below are depicted in Figure 14.

1. With the Torx T5 provided, loosen the two screws on the GRAVAA sprint shifter's head unit.
2. Pry the head unit from the GRAVAA sprint shifter's head mount using the supplied Torx screwdriver or a small flat-head screwdriver. Do this gently, to not damage your shifter or handlebar.
3. Fully remove the GRAVAA sprint shifter's head unit from the handlebar and disconnect the shifter's connector.
4. Turn the head unit around.
5. Disconnect the housing using the Torx T5 screwdriver.
6. Slide the battery holder out of the housing.
7. Remove the coin cell battery while fixating the electronics in its holder.
8. Install the new CR1632 battery. Place the battery correctly. Observe the + and - markings.
9. Reinstall all parts in the reverse order of removal. Pay special attention to the following:
    a. Ensure that the rubber seal between the battery holder and the housing is installed correctly in the groove.
    b. Install the connector fully up against the shifter. Before continuing the installation, check that the LED blinks both when adjusting pressure up and down.

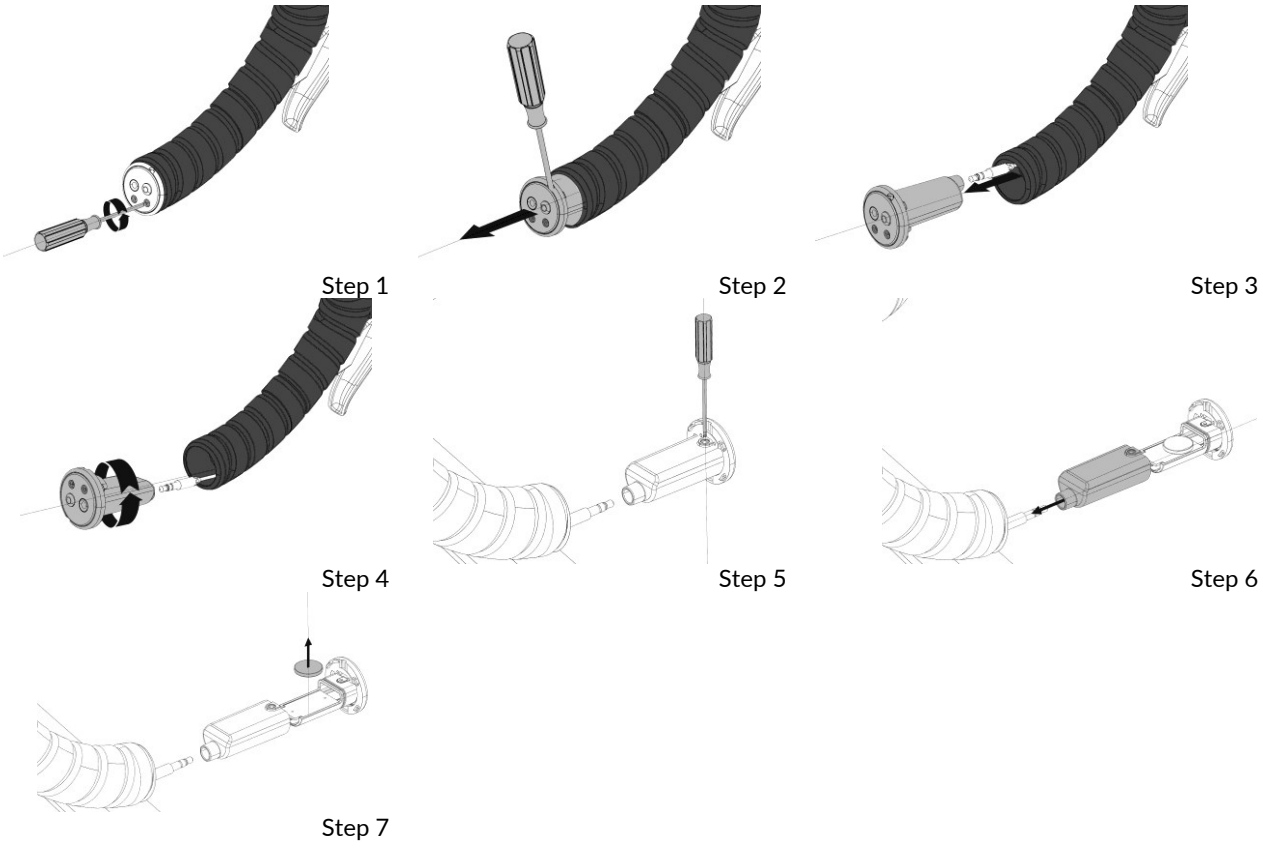


Figure 14: Replacing the sprint shifter's battery

NOTE

Do not dispose of the battery in general waste. Take the discharged battery to an authorized collection point. See section H11.

5.5 Battery of GRAVAA ring shifter

TOOLS

- Allen wrench 2mm
- GRAVAA ring shifter's USB-A charging cable
- USB-A charger (5V)

5.5.1 Check battery status of the GRAVAA ring shifter

Inside the GRAVAA ring shifter, there is a *rechargeable* battery, which lasts up to 3 months, depending on usage.
The GRAVAA ring shifter is equipped with an LED that indicates the battery status. You can check the colour of the LEDs while shifting. For safety it is recommended to get off the bicycle and perform the following procedure:

1. Push the GRAVAA ring shifter (1) up or down very briefly (for less than 0.3 seconds).
2. Observe the colour of the LED (2):

Table 5: LED colour indications on the GRAVAA ring shifter

Led colour		Blinking	Battery status
Green		On for 0.2s (1x)	The battery is more than 25% charge.
Red		On for 0.2s (1x)	The battery is between 15% and 25% charge.
Red		Fast for 1.5s	The battery is below 15% charge. Recharge the battery. See section 5.5.2.
None	x	None	The battery is empty. Recharge the battery. See section 5.5.2.

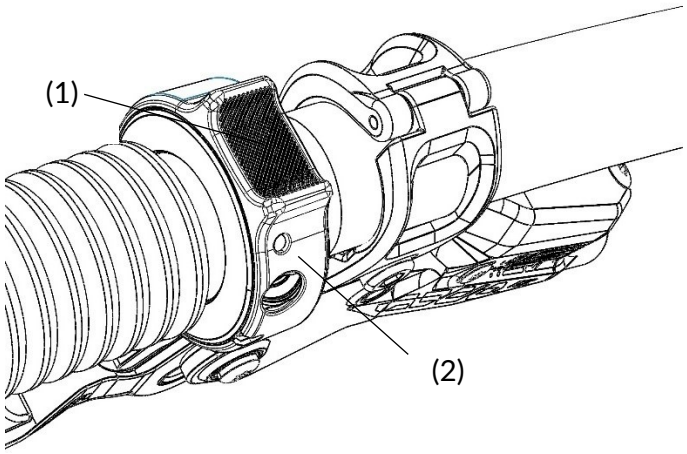


Figure 15: GRAVAA ring shifter buttons and LEDs

5.5.2 Recharge battery of GRAVAA ring shifter

You cannot replace the battery of the GRAVAA ring shifter, but you can recharge the battery.

WARNING

Only use USB chargers that are compliant with IEC/UL 60950-1 or IEC/UL 62368-1 standards.

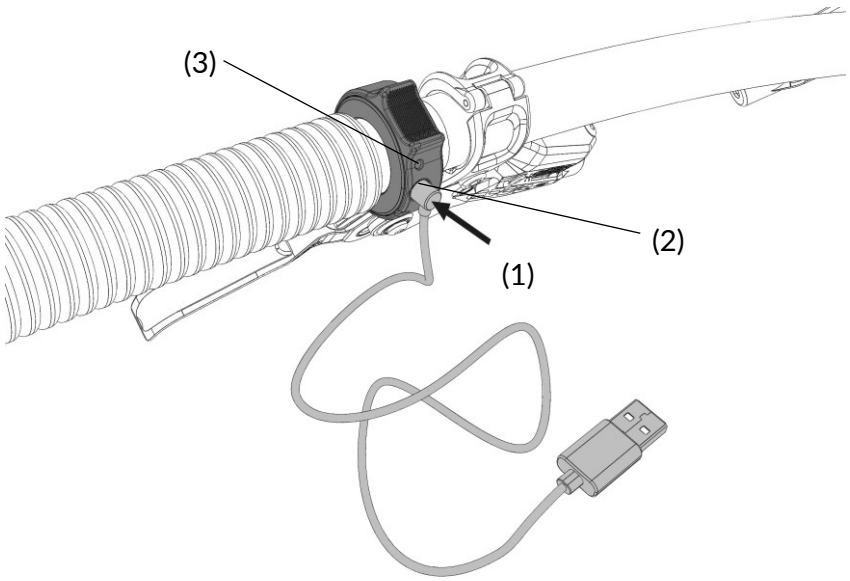


Figure 16: Recharging the battery of the ring shifter

1. Insert the magnetic pogo connector in the opening (1) of the GRAVAA ring shifter (2).
2. Connect the USB cable to a suitable charger and connect to the power mains.
3. The LED (3) will blink green while charging. Once the battery is fully charged, the LED will remain steady green.
4. Disconnect the pogo connector from the GRAVAA ring shifter
5. Remove the USB charger from the power mains.

5.6 Replacing the inner tube

In case of a puncture, you need to replace the inner tube. Basically, the steps from section 3.3.1, 3.3.2 and 3.3.3 describe the procedure of mounting a tire with inner tube. This section also includes the removal of your inner tube and repeats the foregoing steps.

5.6.1 Step 1: Removing your inner tube

TOOLS

- GRAVAA valve tool (or standard Presta core removal tool)
- **Plastic** tire levers

1. First, unmount the valve cap from the GRAVAA valve adapter such that the Presta valve is accessible.
2. Open the Presta valve.
3. Release all air from the tire by pressing on the top side of the valve.
4. Place the GRAVAA valve tool (1) onto the GRAVAA valve adapter (2) as shown in Figure 17.
5. Disassemble the GRAVAA valve adapter from the valve stem, by screwing/rotating counterclockwise with the GRAVAA valve tool until the connection is loose. Hold the GRAVAA valve adapter in place during rotation, please read the caution below.
6. Release the locknut from your inner tube.
7. Now the GRAVAA valve adapter has been disassembled, you can unmount the tire at one side of the rim using plastic tire levers and get the inner tube out subsequently – completely like any other wheel.

CAUTION

- Make sure to hold the GRAVAA valve adapter with one finger to prevent the hose from rotating during step 5. This will protect the tube (attached to the spoke) from strain, leakage or other failures. Make sure the tube stays aligned with the spoke.
- Once the GRAVAA valve adapter is disassembled from the valve stem, beware that no dirt or particles can enter the GRAVAA valve adapter. Failing to do so may result into blockage and reduced performance of the system.

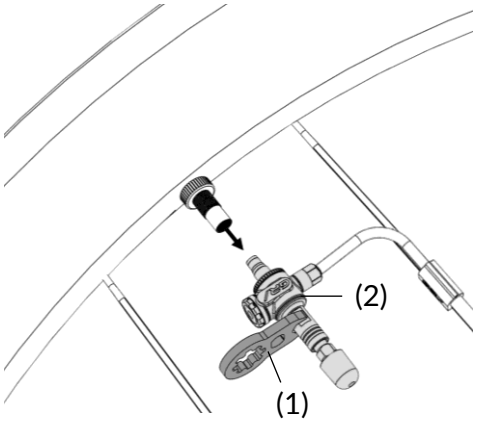


Figure 17: Remove the GRAVAA valve adapter from the valve stem

5.6.2 Step 2: Preparing tires and rims

WARNING

- You must use inner tubes!
- Only use compatible tires! You can find them listed in section 7.2 or in Table 10.

TOOLS

- No tools required for this step

Before mounting the new inner tube, the user must:

1. Inspect the rims for any defects (e.g., sharp edges or failures). In case of any doubts, do not use the rim and contact GRAVAA or a local retailer.
2. Make sure that the rim tape is mounted correctly (no gaps or loose parts).
3. Inspect the rim for any particles (dirt, moisture) on the rim bed. In case of any contamination, please clean it with a soft cleaning cloth.
4. Inspect the tire for any defects (e.g., protruding particles) or excessive wear. Remove any particles from the tire and do not use worn out tires.

5.6.3 Step 3: Mounting tires, inner tubes and GRAVAA valve adapter

TOOLS

- GRAVAA valve tool (or standard Presta core removal tool)
- **Plastic** tire levers

1. First, mount the tire and inner tube back on the rim.
2. If possible, fixate the Presta valve stem (from the inner tube) securely to the rim, by means of the locknut supplied with your inner tube (1), see Figure 18. Do not pressurize the tire at this point.
3. Remove the valve cap (2) and remove the standard Presta valve core (3) from the stem of your inner tube, using the GRAVAA valve tool (4). See Figure 18.
   You do not need this valve core anymore. Please store it for later or dispose it appropriately.
4. Place the GRAVAA valve adapter (5) on the valve stem and place the GRAVAA valve tool (4) onto the GRAVAA valve adapter as shown in Figure 19.
5. Assemble the GRAVAA valve adapter onto the valve stem, by screwing/rotating clockwise until the connection is hand tight. Hold the GRAVAA valve adapter firmly in place during rotation, please read the caution below.
6. To inflate your tires, go to the next step.

CAUTION

- Make sure to hold the GRAVAA valve adapter with one finger to prevent it from rotating during step 5. This will protect the tube (attached to the spoke) from strain, leakage or other failures. Make sure the tube stays aligned with the spoke.

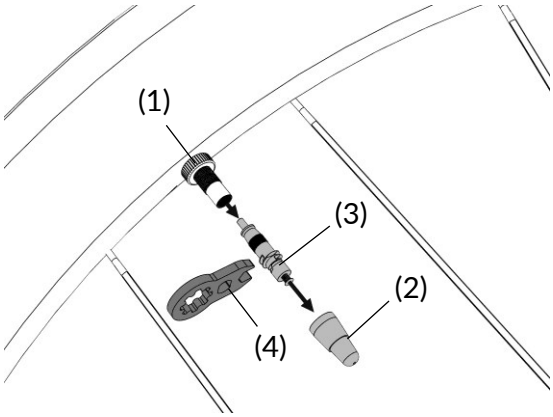


Figure 18: Remove Presta core + valve cap

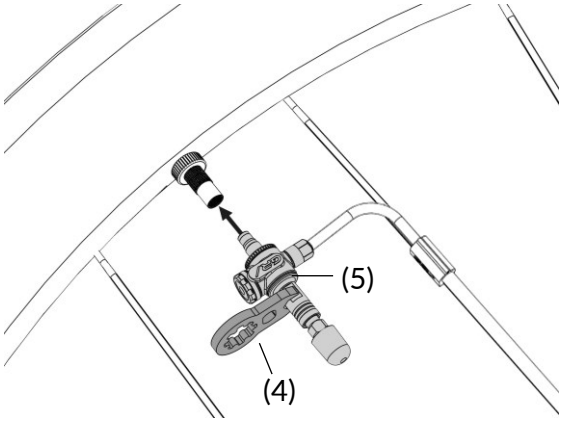


Figure 19: Install GRAVAA valve adapter + valve cap

5.6.4 Step 4: Pressurizing your tires

To (manually) inflate your tire, follow the next steps:

CAUTION

- Both the rims and the tires each can have a **maximum allowable pressure**. The lowest value of these shall be applied; make sure you never exceed this value!
  For example:
  - The maximum allowable pressure stated on the rim is 4.0 bar, and
  - The maximum allowable pressure stated on the tire is 4.5 bar, then:
  - ➢ The lowest maximum value is 4.0bar. Do not inflate beyond this limit value!

TOOLS

- Bicycle pump or compressor with Presta interface

1. Unmount the valve cap from the GRAVAA valve adapter such that the Presta valve is accessible.
2. Open the Presta valve.
3. A standard bicycle pump or compressor with Presta valve interface can be connected now to inflate the tire.
4. Inflate to the maximum approved pressure (see caution above) and check the tire seat on the rim. The tire must contact the rim evenly around its entire circumference.
5. Disconnect your pump or compressor, close the Presta valve and remount the valve cap.

5.7 Store your bike and wheelset

TOOLS

- GRAVAA USB-A charging cable
- USB-A charger (5V)

Make sure your GRAVAA wheelset is stored in a dry place, with temperatures (when not in use) or transport is between 0 °C and +45 °C.
If you are not using your GRAVAA wheelset for an extended period of time and want to store it for future use, please charge the batteries before storing. GRAVAA advises to recharge the batteries of the GRAVAA hubs once every 3 months.

Check the wheels, tires and other components for damage or excessive wear and tear. Replace components if in doubt. All GRAVAA spare parts can be ordered online via www.gravaa.com or via your local GRAVAA retailer.

Make sure your bike and components are clean and ready to use for the next time! See section 5.2 for cleaning instructions.

5.8 Other maintenance, service and repair tasks

Next to the tasks listed in this chapter, other (and less common) maintenance, service and repair tasks must be done by a professional bike mechanic and/or official GRAVAA service point. Specific instructions how to perform these tasks can be found in the Technical OEM/Service manual:

1. Replacing GRAVAA disc brake rotor
   We advise to exchange disc brake rotors at the wear of 0,25mm or when the thickness is less than the minimum stated on the rotor. We also advise you to change the rotors when you change pad compound to ensure powerful, consistent, and quiet brake performance.

2. Replacing GRAVAA air filter
   We advise to exchange the filter only in case it gets polluted, depending on use conditions. Regular cleaning helps to prevent any issues herewith.

3. Replacing GRAVAA hub bearings
   The lifetime of GRAVAA hub bearings is like that of any other high-end wheel brand. The replacement must follow specific instructions, however.

4. Replacing GRAVAA valve adapter
   In the rare case of malfunctioning (i.e., leakage of air) caused by the valve adapter, this part can be exchanged.

5. Replacing GRAVAA pressure relief valve (PRV)
   In the rare case of malfunctioning (i.e., leakage of air) caused by the pressure relief valve, this part can be exchanged.

6. Replacing GRAVAA spoke-hose connection (incl. hose)
   In the rare case of malfunctioning (i.e. leakage or blockage of air) caused by a failed hose or spoke-hose connection, this part can be exchanged.

7. Wheel building instructions for GRAVAA hubs
   Specific rules and guidelines for wheel builders.

H6 / Troubleshooting

This chapter provides troubleshooting lists with possible root causes and solutions for issues which may arise during use of your GRAVAA wheelset. In case of an issue which you can't find or solve, please contact GRAVAA directly or visit one of the nearby service points. You can find all support options via: https://gravaa.com/support.

NOTE

For a list with frequently asked questions (FAQs), please visit the GRAVAA website: https://gravaa.com/faq

6.1 Troubleshooting GRAVAA hub/wheels

In the rare case of a system malfunction, the following list provides helpful information. Some of the errors can be detected by means of the GRAVAA hub's software. Consequently, a warning with instructions will be issued to the GRAVAA app. In case of doubt, it's recommended to connect the GRAVAA app.

Table 6: Troubleshooting – GRAVAA hub/wheels

Issue	Cause	Solution	Error code or reference
The hub does not charge after connecting the charging cable	The charging contact point on the non-drive side of the hub is dirty.	Disconnect the charging cable from the hub and clean the charging contact points. Try again.	Section 5.2
	Software error	Disconnect the charging cable and reconnect it again. If not working, try to restart or reset the hub software by using the charging cable.	Section 6.2
The GRAVAA wheel does not turn on when spinning it.	Battery is empty.	Connect charging cable and charge battery.	Section 5.3
	Your product is in shipping mode.	Connect charging cable and the product should turn on automatically.	Section 3.3.6
My smartphone doesn't connect to the GRAVAA (front) wheel.	Your front wheel is not turned on (see above).	Spin your front wheel by 1 full rotation.	H4
	Your front wheel is connected to another	Check nearby smartphones/devices and	

	smartphone using the same My GRAVAA account.	disconnect wheels via the App, close the App or turn Bluetooth off on the other device.	
	The front wheel is used by another My GRAVAA account. In that case, the App states 'Already connected'.	Check if you have the correct wheel. If so, please ask/contact the owner to delete that wheelset from their account.	
	Bluetooth is disabled on your smartphone	Enable Bluetooth in your phone settings.	
	You're too far away from the front wheel.	Hold your smartphone closer to the front hub.	
The firmware update fails to install.	You've moved too far away from the wheels.	Try again and stay closer to your wheelset during the update until it's finished.	
	Battery is lower than 20%. Firmware update does not start.	Connect charging cable and charge battery.	Section 5.3
	Your rear wheel is not turned on. Firmware update does not start	Spin your front wheel by 1 full rotation.	H4
	No internet connection	To download the firmware update you need a stable internet connection.	
After pressing the shifter's up-button, tire inflation is not working	Rotational speed is too low	Increase cycling speed to a minimum of 10 km/h	Section 9.2
	Rotational speed is too high	Reduce cycling speed. Above 60 km/h, the pump will not be activated to limit wear.	Section 9.2
	The shifter's up-button is not working.	Check the shifter's battery level. If OK, check if the hub does react on a setpoint increase from the GRAVAA app. If so, check for (installation) defects of the shifter.	Sections 3.4 + 5.4 (sprint shifter), Sections 3.5 5.5 (ring shifter)
	You're already at your highest setpoint.	Connect with the GRAVAA app to check your highest preset/increment (in the Pressure Modes menu)	

	You have pushed the same button too quickly after the previous push.	When riding on rough terrain, a user may accidentally push a button more than once in a very short time. To prevent any unwanted actions happening, a debounce timer is used of 2 seconds. This means that the system only reacts once, in case the same button is pressed twice within this period.	Section 3.8
	Battery level is too low to control the system; the system is in a safe mode.	Please check the level of charge. If low (and LED on hub is slowly blinking red), please connect the charging cable and charge battery.	Section 5.3, section 9.3.1
	The air flow is blocked due to a polluted air filter.	Please check if the air filter located behind the endcap at the non-drive side is polluted. Clean it gently using a soft cloth or brush. For replacement, check the Technical OEM/Service Manual.	
	The air flow to the tire is blocked due to a kinked/obstructed hose.	Check if the hose, guided along a spoke between the hub and the rim, has been kinked. Try to remove the kink, e.g. by moving the hose a little up- or downwards along the spoke, or by slightly rotating the GRAVAA valve adapter. For replacement of the hose and/or GRAVAA valve adapter, check the Technical OEM/Service Manual.	
	Software error	Try to restart or reset the hub software by using the charging cable.	Section 6.2
	Temperature out of range	You can ride with GRAVAA below 0 °C, but active control (inflation and deflation of tire) is automatically disabled below 2 °C for safety reasons. Once the hub temperature is above this	Section 9.2

		limit again, active control is enabled automatically again.	
After pressing the shifter's down-button, tire deflation is not working	Rotational speed is too low	Increase cycling speed to a minimum of 10 km/h	Section 9.2
	Rotational speed is too high	Reduce cycling speed. Above 60 km/h, deflation will not be activated for safety reasons.	Section 9.2
	The shifter's down-button is not working.	Check the shifter's battery level. If OK, check if the hub does react on a setpoint decrease from the GRAVAA app. If so, check for (installation) defects of the shifter.	Sections 3.4 + 5.4 (sprint shifter), Sections 3.5 5.5 (ring shifter)
	You're already at your lowest setpoint.	Connect with the GRAVAA app to check your lowest preset/increment (in the Pressure Modes menu)	
	You have pushed the same button too quickly after the previous push.	When riding on rough terrain, a user may accidentally push a button more than once in a very short time. To prevent any unwanted actions happening, a debounce timer is used of 2 seconds. This means that the system only reacts once, in case the same button is pressed twice within this period.	Section 3.8
	Battery level is too low to control the system; the system is in a safe mode.	Please check the level of charge. If low (and LED on hub is slowly blinking red), please connect the charging cable and charge battery.	Section 5.3, section 9.3.1

	The air flow is blocked due to a polluted air filter.	Please check if the air filter located behind the endcap at the non-drive side is polluted. Clean it gently using a soft cloth or brush. For replacement, check the Technical OEM/Service Manual.	
	The air flowing out of the tire is blocked due to a kinked/obstructed hose.	Check if the hose, guided along a spoke between the hub and the rim, has been kinked. Try to remove the kink, e.g. by moving the hose a little up- or downwards along the spoke, or by slightly rotating the GRAVAA valve adapter. For replacement of the hose and/or GRAVAA valve adapter, check the Technical OEM/Service Manual.	
	Software error	Try to restart or reset the hub software by using the charging cable.	Section 6.2
	Temperature out of range	You can ride with GRAVAA below 0 °C, but active control (inflation and deflation of tire) is automatically disabled below 2 °C for safety reasons. Once the hub temperature is above this limit again, active control is enabled automatically again.	Section 9.2
After pressing the shifter's down-button, deflation goes below my setpoint (too much deflation)	The selected tire size in the GRAVAA app is too big.	Please select a smaller tire size. Open the GRAVAA app and go to: Settings > Advanced settings > Change tire specifications and pressure limits. Follow the instructions in the app and select a smaller tire size.	
	The tire is in reality smaller than expected based on the information stated on the tire (and entered in the GRAVAA app initially).	Please select a smaller tire size. Open the GRAVAA app and go to: Settings > Advanced settings > Change tire specifications	

		and pressure limits. Follow the instructions in the app and select a smaller tire size.	
After pressing the shifter's down-button, deflation goes in multiple deflate steps to my setpoint (too little deflation)	The selected tire size in the GRAVAA app is too small.	Please select a larger tire size. Open the GRAVAA app and go to: Settings > Advanced settings > Change tire specifications and pressure limits. Follow the instructions in the app and select a larger tire size.	
	The tire is in reality larger than expected based on the information stated on the tire (and entered in the GRAVAA app initially).	Please select a larger tire size. Open the GRAVAA app and go to: Settings > Advanced settings > Change tire specifications and pressure limits. Follow the instructions in the app and select a larger tire size.	
	The air flowing out of the tire is partially blocked due to a kinked/obstructed hose.	Check if the hose, guided along a spoke between the hub and the rim, has been kinked. Try to remove the kink, e.g. by moving the hose a little up- or downwards along the spoke, or by slightly rotating the GRAVAA valve adapter. For replacement of the hose and/or GRAVAA valve adapter, check the Technical OEM/Service Manual.	
My tire is leaking air	Puncture of inner tube	Check the inner tube for punctures. Follow the steps from section 5.6.	Section 5.6
	The Presta valve core is not mounted/tightened correctly the GRAVAA valve adapter.	Use the GRAVAA valve tool to firmly tighten the Presta valve core. *Tip: you can apply some soap on the valve adapter to detect leakage.*	Section 3.3.2 and 3.3.3
	The GRAVAA valve adapter is not mounted/tightened	Use the GRAVAA valve tool to firmly tighten the	Section 3.3.2 and 3.3.3

	correctly onto the valve stem.	GRAVAA valve adapter onto the valve stem. *Tip: you can apply some soap on the valve adapter to detect leakage.*	
	The hose between the hub and rim has failed.	Check if the hose, guided along a spoke between the hub and the rim, has been damaged. For replacement of the hose and/or GRAVAA valve adapter, check the Technical OEM/Service Manual.	
I hear a loud rattling noise when inflation starts or stops	Thru axle is not tightened correctly.	Tighten the thru axle up to the correct torque, following the bike manufacturer's instructions.	Section 3.3.5
	Missing endcap or corrugated spring	Check if both endcaps are fitted correctly and if the corrugated spring is mounted behind the endcap on the non-drive side.	Section 5.2.2
	The air flow is blocked due to a polluted air filter.	Please check if the air filter located behind the endcap at the non-drive side is polluted. Clean it gently using a soft cloth or brush. For replacement, check the Technical OEM/Service Manual.	
	The air flowing in and out of the tire is blocked due to a kinked/obstructed hose.	Check if the hose, guided along a spoke between the hub and the rim, has been kinked. Try to remove the kink, e.g. by moving the hose a little up- or downwards along the spoke, or by slightly rotating the GRAVAA valve adapter. For replacement of the hose and/or GRAVAA valve adapter, check the Technical OEM/Service Manual.	
	The air flow is (partially) blocked inside the hub.	Please contact GRAVAA if none of the solutions	

	above helped to resolve the issue. Please try to avoid riding with the wheelset to limit wear.

6.2 Restart or reset the GRAVAA hub software

TOOLS

- GRAVAA USB-A charging cable
- USB-A charger (5V)
- Smartphone with GRAVAA app

6.2.1 Restarting the GRAVAA hub

In the rare case of a software malfunction (e.g., the software hangs and does not respond as expected), the first thing to check is to restart the GRAVAA wheels by turning them off and on again. This can be done in two ways:

1. If you have the option to use the GRAVAA app, stop riding and park the bike. Use the GRAVAA app and connect to your wheelset. Turn the wheelset off by:
    a. Clicking on *Power off your wheels* in the Wheels menu, clicking on the ⋮-icon, or
    b. Clicking on *Power off your wheels* in the Settings menu > Connections > Power off

    Hereafter, turn the wheels on again by spinning the wheels or using the charging cable.
2. If you don't have the option to use the GRAVAA app, stop riding and park the bike. After 15 minutes (default setting) of inactivity, i.e. no rotation of the wheels, the front wheel turns off. The rear wheel turns off directly after the front wheel has turned off. Turn the wheels on again by spinning the wheels or using the charging cable.

    Note that the sleep timer is settable in the GRAVAA app, under Settings. You may have changed this another duration.

If the problem persists after the device has restarted or in case the device does not restart at all, please continue to the next section.

6.2.2 Resetting the GRAVAA hub

In the rare case of a software malfunction and restarting the hub (section 6.2.1) did not work or did not solve your issue, there is a procedure to reset the software. Since there is no physical button on the GRAVAA hubs, the charging cable must be used. The user must follow these steps to restart the software:

1. Stop riding and park the bike.
2. Connect the charging cable to the device for at least 10 seconds.
3. Disconnect the cable between 4 and 10 seconds.
4. Reconnect the cable between 4 and 10 seconds.
5. Disconnect the cable between 4 and 10 seconds.
6. Finally, reconnect the cable. The hub firmware should now initiate a reset. A successful reset is indicated by the white LED turning on solid for approximately 30 seconds. Hereafter, you should be able to use the GRAVAA hub normally again. If not, please contact us directly or via one of our official retailers.

6.3 Troubleshooting GRAVAA sprint shifter

If you encounter issues with the GRAVAA sprint shifter, please refer to the table below.

Table 7: Troubleshooting – GRAVAA sprint shifter

Issue	Cause	Solution	Error code or reference
The LED on the GRAVAA sprint shifter does not blink after a shifting command.	The battery of the shifter is empty.	Check the battery status: See section 5.4.1. If necessary, replace the battery of the sprint shifter.	See section: 5.4.2
The LED on the GRAVAA sprint shifter blinks red after a shifting command.	The battery of the shifter is empty.	Replace the battery of the sprint shifter.	See section: 5.4.2
The LED on the GRAVAA sprint shifter only blinks when shifting up, but not when shifting down, or vice versa.	The connector of the shifter or the satellite buttons is installed incorrectly into the GRAVAA sprint shifter.	Remove the GRAVAA sprint shifter from the handlebar and make sure the connector is installed into the GRAVAA sprint shifter up to the stop.	

6.4 Troubleshooting GRAVAA ring shifter

If you encounter issues with the GRAVAA ring shifter, please refer to the table below.

Table 8: Troubleshooting – GRAVAA ring shifter

Issue	Cause	Solution	Error code or reference
The LED on the GRAVAA ring shifter does not blink after a shifting command.	The battery of the shifter is empty.	Check the battery status:	See section 5.5
The LED on the GRAVAA ring shifter blinks red after a shifting command.	The battery of the shifter is empty.	Recharge the battery of the GRAVAA ring shifter.	See section 5.5.2

6.5 Troubleshooting bike computer

If you encounter issues with connecting your bike computer, please refer to the table below.

Table 9: Troubleshooting – bike computer

Issue	Cause	Solution	Error code or reference
My bike computer does not find the ANT+ ID of the hub I'm trying to connect.	The bike computer is too far away from the hub.	Hold your bike computer (very) close to the hub. Some bike computers can only connect the first time to a new sensor when it's held very close to it.	See section 3.7

H7 / Compatibility

GRAVAA aims to offer a wide range of compatibility and connectivity to their products. However, not all operating systems, bike computers, and other bike equipment are compatible. In this chapter, compatible devices and systems are listed. The most recent version of this list can be found on our website www.gravaa.com.

7.1 Compatible group sets

GRAVAA rear hubs are equipped with standard DT Swiss ratchet system (freehub body), which means that basically all state-of-the art group sets can be fitted. The freehub bodies from DT Swiss that we support:

- Shimano Road HG (for Shimano road and gravel 11- and 12-speed cassettes)
- Shimano Microspline (for Shimano gravel and mountain bike 12-speed XTR, XT, SLX, and DEORE cassettes)
- SRAM XD (for SRAM XS/XG mountain bike cassettes)
- SRAM XDR (for SRAM XG road cassettes)
- Campagnolo Ekar (for Campagnolo Ekar 13 speed cassettes)

Please check the guidelines from your group set and cassette manufacturer to check which DT Swiss ratchet system (freehub body) suits.

7.2 Compatible tires and inner tubes

WARNING

- You must use inner tubes!
- The use of tubeless tire sealant or any other liquid substances inside the tire is strictly prohibited!

The GRAVAA wheelsets are available in multiple product versions (starting with a gravel and road version). Each hub can be equipped with a different rim (brand, type, etc.). The tires that can be fitted must comply to the tire size limits (i.e., minimum and maximum tire widths):

1. As set by GRAVAA for that product version, see Table 10 , *and*
2. As set by the rim supplier, as stated by the rim's manufacturer.

CAUTION

- Only use inner tubes with a removable Presta core!
- Do not use too long valve stems as this may cause the hose (connected to the GRAVAA valve adapter) to kink.

The inner tube must:

1. Match the tire size,
2. Have a removable Presta core,
3. The valve stem must have a correct length, which differs per rim. A guideline for choosing the correct valve height is given in Figure 20. E.g., for the GRAVAA Gravel x DT Swiss GRC500 wheelset, inner tubes with a valve stem of 60mm suit well.

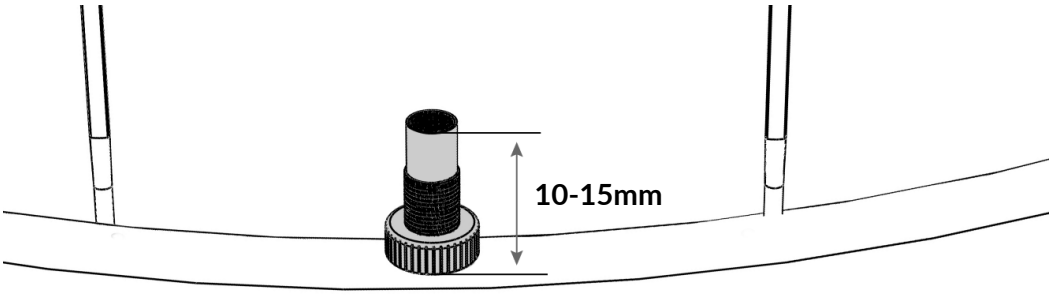


Figure 20: valve height guideline

7.3 Compatible disc brake rotors

GRAVAA hubs are only compatible with GRAVAA disc brake rotors. This results into an integral design of the rotor with the pressure management technology, which also results into a lightweight design. Standard 6-bolt rotors and centerlock rotors do not fit.

The GRAVAA disc brake rotors are mounted with 5 (custom) bolts and are one of the lightest on the market. The disc brake rotors are standard delivered as part of your wheelset. Instructions on how to replace the rotors can be found in the Technical OEM/Service Manual.

CAUTION

- GRAVAA hubs are only compatible with GRAVAA rotors.
- Only use the GRAVAA screws for rotor fixation (M5 x 14mm, Torx T15)

The rotors are made of specially hardened stainless steel and are available in three different sizes:

- 140 mm disc (95 grams)
- 160 mm disc (111 grams)
- 180 mm disc (129 grams)

NOTE

GRAVAA advises to use organic (resin) brake pads for an optimal braking behaviour.

7.4 Compatible smartphones

The GRAVAA app is available for the most popular operating systems, Android and iOS.

- Android 8.0 and higher
- iOS 16.0 and higher

The smartphone must support BLE 4.0 or higher.

You can find the instructions to download and install the app in section 3.6.1.

7.5 Compatible bike computers

It is possible to connect your GRAVAA wheelset with your bike computer. This will allow you to visualize the actual tire pressure of the front and rear wheel. More functionality and information, such as pressure setpoints, are included in the GRAVAA Connect IQ app for Garmin. For instructions to connect your bike computer, see section 3.7 of this manual.

Brand	App	Devices
Garmin	Garmin IQ	Garmin Edge 840/1040/1050
Wahoo	ELEMNT	Elemnt Roam V2, Elemnt Bolt V2

7.6 Compatible rims

GRAVAA hubs are compatible with 28” and 29” rims (622c) only. Do not use any other size rim such as 650B (584cc).

7.7 Compatible bikes

GRAVAA wheels can be installed easily in a bike, as explained in section 3.3.5. GRAVAA does not put a lot of restrictions on the type of bike, but the following requirements apply:

- Only N**on-BOOST** (100 mm front / 142 mm rear) hub spacing will work[5].
- **Disc brake only**: with rotor diameters from 140 mm, 160 mm, 180 mm*
- Thru axles with a diameter of 12 or 15 mm front, and 12 mm rear, and
- Groupsets, following section 7.1.

[5] In future GRAVAA will also launch BOOST version hubs.

H8 How it Works

GRAVAA wheelsets come in multiple versions depending on their usage, as explained in 1.1. Although they differ slightly to accommodate optimal and safe usage in their product category, the key working principles are the same across all versions. Both the front and the rear wheel are equipped with a tire pressure management system, called the GRAVAA system. This technology is enclosed inside each hub and enables you to inflate and deflate your tire while riding. Controlling and monitoring the system is done completely wireless, via Bluetooth Low Energy (BLE) and ANT+ communication protocols.

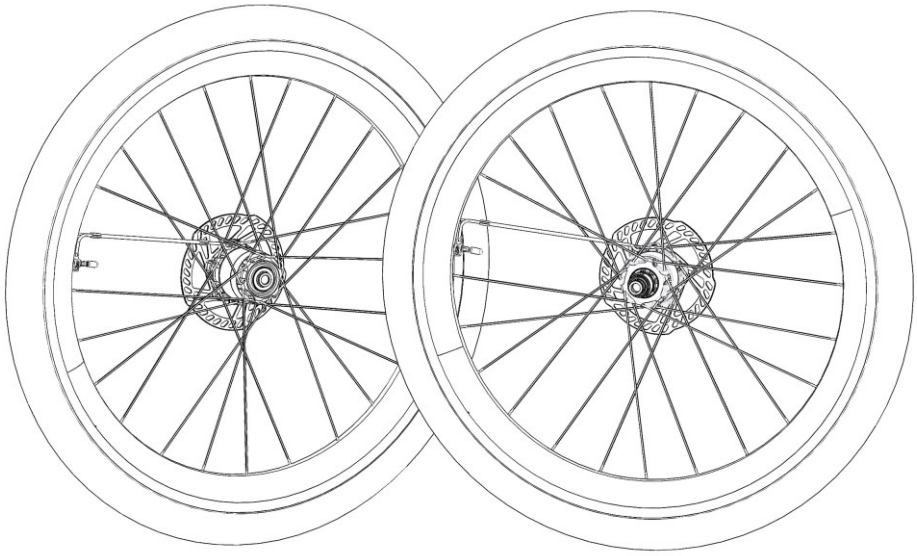


Figure 21: Illustration of a GRAVAA wheelset

You can control your tire pressure using one of our electronic GRAVAA shifters, mounted on the handlebars. Monitoring the actual tire pressures of both front and rear tire can be done on (compatible) bike computers or a smartphone (via the GRAVAA mobile App) using wireless protocols.

During inflation of your tire, air will flow from the miniature high-pressure pump inside your hub into your tire via a pneumatic hose guided along a spoke. The pneumatic hose is connected to a standard Presta valve stem (without Presta valve core) via the proprietary GRAVAA valve adapter. The pump is driven by the rotation of your wheel, which means it uses (little) human power only. By means of an integrated clutch, the pump can be activated for inflation and deactivated – which is done automatically for you by default. Hence, only when activated the pump consumes (minimal) human power. When the setpoint pressure is reached, the pump will automatically be deactivated and return to zero power consumption.

Operating the system is very intuitive: just press the buttons to inflate or deflate, using the GRAVAA shifter. Settings (e.g., personal preferences for pressure settings) can be done via the GRAVAA app. After first activation (by using the charger and App), the system will automatically wake up by rotating the wheels once or by connecting the charging cable.

As mentioned above, the GRAVAA system is completely wireless. All controls are powered by an integrated rechargeable battery, which can be recharged using GRAVAA's charging supplies.

The basic functions, like how to switch on/off the system, how to pair devices, how to control your tire pressure, and how charge your batteries, are all explained in this Manual and can be found on our website.

H9 Specifications

GRAVAA enables you to control your tire pressure: gain an advantage through more traction and benefit from less rolling resistance on different surfaces. Furthermore, improve your safety by keeping traction under all conditions and get more comfort.

WARNING

In all cases, the users shall, at all times, assume responsibility to ride with safe tire pressures. If in doubt, contact GRAVAA.

NOTE

- Each GRAVAA wheelset model is only suited for a range of tire widths. The user must use a tire from this selection.
- With the product, a mechanical pressure relief valve (PRV) is fitted, which is part of the GRAVAA valve adapter. This PRV allows for safe use of the system in the rare case of a malfunction.

9.1 GRAVAA product versions and tire limits

The GRAVAA product is available in multiple versions, with the following specifications:

Table 10: GRAVAA product versions/models with the minimal and maximum allowed tire size

Product	**Model type**	**Hub width**	**Tire width (min)**	**Tire width (max)**	**Pressure relief valve** (limit pressure)
GRAVEL (GR)	1	Non-BOOST	35mm 28 x 1,4” | 700 x 35C (35-622 ETRTO)	45mm 28 x 1,75” | 700 x 45C (45-622 ETRTO)	Orange (5.5 bar)
ROAD (RD)	2	Non-BOOST	25mm 28 x 1.0” | 700 x 25C (25-622 ETRTO)	34mm 28 x 1,35” | 700 x 34C (34-622 ETRTO)	Red (7.5 bar)

A user can use setpoints between the minimum and maximum allowed tire pressure. These minimum and maximum allowed values are calculated automatically by the GRAVAA app, depending on the product version, tire size and weight of the rider. The following tables provides example values for gravel and road tires, using a rider weight of 75 kg.

Table 11: Example of tire pressure limits for Road (using inner tube, rider 75kg)

Tire width [mm]	Tire size	Minimum tire pressure [bar]	Maximum tire pressure [bar]	Default safe pressure [bar]
25	28 x 1” | 700 x 25C (25-622 ETRTO)	3,0	7,0	5,0
26	28 x 1” | 700 x 26C (26-622 ETRTO)	2,9	7,0	5,0
27	28 x 1,05” | 700 x 27C (27-622 ETRTO)	2,8	7,0	4,9
28	28 x 1,1” | 700 x 28C (28-622 ETRTO)	2,7	6,8	4,8
29	28 x 1,15” | 700 x 29C (29-622 ETRTO)	2,6	6,6	4,6
30	28 x 1,2” | 700 x 30C (30-622 ETRTO)	2,5	6,4	4,5
31	28 x 1,2” | 700 x 31C (31-622 ETRTO)	2,4	6,2	4,3
32	28 x 1,25” | 700 x 32C (32-622 ETRTO)	2,3	6,0	4,2
33	28 x 1,3” | 700 x 33C (33-622 ETRTO)	2,2	5,8	4,0
34	28 x 1,35” | 700 x 34C (34-622 ETRTO)	2,1	5,6	3,8

Table 12: Example of tire pressure limits for Gravel (using inner tube, rider 75kg)

Tire width [mm]	Tire size	Minimum tire pressure [bar]	Maximum tire pressure [bar]	Default safe pressure [bar]
35	28 x 1,4” | 700 x 35C (35-622 ETRTO)	2,0	5,0	3,5
36	28 x 1,4” | 700 x 36C (36-622 ETRTO)	1,9	5,0	3,5
37	28 x 1,45” | 700 x 37C (37-622 ETRTO)	1,8	5,0	3,4
38	28 x 1,5” | 700 x 38C (38-622 ETRTO)	1,7	4,8	3,3
39	28 x 1,55” | 700 x 39C (39-622 ETRTO)	1,6	4,6	3,1
40	28 x 1,55” | 700 x 40C (40-622 ETRTO)	1,5	4,4	3,0
41	28 x 1,6” | 700 x 41C (41-622 ETRTO)	1,4	4,2	2,8
42	28 x 1,65” | 700 x 42C (42-622 ETRTO)	1,3	4,0	2,7
43	28 x 1,7” | 700 x 43C (43-622 ETRTO)	1,2	3,8	2,5
44	28 x 1,75” | 700 x 44C (44-622 ETRTO)	1,2	3,6	2,4
45	28 x 1,75” | 700 x 45C (45-622 ETRTO)	1,2	3,4	2,3

9.2 GRAVAA product specifications

The general GRAVAA product specifications and shifter specifications are listed in the next tables. Specifications are valid for all versions, unless stated otherwise.

Table 13: General product specifications

System	
Connectivity	Wireless, ANT+ & BLE
Drivetrain	Shimano HG and MicroSpline SRAM XD and XDR Campagnolo N3W
Max. system weight	110kg (rider+bike)
Tire pressure range[6]	Between 0.7 and 7 bar
Accuracy tire pressure control	+/-50 mbar
Inflation while riding?	Yes, between 10 and 60 km/h
Deflation while riding?	Yes, between 10 and 60 km/h
Avg. inflation rate of tire[7]	1.3 bar/km (for 700x30c tire, 30-622)
Avg. deflation rate of tire	>200 mbar/s
App	Android, iOS
Compliant devices/parts	See section 9 of this manual
Avg. power consumption[8]	2-4.5 W at 25km/h per wheel
System weight[9]	235 g
Operating temperature	-20°C to +45°C
Active control temperature	+2°C to +45°C
Storage temperature	+0°C to +45°C
Ingress protection class	IP55
Brake type	GRAVAA disc brake rotors only (5-bolt discs)
Hub (Boost)[10]	
Suitable for:	N/a
Axle system:	Front: 12 or 15mm and rear: 12mm thru axle.
Built-in dimension (boost)	Front: 110 mm, Rear: 148 mm
Freehub system	DT Swiss Ratchet System (36 teeth)
Disc brake interface	GRAVAA 5-bolt disc brake rotors
Spoke count	28
Hub (non-Boost)	
Suitable for:	Gravel (GR), Road (RD)
Front Axle system:	Front: 12mm and Rear: 12mm thru axle.
Built-in dimension	Front: 100 mm and Rear: 142 mm
Freehub system	DT Swiss Ratchet System (36 teeth)
Disc brake interface	GRAVAA 5-bolt disc brake rotors
Spoke count	24
Battery and charging supplies	
Battery life	Up to 40h during usage
Battery	Integrated, USB-A rechargeable
Charging cable length	Standard 3.5m
Charging interface on hubs	Magnetic pogo pin contact

6 Limited by the version/application, tire type and size, and rim type
7 Depending on the tire size (volume)
8 When pump is active only. Power consumption depends on actual pressure and riding speed
9 Additional weight by system parts inside the GRAVAA hubs only.
10 The boost version hubs will be available for sale later.

Table 14: GRAVAA sprint shifter specifications

GRAVAA sprint shifter	
Suited for	Drop bar handlebars
Type	1 head unit with 2 wired/cabled shifter buttons
Battery	Replaceable, CR1632 coin cell battery
Connectivity to GRAVAA hubs	Wireless, BLE

Table 15: GRAVAA ring shifter specifications

GRAVAA ring shifter	
Suited for	Flat bar handlebars
Inner diameter shifter	22 mm
Width	14 mm
Type	1 unit with integrated shifter (rotates up/down)
Battery	Integrated, USB-A rechargeable
Charging interface on shifter	Magnetic pogo pin contact
Connectivity to GRAVAA hubs	Wireless, BLE

9.3 LED colour indications

9.3.1 GRAVAA hub LED colour indications

The LED on the non-drive side of each hub (located next to the charging point) gives visual feedback to the user. This LED is best visible when standing still. While riding (above 10 km/h) the LED will turn off, except when there is a critical error.

CAUTION

In case of a critical error, the hub will show extremely fast blinking red lights. In such a case, the user shall stop riding and inspect the root cause. Use the Troubleshooting and/or the GRAVAA app to solve the issue. In case of doubt, contact us or your local retailer.

Table 16: LED colour indications (visible on non-drive side of hub)

Led colour	Style	Activity
Off		No activity. Connect charger to activate.
Blue	Medium	Hub running and searching for (paired) connections (after startup)
Green	Fast	Charging, battery not full
Green	Solid	Battery fully charged.
Green	Slow	System ready to go.
Orange	Extreme	Non-critical system error. Riding is permitted but highly advised to resolve the error as soon as possible.
Red	Solid	Hubs are going to sleep mode (e.g., when battery is critical, a timeout occurs, or if the hubs are turned off by the user via the App)
Red	Extreme	Critical system error. Your hubs will go to safe mode. Stop riding.
Red	Slow	Battery low. Charge battery.
White	Medium	Firmware update running.
White	Solid	Device reset successful (after 30 seconds, the LED will turn off)
Yellow	Medium	Your GRAVAA wheel has entered a default safe pressure state. This happens for example in case the pressure cannot be adjusted anymore (e.g., either the front wheel or the shifter is not active anymore, for example when the battery of one of these devices has become too low).

9.3.2 GRAVAA sprint shifter LED colour indications

For more details on the LED colours, see section 5.4.1

9.3.3 GRAVAA ring shifter LED colour indications

For more details on the LED colours, see section 5.5.1

H10 / Warranty

GRAVAA warrants the quality of all rims, hubs and components purchased from GRAVAA or a GRAVAA-authorized distributor for a period of two (2) years from the date of delivery thereof to you. At delivery of the ordered products you will receive a certificate of warranty, also containing the conditions of warranty, according to the model which can be viewed at https://gravaa.com/warranty.
The carbon rims that are used for our GRAVAA wheels are engineered for performance and designed to lead the market in strength, durability and riding quality. However, we do not design products to be indestructible. If you exceed the limits of your product while riding or crashing even our wheels and/or product may fail or become defective.

GRAVAA cares about their products and customers. We develop and produce all our products according to the highest quality standards. However, like all products, GRAVAA products are not indestructible. Since we care about the quality of our products and we want to keep you riding, we grant you this warranty.

10.1 Contents warranty

GRAVAA warrants the quality of products sold to the Customer. This warranty however is limited to the products sold and delivered to the Customer on the basis of order with the confirmation number as mentioned on the front page of this warranty certificate.

In case of defects to GRAVAA's products which have been caused by material or manufacturing faults occurring and claimed within the warranty period GRAVAA will repair these defects free of charge. In case of repair GRAVAA will when necessary replace defect parts of the product delivered. GRAVAA may, at its sole discretion, also decide not to repair the defects, but to re-deliver the relevant product.

The warranty as mentioned herein only exists if and when the claim of the customer is issued in writing in time, which means that this claim needs to be received by GRAVAA ultimately on the last day of the warranty period. After expiry of the warranty period the customer cannot claim on GRAVAA for or in relation to any defects to GRAVAA's products.

GRAVAA is not liable for any (other or further) damage, in particular but not limited to indirect damage, consequential damage and subsequent damage, caused by or being a consequence of any defect and/or non conformity of GRAVAA's products.

10.2 Exclusions warranty

- The customer is not able to claim on the basis of this warranty if and when GRAVAA's product has not been used properly and/or the maximum system weight has been exceeded.
- Normal wear and tear, the wearing out of components as well as visual faults are excluded from this warranty.
- The serial number of GRAVAA's product must at all times be and remain identifiable. If this is not the case the customer cannot appeal on this warranty.

- To be able to make a claim on the basis of this warranty all instructions with regard to the assembly, use and maintenance of GRAVAA's product must have been complied with. Amongst others, this includes that:
    - The Customer is not allowed to open the GRAVAA hubs. Only GRAVAA service centers are allowed to do so. In case hubs are opened by the customer this warranty will become void. Maintenance to the hub inner parts is to be done by GRAVAA's appointed service centers only.
    - Users are allowed to execute the installation and maintenance instructions as described in the User manual, unless explicitly stated that a certain task or action must be performed by GRAVAA. A user must follow the instructions, as mentioned in the User Manual.
    - Service and maintenance actions which are not stated in the User manual (such as exchanging hub bearings) must be performed by GRAVAA's appointed official service centers, unless explicitly stated otherwise.
- To be able to claim on the basis of this warranty GRAVAA's product may not have been modified or used in combination with incompatible parts. Amongst others, this includes that only GRAVAA spare parts shall be used for:
    - GRAVAA disc brake rotors (including fixation bolts)
    - GRAVAA shifters
    - DT Swiss ratchet freehub bodies
    - GRAVAA air filters
    - GRAVAA valve adapters (including PRV)
    - GRAVAA bearings (including the right sealings)

10.3 Further conditions warranty

GRAVAA requires a product registration in advance via the https://gravaa.com/ website. The customer will need to register its GRAVAA product and apply for a user account before the first use of the GRAVAA products. Only doing this, the GRAVAA product bought by the customer will automatically be registered for warranty. Without this registration this warranty will not be effective.

The place of performance and jurisdiction shall be The Netherlands. Dutch law shall therefore apply to this warranty. Any disputes arising from or related to this warranty will be settled exclusively by the Dutch court seated in Den Bosch, the Netherlands.

10.4 Raise a claim

How to proceed if your product is damaged? Please follow these instructions:

1. Please contact us via https://gravaa.com/contact or via an official GRAVAA service center.
2. You will receive a reply from GRAVAA within 2 working days with instructions.
3. The product must be sent to a GRAVAA service center to be checked.
4. For wheels: tires and cassettes must be removed before shipping the wheels.
5. GRAVAA shall assume the shipping cost to the customer. The customer shall bear the shipping costs to GRAVAA as well as any customs fees, when applicable.
6. GRAVAA will repair the defects (or replace or re-deliver, as the case may be) as soon as possible; however, no repair period can be guaranteed.

H11 Recycling (end-of-life)

Remove the shifter from the handlebar and disassemble the following components from your GRAVAA wheels such that you have only the GRAVAA hubs left:

- tires and inner tubes,
- rim tape,
- GRAVAA disc brake rotors,
- cassette (rear wheel only), and
- disassemble or cut the spokes and hose with GRAVAA valve adapter, to separate the hubs from the carbon rims.

Do NOT dispose of the products in your general household waste! Comply with the current local legal requirements and contact your local authorities in case of any doubt.

Each GRAVAA hub contains a non-replaceable rechargeable battery. These batteries may only be removed by a qualified professional. Also each GRAVAA ring shifter contains a non-replaceable rechargeable battery. These batteries may only be removed by a qualified professional.

The GRAVAA sprint shifter contains a replaceable battery. Remove this battery and only submit the discharged battery to an authorized collection point.

H12 Declarations of conformity

WARNING

- Changes or modifications not expressly approved by the party responsible for compliance with the rules and standards could void the user's authority to operate the device. This applies in particular to the antenna supplied with the device.

NOTE

- A signed copy of the original Declarations of Conformity (English) can also be downloaded from our website.
- The GRAVAA product has the following radios inside: ANT+ and BLE. Note that the product operates in a frequency range between 2400-2483.5 MHz (BLE and ANT+).

12.1 EC declaration

GRAVAA hereby declares that the radio equipment of the GRAVAA hubs and the GRAVAA shifters (certified by Classified Cycling) are in conformity with Directive 2014/53/EU. With respect to GRAVAA hubs, GRAVAA complies next to RED (2014/53/EU) also to:

- Health and safety (2014/35/EU), and
- EMC Directive (2014/30/EU).

The full text of the EU declaration of conformity can be found online via www.gravaa.com.

12.2 UKCA declaration

Following the UKCA certification, the product complies with the essential requirements of Radio Equipment Regulation 2017, for the below mentioned articles:

- Health and safety (requirements according to directive 2014/35/EU),
- EMC (requirements according to directive 2014/30/EU), and
- Effective and efficient use of the radio spectrum to avoid harmful interference.

12.3 FCC (USA) and ISED (Canada) declarations

The portable transmitter in the GRAVAA product and its antenna comply with FCC and ISED limits for RF exposure of the general population /uncontrolled exposure.

12.3.1 FCC declaration of conformity

This device complies with the essential requirements for EMC and RF/Radio, following part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause any harmful interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

12.3.2 ISED declaration of conformity

This equipment contains one or more transmitters and/or receivers for which no permit is needed, and which comply with the applicable RSS(s) for which no permit is needed in Canada. Operation is subject to the following two conditions:

1. This device may not cause any harmful interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

12.3.3 Overview of certificate numbers

The respective numbers can be found in the table below.

Table 17: FCC and IC/ISED certificate numbers of GRAVAA

Product	Certificate numbers
GRAVAA KAPS hub/wheelset	FCC ID: 2BNX6-GRAVAA0001 IC: 33677-GRAVAA0001
GRAVAA sprint shifter *Supplied and certified by Classified Cycling*	FCC ID: 2AZ7A-CLASSIAV1 IC: 27531-CLASSIAV1 M/N: 029_003_01
GRAVAA ring shifter *Supplied and certified by Classified Cycling*	FCC ID: 2AZ7A-SU210 IC: 27531-SU210 M/N: SU210

12.4 Other labels

The product fulfils the requirements of IEC 60529:1989 + A1:1999 + A2:2013 for IP55.

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