BrainRobotics

Kneuro BR4B/BR4C

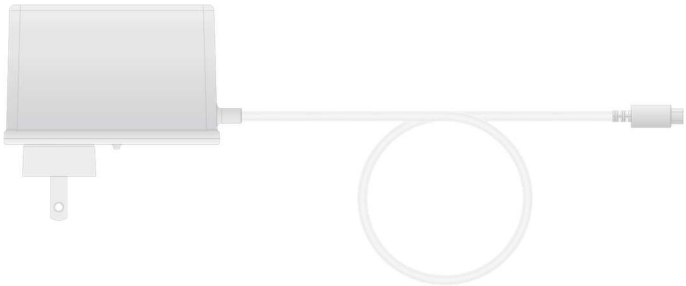
User Manual

Quick Start Guide

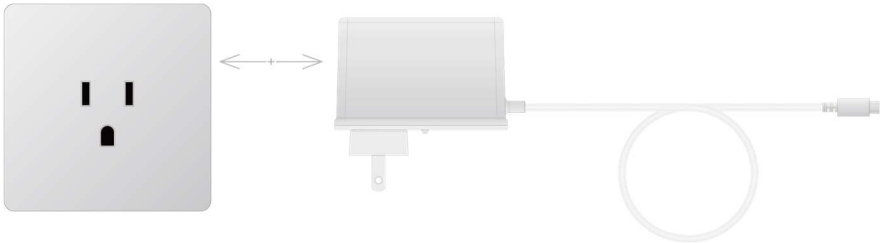
1. Item List

2. Charging

2.1. Charging Cable and Adapter



2.2. Connect to Power Supply



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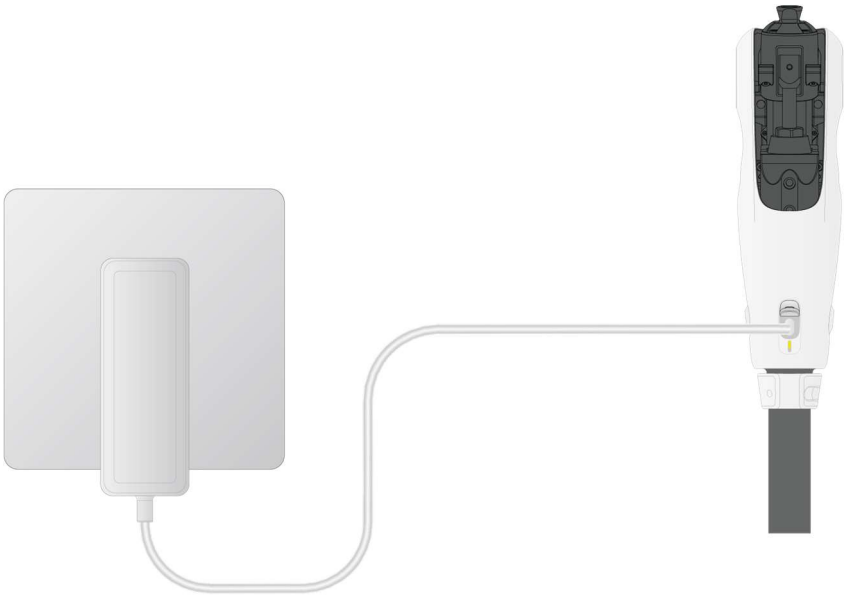
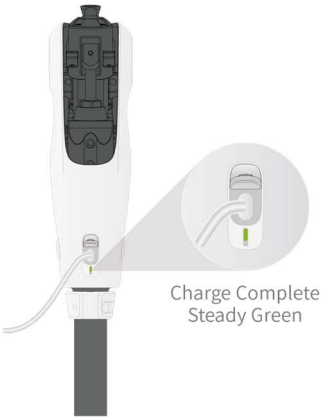
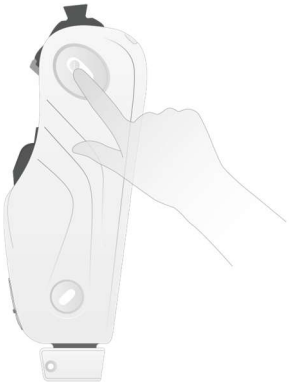
2.4. Charging the Battery



3. Charging Status Indicator



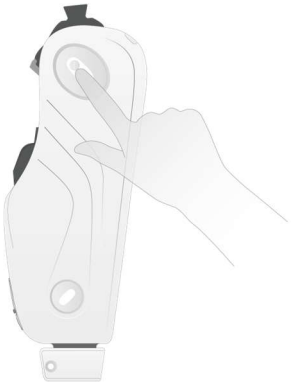
4. Power On/Off



Power On

Press and hold the power button until the long beep and vibration.

LED turns steady green.



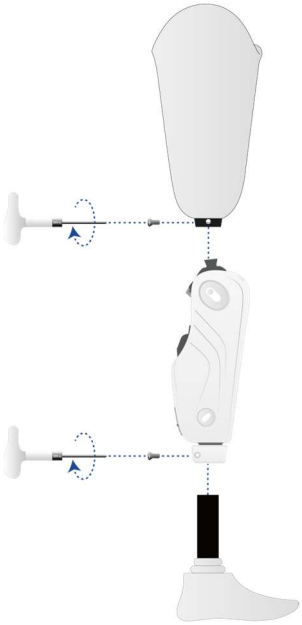
Power Off

Press and hold the power button for 5s until LED turns off.

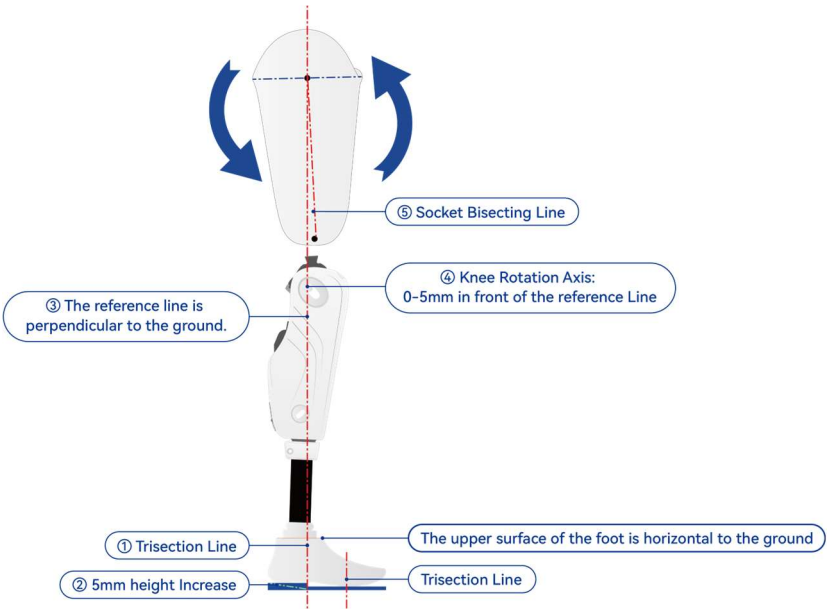
*Please remove prosthesis to observe the LED indicator.

5. Installation

5.1. Prosthetic Knee Installation



5.2. Alignment



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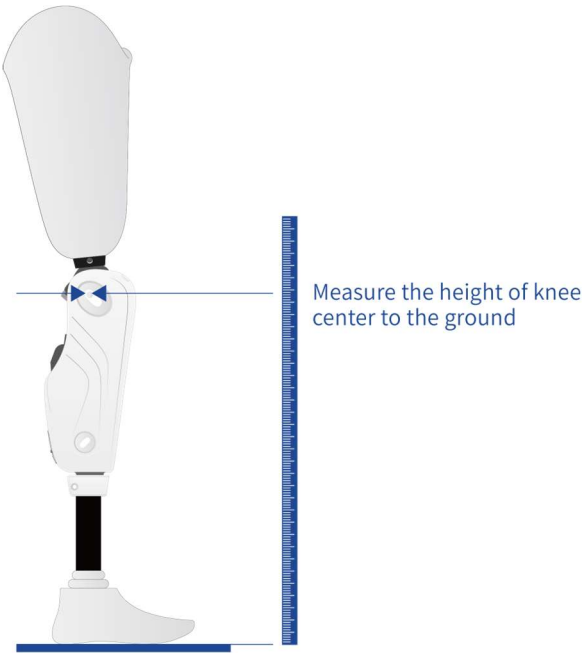

7. Movement Range Check

Kneuro

User Manual

BrainRobotics

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1. Forewords

1.1. Basic Information

▸To ensure the safe and efficient use of this product and to avoid potential injuries, please read the safety instructions and user guide carefully before operation.
▸Use this product strictly in accordance with the information included in the accompanied manual, and under the guidance of a certified prosthetist.
▸If you need help with product setup, use or maintenance, please contact the responsible prosthetist or our customer service.
▸The pictures in this manual are for reference only.
▸This product can only be installed by an authorized clinics' prosthetist who has completed training and is certified by BrainRobotics.
▸According to BrainRobotics, the user is the product operator as defined in IEC 60601-1 standard.

2. Safety Instructions

Before using this product, please carefully read and follow the safety instructions in this manual. Failure to comply may result in sub-optimal system performance or damage to the product from incorrect operation. If you're uncertain whether this product is suitable for you due to physical reasons, consult a certified prosthetist promptly.

2.1. Product Warnings

Warning Possible risks of severe product damage or serious personnel injury.

Caution Possible risks of components damage or personnel injury.

Notice Possible risks of product malfunction, technical damage or function failure.

2.2. General Safety Warnings

Warning
Please do not ignore the safety instructions in the user manual. Using this product beyond its designated scope may cause damage to the product or severe injury.

Warning
Please do not ignore the malfunction signals from the product. Using this product in a malfunctioning state may cause damage to the product or severe personal injury.

Warning

Do not use the prosthetic leg to drive a vehicle or operate its attachments (for example, clutch pedal, brake pedal, and accelerator pedal, etc.). Due to the change in resistance characteristics, unexpected movements of the prosthetics may cause accidents, leading to personal injury and property damage. For safety reasons, please adhere to the regulations in your country regarding driving with prostheses. According to the laws for vehicle modification based on prostheses configuration in your country, please proactively seek qualified departments to assess your driving capability.

Caution

Please check the condition of the product before each use. Using this product with visible damage may lead to injury or falls.

Caution

Please report any product abnormalities promptly to your clinic or call BrainRobotics customer service.

Caution

Do not modify, repair, or replace the product on your own. Breaching safety regulations may lead to product damage or falls.

Caution

This product is intended solely for the use of the purchaser. Refrain from lending it to others, as doing so could pose risks to you or them.

Caution

Do not exceed the product's specified maximum load, as this could lead to structural damage, functional failure, product malfunctions, or falls.

Caution

Keep the product out of the reach of children and pets to avoid interaction that could lead to injury or damage to the product.

Caution

If you experience adverse reactions, such as skin allergies, while using the product, discontinue its use immediately and consult a medical professional.

Notice

When transporting the product over long distances, please place it in the original packaging box to prevent product malfunction or damage.

Notice

This product should only be cleaned with a damp (freshwater) cloth. Using the wrong cleanser may cause damage to the product.

Special Notice: Possible Noise During Movement

When using a prosthetic knee, noise may arise from the control functions of servo motors, hydraulic and pneumatic systems, or extension/flexion stops. This noise is a normal occurrence and is unavoidable. Under regular conditions, it poses no concerns. However, if the noise noticeably increases over the lifespan of the knee, immediately consult your prosthetist or our customer service for an inspection or contact BrainRobotics customer service team for troubleshooting.

2.3. Installation and Alignment Safety Instructions

⚠ Caution

Improper installation and alignment can lead to product malfunction or falls. Ensure the product is installed and aligned by a certified prosthetist.

⚠ Caution

Please use only BrainRobotics authorized prosthetic accessories. Utilizing unauthorized accessories can lead to product malfunction or falls.

⚠ Caution

Please tighten the socket fixing bolts to the specified torque. Incorrect torque may cause the socket to loosen or damage, leading to falls.

⚠ Caution

Please insert the pylon to the specified depth. Incorrect insertion depth can result in instability or loosening of the pylon, which may cause falls.

⚠ Caution

Ensure the pylon clamp is securely fastened. If not, it might cause the pylon to become unstable or rotate, leading to falls.

⚠ Caution

During installation, please verify the range of motion of the prosthetic knee. If necessary, install a flexion stop. Ensure there is a safe distance between the socket and the shell; otherwise it could result in product damage.

2.4. Environment Safety Instructions

⚠ Warning

Please do not use this product near gas stations (service stations), flammable materials, chemicals, and other explosive-prone areas. Also, do not store or transport the product and its accessories with flammable liquids, gases, or explosive substances in the same box. Improper storage or transportation could cause explosions or fires, posing significant risks to both property and lives.

⚠ Caution

Please avoid exposing the product to seawater, chlorinated water, or other corrosive liquids, including soap, bath gel, body fluids, and wound fluids. Such exposure may lead to corrosive damage to the product.

⚠ Caution

Avoid immersing the device in water or using it submerged for extended periods. If the device becomes wet, use a lint-free cloth to dry the joints and components, then allow the components to air dry.

Caution

Please avoid staying in areas with strong magnetic fields or strong electrical interference (such as theft-prevention security systems, metal detectors, etc.), or rooms with strong magnetic fields (such as MRI, MRT equipment, etc.), as this may cause damage to the product and cause falls. If it is unavoidable to stay in such environments, please provide protection for walking or standing (for example, with the assistance of others or through railing handrails).

Caution

Do not place the device directly over an open flame. Incorrect operation can cause the device to surpass the safe temperature limit, resulting in malfunction.

2.5. Battery and Charging Instructions

Warning

Do not use damaged power plugs, adapters, and charging cables, exposed electrified components may cause electric shocks, damaged electrical equipment may cause fires.

Warning

Avoid disassembling the battery box, adapters, and charging cables, or subjecting them to extreme loads. Doing so might damage the product and pose risks of electric shocks or fires.

Caution

Avoid using non-standard adapters or charging cables. Inappropriate charging voltage and current can damage the product.

Caution

Do not use the prosthesis while it's charging, as this can lead to product damage or personal injury. Ensure the prosthesis is detached before charging and disconnect the charging cable once charging is complete.

Caution

Avoid using the prosthesis for extended periods when the battery is low. When the battery level drops significantly, the product will enter safety mode. In this state, the product can only support the user for a short duration. Please charge the prosthesis promptly.

2.6. Sport and Activity Instructions

Warning

Do not use the prosthetic for sports without appropriate training, as it may lead to personal injury.

Caution

Do not insert limbs into the gaps of moving parts , as this could lead to injures.

Caution

Ensure you remain stationary and rely on your healthy leg for support when switching modes to prevent falls caused by resistance changes during the mode switch.

⚠ **Caution**

The hydraulic components of the product will generate high temperature after a long period of activity. Lower the level of activity when a overheat warning is triggered, and allow the hydraulic components to cool naturally.

⚠ **Caution**

Do not touch overheated hydraulic components with exposed skin when a high temperature warning is triggered, as it may cause injuries.

⚠ **Caution**

Do not walk on excessively steep slopes, as this can cause unexpected resistance changes and lead to falls.

2.7. Software Usage Instructions

⚠ **Notice**

Please complete the software setup under the guidance of a certified prosthetist. Do not use the product until setup is complete.

⚠ **Notice**

Please set parameters in a BrainRobotics authorized clinic. Do not walk unprotected before the adjustments are completed.

Special Notice: All pictures, screenshots and figures in this manual are for reference only and may vary slightly depending on the mobile device and version used.

2.8. Conditions of Use

▸The product can only be used as an external prosthetic for lower limb.

▸This product can NOT be used with Osseointegrated Implant Systems.

▸The product is designed for everyday use and must NOT be used for extreme activities (e.g., free climbing, parachuting, paragliding, etc.).

▸The product is intended solely for the user's personal use.

▸The product can only be used optimally with appropriate components, and the selection of appropriate components must be evaluated by an authorized clinic based on body weight and muscle condition of the residual limb.

2.9. Indications of Use

▸The product is for patients aged 16 and older.

▸It is required that the patients weight under 330 lbs (150 kg), the foot length should range between 21 cm and 30 cm.

▸The product is designed for users with knee disarticulation, transfemoral amputation or hip disarticulation. Special accessories are required for hip or knee disarticulation, in which case the authorized clinic must be consulted before fitting and installing.

▸The product is for users with unilateral amputation. In the future, the product may be equipped with bilateral amputation through software upgrades.

▸Patients with limb deformities must consult the clinic before fitting.

▸Patients must be able to sense light signal, audio signal and mechanical vibration, patients should consult the clinic before fitting.

2.10. Contraindications

▸Contraindication: Body weight over 330 lbs (150 kg).

2.11. Qualification

▸The installation and fitting may only be done by an authorized clinics' prosthetist who has completed training and is certified by BrainRobotics.

3. Product Description

3.1. Basic Information

▸Kneuro features a built-in sensor system; the algorithm can control the hydraulic system in real-time, offering suitable resistance for everyday use.

▸Kneuro can be adjusted according to the user's needs using the software for individual parameters. (See 5.3.4. Parameter Configuration and Default Mode Settings)

▸Kneuro has custom modes for special activities. (e.g. cycling, golfing, etc.).

▸Kneuro has the capability to automatically adjust its product performance to accommodate various conditions, including different road surfaces, inclines and declines, staircases, and different walking speeds. This feature allows for a smoother and more adaptable user experience. .

▸The waterproof level of Kneuro is IP67.

▸The waterproof level of power adapter is IP22.

▸The battery life during normal use is up to 5 days.*

*Note: Battery life is based on 5,000 steps daily at room temperature, with rest time being in idle

3.2. Product Image

3.3. Product Functions

▸This product features adaptive control for both standing and swing phase, which enables adaptive gait adjustment according to the user's intention in everyday scenarios (e.g., fast and slow walking, walking up and down ramps, walking up and down stair, and crossing obstacles, etc.).

▸The product controls the hydraulic system based on the measured values from the sensor system, and the product characteristics are thus dynamically adapted in real time to the current movement condition (walking period).

▸The control parameters can be adjusted according to the user's needs through the Kneuro App.

▸The product is equipped with custom modes for special types of activities (Cycling, elliptical training, ping-pong, golf and yoga). The customized modes are preset by an authorized fitting technician through the Kneuro App and can be activated by the user.

▸Safe Mode allows the product to assist the user to walk short distances when the battery is depleted; however, the system's adaptive control is disabled. Please recharge the product promptly.

3.4. Product Packing List

Item	Qty
Kneuro Prosthetic Knee	1
Charging Adapter	1
USB-C Charging Cable	1
Flexion Stop B	2
Flexion Stop C	2
Flexion Stop Screw	4
User Manual	1
Warranty Card	1
Product Certificate of Quality	1

▸For first time users, please make sure that the items in the above list are intact before installing and using the product.

▸Prosthetic feet and corresponding accessories are not included and can be ordered separately from authorized clinics.

4. Prosthetic Installation Instructions

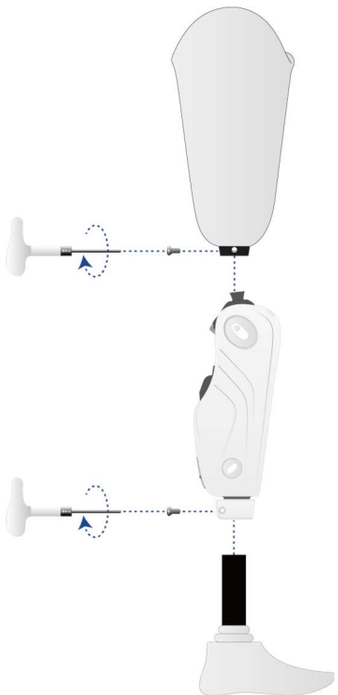
4.1. Pylon Installation

1) Measure and determine the desired pylon length.
2) Cut and shorten the pylon to the desired length with a pipe cutter.
3) Smooth the cut edges with files.

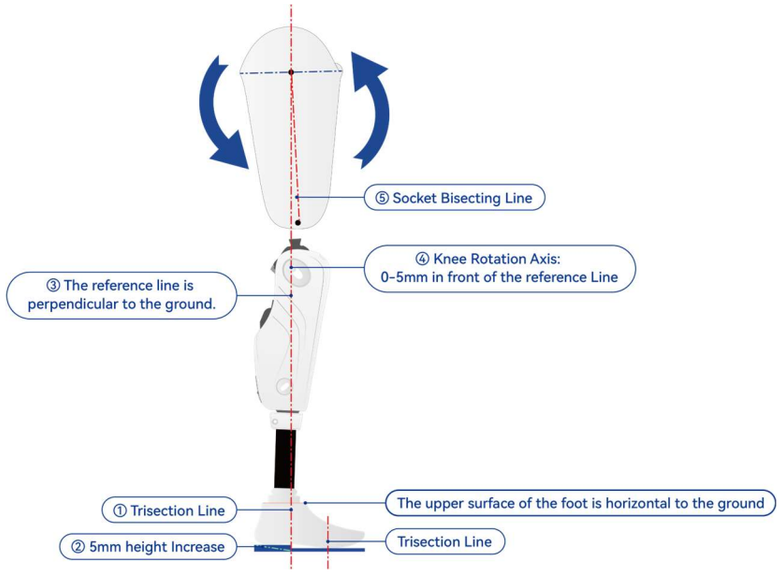
   ⚠ Notice **Metal shavings should not fall into the pylon.**

4) Chamfer the outer side with a file.
5) Flatten the inside and outside of the cut edges with sandpaper.
6) Attach the prosthetic foot to the pylon and tighten the screws with a torque of 5Nm-7Nm.
7) Insert the pylon into the knee joint to a depth of approximately 40mm.
8) Gently rotate the prosthetic foot outward and lightly tighten the pipe clamp bolts (~10Nm).

   ⚠ Notice **After fitting, it is necessary to lock all bolts alternately in multiple steps.**



4.2. Alignment



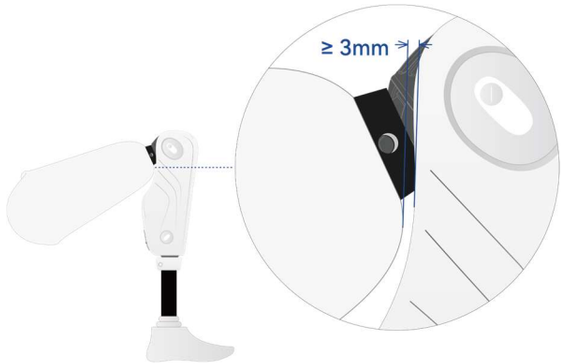
Establish an alignment reference line perpendicular to the ground:

① Place the rear third of the foot on this line (refer to the prosthetic foot user manual);
② Increase the effective heel height by 5mm and rotate the foot outward (Effective heel height = Heel height — Thickness of the forefoot area) ;
③ Place the knee rotation axis at approximately 0mm-5mm in front of the reference line (according to the user's need). The knee joint axis should be level with the rotation axis of the healthy side, and with a yaw angle of 5° (this angle can be adjusted according to the user's situation);
④Connect the prosthetic foot and the knee with the pylon connector and the pylon, tilt the connector to the correct position and set the required pylon length;
⑤ Create a bisecting line of the socket, linking the upper and lower center point;
⑥ Position the socket so that the reference line passes through the upper center point. Adjust the socket in flexion by 3°- 5°, but take into account individual circumstances (e.g. hip flexion contracture), and the height of the sciatica;

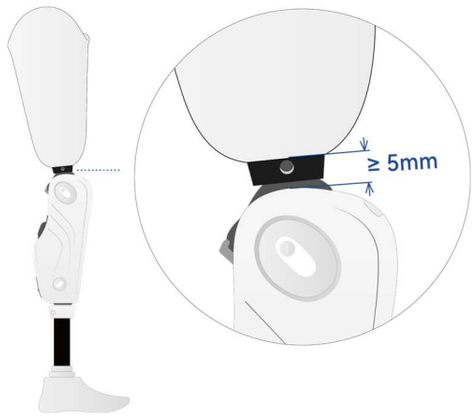
*NOTE: Use the appropriate connectors to attach the socket and articular prosthetic foot.

4.2.1. Socket Check After Alignment

Maximum Flexion Check: The frame may be damaged if the distance between the socket and the cover at maximum flexion is too close. Please check the distance as follows::
1) Place the knee with the socket at the maximum extension position.
2) Check the available distance between the upper edge of the knee and the socket. There should be a minimum clearance of 3mm. If the distance is less than 3mm, installation of flexion stop is required.



Maximum Extension Check: The frame might be damaged if the distance between the socket and the cover at maximum extension is too close. Please check the distance as follows:
1)Place the knee with the socket in the maximum extension position.
2)Check the available distance between the upper edge of the knee and the socket. There should be a minimum clearance of 5mm.



4.2.2. Flexion Stop

▸The product comes factory-equipped with a Flexion Stop. This stop limits the maximum flexion angle to 120°, preventing possible collisions between the socket and the hydraulic components.

To limit the deflection angle, the following flexion stops can be installed:

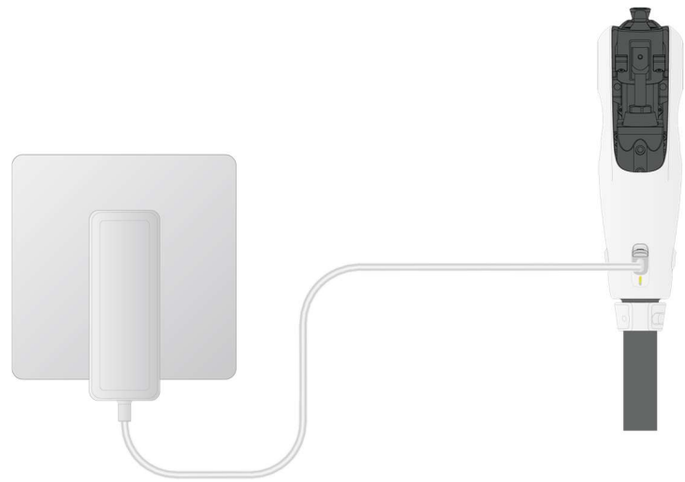
- Flexion Stop B (included in the package): reduce the maximum flexion angle by 5°.
- Flexion Stop C (included in the package): reduce the maximum flexion angle by 10°.

4.3. Battery

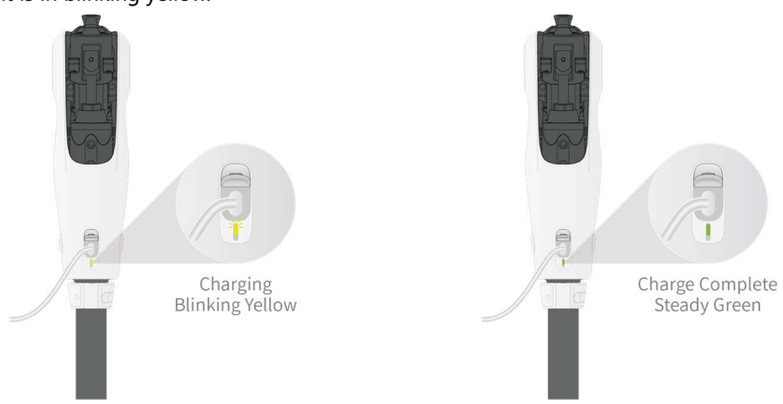
▸The built-in battery is a rechargeable lithium battery with a capacity of 3000mAh and a rated voltage of 3.7V. For other specific parameters, please refer to ***14. Technical Specifications***.

4.3.1. Charging the Battery

- Plug the USB-C charging cable into the charging port of the prosthetic knee and connect to the power supply.



- The charging process begins. The LED indicator light is in blinking yellow.



- When charging is complete, the LED indicator light is steady green. You can then remove the USB-C charging cable from the charging port.

Warning

It is strictly prohibited to use the prosthesis while charging:

- There is a risk of electrocution and possible secondary injury to the stump.
- For the safety of the user, remove the prosthesis from the body before charging.
- When charging is complete, disconnect the power adapter from the prosthesis.

4.4. Audio, Vibration and LED Feedback Signals

Type	Function	Audio	Vibration	LED
Normal Use	Power On	Long Signal ×1	Long Signal ×1	Steady Green 50% brightness after 30s
	Switch to Default Mode	Medium Signal ×3 (3s Countdown) Long Signal ×1 (After successful switch)	Medium Signal ×3 (3s Countdown) Long Signal ×1 (After successful switch)	Steady Green
	Switch to Custom Mode	Medium Signal ×3 (3s Countdown) Short Signal ×2 (After successful switch)	Medium Signal ×3 (3s Countdown) Short Signal ×2 (After successful switch)	Steady Green
	Auto Lock	-	-	Steady Green
	Manual Lock/Unlock	Short Signal ×1	-	Steady Green
	Power Off	Long Signal ×1	-	LED Off

Type	Function	Audio	Vibration	LED
Recharging and Maintenance	Recharging	-	-	Blinking Yellow (Charging) Steady Green (Complete)
	Problem Report	Short Signal ×2 (Start) Short Signal ×2 (Stop)	-	Steady White
	Firmware Update			Blinking White
Sleep Mode	Sleeping	-	-	Breathing Blue 50% Brightness
	Awake	-	Long Signal ×1	Steady Green 50% brightness after 30s
Device Connection	Connected	-	-	Steady Green
	Disconnected	-	-	Blinking Green
Parameter Setting	Setting Updated	Medium Signal ×1	Medium Signal ×1	Steady Green

*For warning signals, please check ***7. Warning Signal*** of this user manual.

*If you see anything abnormal with the LED light indicator, please contact BrainRobotics Customer Service.

4.5. Low Battery

Battery Level	LED Signal	Vibration Signal	Audio Signal
Battery Level < 20%	Steady Yellow	5x 0.5 seconds vibration	5x 0.5 seconds beep
Battery Level < 5%	Blinking Yellow	5x 0.3 seconds vibration	5x 0.3 seconds beep
Battery Level 0%	None	None	None

The following points must be noted when charging the battery:

- The battery will last approximately 4-5 days when fully charged, depending on usage;
- Charge the battery for at least 3 hours before the first use;
- For normal use of the prosthesis, daily charging is recommended;
- If the product shuts off due to low battery, it cannot be manually powered on again; the prosthetic knee must be recharged.
- Check the ambient temperature and make sure that it is within the permissible range of this product (see ***14. Technical Specifications***).

5. Kneuro App

5.1. Download Kneuro App

▸The Kneuro App controls the prosthetic knee, which can be downloaded free of charge from the corresponding app store. To download the Kneuro App, you can scan the QR code below (iOS/Android).

Software Name: Kneuro

System Requirement: iOS 12 or above / Android 5.0 or above

5.2. Account Registration and Login

▸You can login with your phone number or username to use Kneuro App.

▸Only Prosthetists can register a new account for patients. If you see "Your account is not activated for Kneuro service" when logging in, please contact your Prosthetist.

▸Please read and agree to the ***Privacy Policy*** and ***User Agreement*** before logging in.

5.3. Using Kneuro App as a Prosthetist

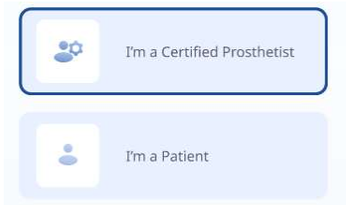
5.3.1. Login as Prosthetist

▸To be certified as a prosthetist, contact BrainRobotics and provide your personal information, along with contact information such as name, email and phone number.

▸All personal data will be stored in BrainRobotics back end server and will be erased when the service of Kneuro is terminated.

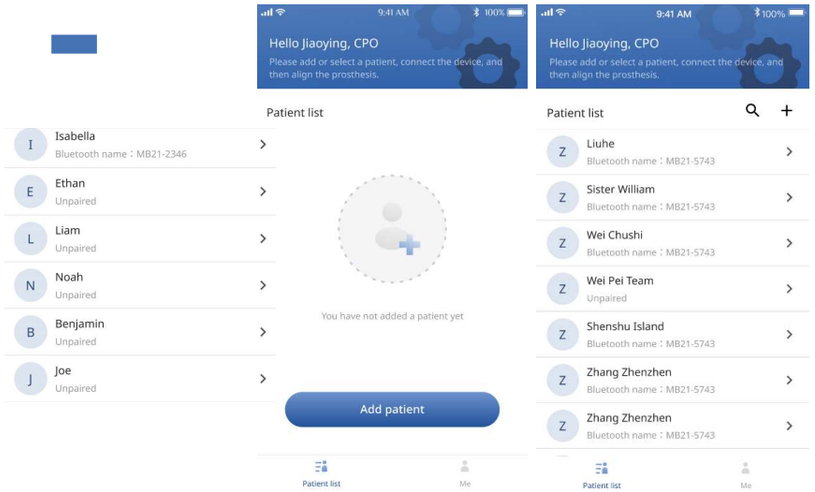
▸The Prosthetist can use the Kneuro App for user management, parameter adjustment, remote management, and custom mode management.

▸Select "Certified Prosthetist" on the welcome screen to enter Prosthetist mode. This mode is only available to a certified prosthetist.



5.3.2. User Management and Device Pairing

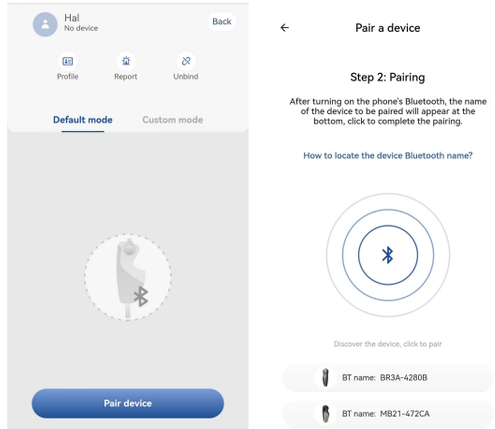
▸Upon logging in as a Prosthetist, the app will display the user list page. Here, a prosthetist can add new patients, create accounts for them, or select an existing patient account to carry out tasks like device management, parameter settings, mode management, and more.



▸Click the user name card to enter the user management page. If the user is not paired with a device, the following page will be displayed. Click "Pair Device" to enter the pairing mode. After entering the pairing mode, please follow the instructions on the screen.

▸When connecting to the application, please make sure that the Bluetooth of your smart phone is turned on, and the product will automatically connect once the product pairing is completed.

Notice：Please turn on the prosthetic knee and the Bluetooth feature of your phone.



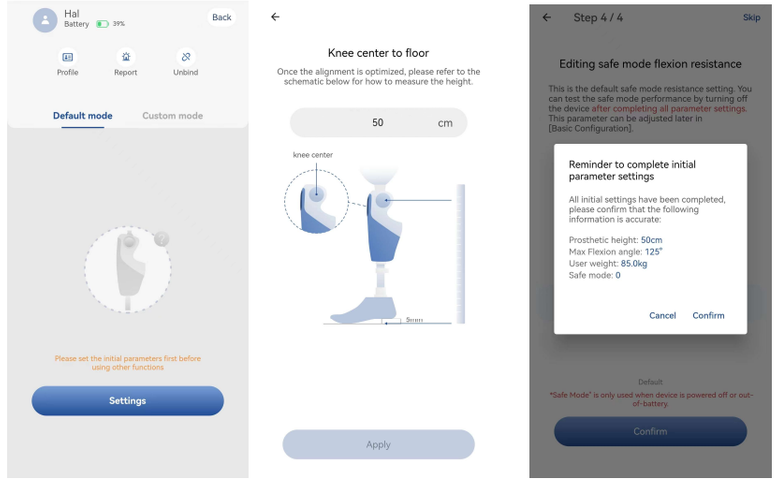
5.3.3. Basic Parameter Settings for New Prosthesis

▸When pairing a new device for the first time, the application goes to the initial parameter setting page. Please follow the instructions on the screen to complete the initial parameter setting.

▸The initial parameter settings include: prosthesis height, flexion limit, user weight and safety mode resistance.

▸After finalizing the settings, click the "Apply" button and verify the parameter settings in the subsequent pop-up window.

▸The prosthetist can change these parameters in the "Basic Parameter Setting" screen. Please see ***5.3.4 Parameter Configuration and Default Mode Settings***.

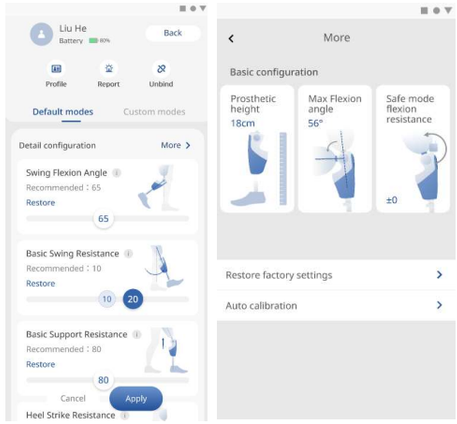


*Note: If you skip the initial parameter setting step, the prosthesis will not be initialized. Please complete the settings in the "Basic parameter settings" page before use.

5.3.4. Parameter Configuration and Default Mode Settings

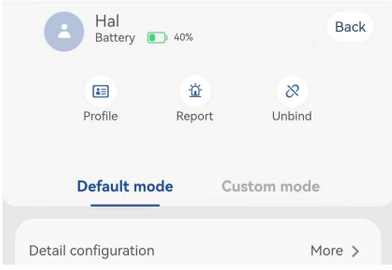
▸In the homepage, the prosthetist can adjust the resistance characteristics of Default Mode with the slider and confirm the changes by clicking the button at the bottom of the screen.

▸Click the "More" button to view and adjust basic parameters, restore factory settings and perform Auto calibration.



*The prosthetic knee must connect to the Kneuro App to adjust parameters.

5.3.5. Default Mode Parameters



【Swing Flexion Angle】

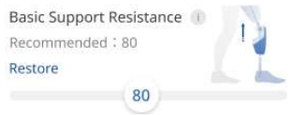
This parameter determines the angle at which the knee ceases its backward swing and begins to extend. This angle remains consistent regardless of walking speed. The default value is 65 degrees, but users can adjust it based on their individual needs. A lower value can assist users in walking faster.

【Basic Swing Resistance】

The Basic Swing Resistance helps users to better control their swing motion. The recommended value is 10. Setting the value too high may cause users to feel fatigued during extended use.

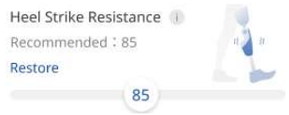
【Basic Support Resistance】

This value modulates the typical support in various situations, influencing activities such as sitting, standing, walking, and descending ramps and stairs. Adjusting this parameter necessitates user experience and feedback. While the recommended value is 80, heavier users or those of older age might need a higher value.



【Heel Strike Resistance】

The heel strike resistance helps to support the user's body during walking and running, allowing for a safe and smooth transition to the next step. The recommended value is about 1.1 times the normal state flexion support, with a default value of 85. It can be adjusted according to the user's habits.



【Upstairs Extension Resistance】

The upstairs extension resistance helps the user to smoothly position their leg on the next step of the stairs. It needs to be adjusted based on user's stride length and posture. The recommended value is 40.

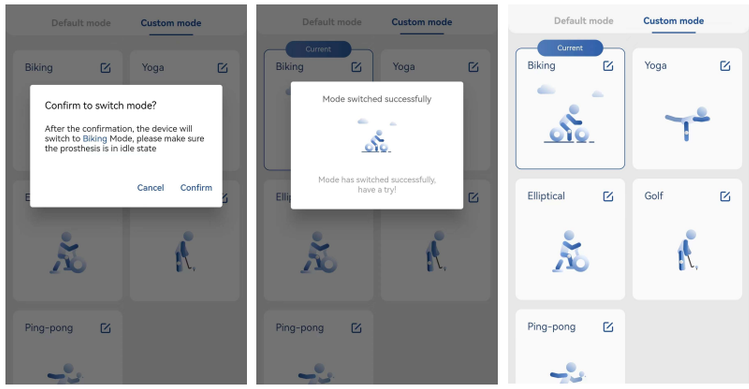
5.3.6. Custom Modes

▸Click the "Custom Modes" tab on the user home page to view the list of Modes

▸The prosthetist can switch the mode for the user, or configure the resistance characteristics of each mode.

Please ensure that the prosthesis is in idle state when switching modes to prevent the risk of falling caused by possible changes in resistance.

▸The Prosthetist can disable or enable modes for the patient. Modes that are disabled will not appear in the patients app and will be inaccessible.

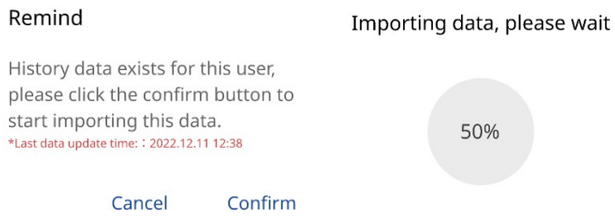


5.3.7. Parameters Import

▸When transitioning to a new prosthesis, you can import the data from the previous prosthesis to complete the parameter settings for the new device.

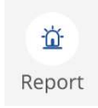
▸Please unbind the existing prosthesis first before pairing a new one.

▸After the new prosthesis is paired, if the Kneuro App detects existing data in the server, the App will notify the user with a pop-up window. The prosthetist can choose to import the previous data in this pop-up window.



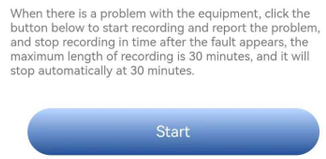
5.3.8. Problem Report

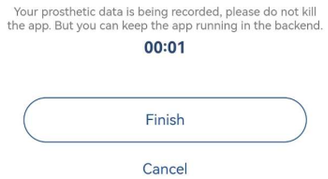
▸If you encounter problems or malfunctions during use, you can use the Problem Report function in the user home page to record and send feedback sensor data to BrainRobotic's back end server. The recorded data is solely utilized for the purpose of analyzing users' issues and will not be utilized for any other purposes .



Note: This feature is disabled by default. If you require access to this function, please contact BrainRobotics customer service.

▸To start recording, tap the “Start” button. The “Finish” button will end the recording session and upload the recorded data. The “Cancel” button will discard the recorded data.



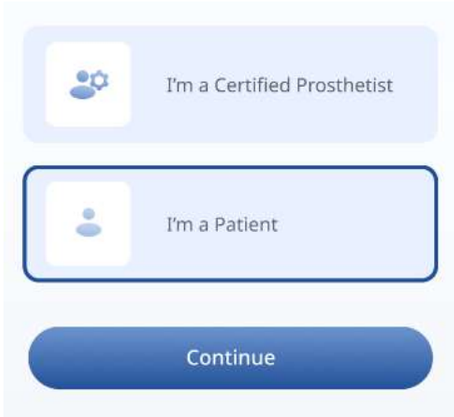


5.4. Using Kneuro App as a Patient

5.4.1. Login as Patient

▸Patients can use the Kneuro App to check device status, switch modes, and manage devices.

▸Select "Patient" on the "Select Login Role" page to log in to patient mode.



5.4.2. Quick Start and Prosthesis Pairing

▸After successfully configuring the initial parameters, the prosthetic knee will switch to "Default" mode. Patient can switch to any custom mode with the Kneuro App, or use the app to check information such as the battery level, total steps, and firmware version.

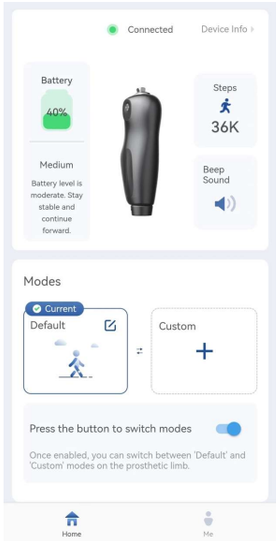
▸Patient accounts need to be created by the prosthetist. The Kneuro App can only be used after the account is successfully created.

▸When connecting to the Kneuro App, make sure that the Bluetooth function of your phone is turned on. Once the product is paired, it will automatically connect to the user's phone.

Caution All first-time users are required to finish the initial parameter configuration and product training at an authorized clinic.

5.4.3. Main Page

▸The main page of the app includes two main modules: The main control panel (including connection status, battery level, total steps and beep sound switch) and the modes module.



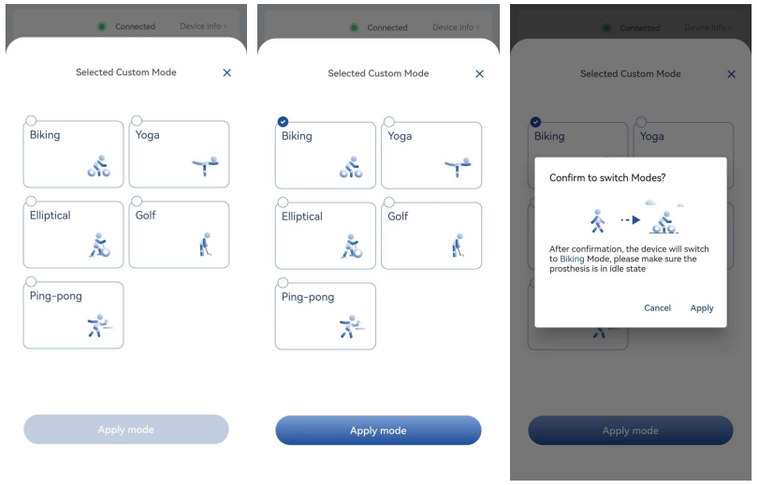
5.4.4. Mode Switch and Custom Mode Selection

▸The product will automatically enter default mode when turned on.

▸When using the Modes module, click the edit icon in the top right corner of the custom mode tab to enter the custom mode list.

▸Select a mode and tap the "Apply mode" button to set the selected mode as a Custom Mode and switch to this Mode.

▸If the "Press-to-Switch" function is turned on, you can quickly switch between the Default Mode and Custom Mode by double-clicking the power button, without using the APP.

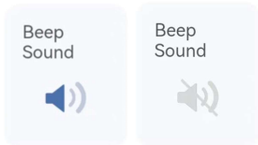


⚠Caution

Please ensure that the prosthesis is in idle state when switching modes to prevent the risk of falling caused by possible changes in resistance.

5.4.5. Audio Feedback

▸In the main control panel, you can turn the audio feedback (the beep sound) on or off with a switch. The audio feedback is OFF by default.



⚠Caution

After turning off the audio feedback, except for the special warnings listed below, the prosthesis will no longer beep and only provide vibration feedback.

After turning off the beep sound, the following audio feedback will be turned off:

-Switching modes

-20% battery alert

When the beep is turned off, the following audio feedback will remain on.

-Switch on/off

-5% battery alert

-Serious malfunction

-Parameter Setting

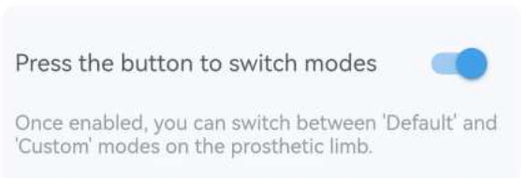
5.4.6. Press-to-Switch

▸In the Modes module, you can turn the "Press-to-Switch" function on or off. This function is off by default.

▸This function allows users to quickly switch between "Default Mode" and "Custom Mode" by double-clicking the power button. Before using this function, please follow the instructions in 5.4.4 to set the "Custom Mode".

⚠Caution

Once this function is activated, the user will be able to switch modes by double clicking the power button. When switching between modes, please make sure the prosthesis is in idle state to prevent damage caused by the change of resistance.



5.4.7. Firmware Upgrade and Device Management

▸To ensure the best performance and experience, please update your firmware to the latest version.

▸You can check and install the firmware upgrade in My Account - Device Management - Firmware Upgrade.

▸Each account can only pair one prosthesis. If you need to switch to a new prosthesis, please unbind the current one in My Account - Device Management.

5.4.8. User Information Collection

▸In order to ensure the optimal experience of using the product, some of your personal information and movement information will be collected by the Kneuro App and the sensors within the product. Your personal information will be deleted when the service of Kneuro is terminated. Please read the Privacy Policy and User Agreement within the application for details of information collection and privacy protection policy.

6. Using Kneuro

6.1. Motion Patterns in Default Mode

6.1.1. Standing

▸When the user stands, Kneuro will detect this position and offer enhanced support, making it easier for the user to remain upright.

6.1.2. Walking

▸During stance phase, the hydraulic stabilizes the knee joint.

▸During swing phase, the hydraulic will release the knee joint so that the prosthetic knee joint can swing freely.

6.1.3. Short Distance Running

▸Initial use of prosthetic running must be performed under the full guidance of professionals.

▸When the user initiates the running action, the product will automatically switch from walking to running.

6.1.4. Sitting Down

▸During the process of sitting down, the prosthetic knee will continue to provide support for the user, ensuring that the user descends evenly into the seat.

▸Stance resistance can be set via Kneuro App.

6.1.5. Sitting

▸When the user remains in a sitting position for longer than 2 seconds, with the thigh essentially horizontal, the resistance of the prosthetic knee will decrease to its minimum value. This allows the user to position the prosthetic leg with ease.

6.1.6. Standing Up

▸While standing up, the user should keep both feet level and lean their upper body forward. As the user stands, the resistance of the prosthetic knee will incrementally increase to distribute the load evenly across both feet.

6.1.7. Stance Lock

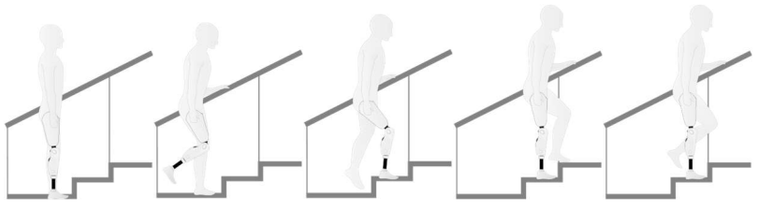
This feature allows the knee to lock at a specific angle between 20°- 40°, supporting the user's body weight. It offers an opportunity for the user to bear weight on the prosthetic leg and take a moment to relax.

Activate this mode by holding the prosthetic knee at any desired angle for 2 seconds. To unlock, simply straighten the knee.

⚠ Notice

This feature can only be activated when the knee is slightly bent (20°- 40°).

6.1.8. Walking Upstairs (Step-Over-Step)



▸To walk upstairs step-over-step, the user must complete guidance training and practice under the supervision of a professional practitioner.

Notice

To switch from walking to walking upstairs, please pause for about 1 to 2 seconds to exit the walking phase, then:

(1) Raise the extended prosthesis off the ground;

(2) As the prosthesis begin to lift, slightly extend the hip and then rapidly bend to the back to perform a kicking motion;

Caution

Be cautious of individuals behind you when executing the back kick action.

(3) Once adequate flexion acceleration is attained, the knee will elevate its extension resistance to a specific level. This ensures the foot has sufficient time to step onto the subsequent stair before the knee joint transitions to the extension state.

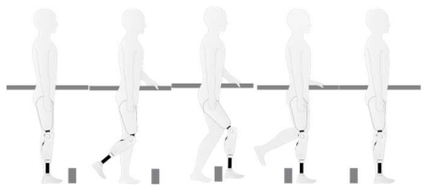
(4) Position the foot on the next step. Ensure the foot has ample support on the stair tread and that the heel isn't extending excessively beyond the step's edge. If the supporting surface is inadequate, the lower leg may prematurely reach full extension, causing the leg to lean backward. By this point, the knee will have transitioned to its highest flexion resistance (locked). This prevents further bending of the knee and ensures only extension can occur. This safety feature ensures the leg remains straight if the hip lacks the strength for extension.

(5) Use a handrail to provide more support. Even a smooth wall will suffice for support. This lateral support is crucial to prevent the residual limb from twisting inside the socket. Such twisting can lead to discomfort due to friction between the skin and the socket. Additionally, this support aids in maintaining balance.

(6) Fully extend the knee joint. Once the knee reaches full extension, it will revert to its initial state.

(7) You can continue to climb the next step or continue walking normally.

6.1.9. Step Over Obstacles



▸The ***Walking upstairs (step-over-step)*** function can also be used to cross over obstacles:

Notice To switch from walking to cross over obstacles, please pause for about 1 to 2 seconds to exit the walking phase.

(1) Lift the extended prosthesis off the ground.

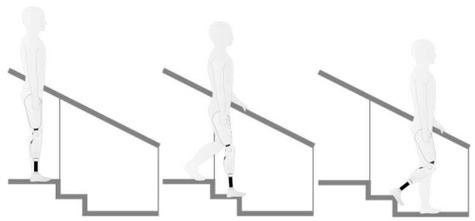
(2) Briefly extend the hip.

(3) Rapidly flex the hip, causing the knee joint to bend.

(4) Cross over the obstacle with the bent knee.

The extension resistance increases when the knee joint is adequately flexed, ensuring there's ample time to navigate the obstacle.

6.1.10. Walking Downstairs



▸This function must be practiced and performed with attention. The knee can respond correctly and allow controlled flexion only when the foot is positioned correctly.

▸To walk upstairs step-over-step, the user must complete guidance training and receive practice under the supervision of a professional practitioner.

(1) Hold on to the handrail with one hand.

(2) When placing the prosthetic leg on the step, ensure that half of the prosthetic foot extends over the edge. This positioning ensures a safe and smooth rolling action.

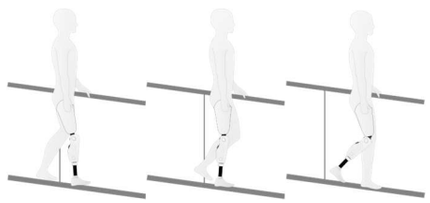
(3) Rotate the prosthetic foot over the edge of the step, slowly and evenly bend the prosthesis at the knee joint.

(4) Place the sound limb onto the next step.

(5) Repeat the above actions and place the prosthetic leg on the next step below.

▸The speed of the flexion can be changed through the parameter "Weight Acceptance Flexion Resistance" using the Kneuro App.

6.1.11. Walking Down Ramps



▸Control the bending of the knee under increased flexion damping, and lower the body's center of gravity.

▸Flexion resistance can be modified using Kneuro App.

Caution

Do not walk on excessively steep slopes (≥25°), as it may lead to decreased resistance and loss of support.

6.1.12. Manual Lock

▸To lock the knee joint allowing the product to support weight vertically, fully extend the knee then press and hold the power button for 0.5s until a short beep signal.

▸To unlock, press and hold the power button again for 0.5s until a short beep signal. You can try to bend the knee to confirm the lock status.

▸This function has been specially designed to assist the user in easily putting on and taking off the socket while standing, as depicted in the subsequent illustration.

6.2. Custom Mode

▸The prosthetic knee is available for different types of activities. You can modify and switch to the Custom Mode in different scenarios. For operation instructions of using Custom Mode, please refer to ***6.2.1 Switching to Custom Mode.***

6.2.1. Switching to Custom Mode

▸Before using, always check whether the selected mode matches the desired type of activity.

▸You can double-click the power button to switch between Default Mode and the selected Custom Mode. Please refer to ***5.4.6 Press-to-Switch*** if you want to use this feature.

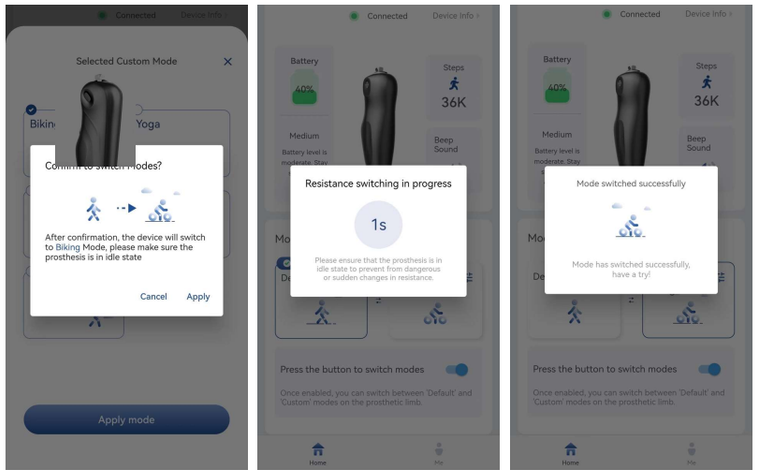
▸The prosthesis must be turned on, and successfully connected to the device before using the Kneuro app.

▸Once connected to the prosthesis, you can switch directly between different custom modes via the app:

1) Click on "Home" at the bottom of the Kneuro App, choose different custom modes for your activities. The page can display five preset modes by default.
2) Depending on the condition of a patient's limb and training level, the prosthetist may choose disable one or more modes to the patient. Disabled modes will be hidden from the patient side and cannot be selected.
3) The prosthetist can adjust the resistance characteristics for every custom mode.
4) When switching between modes, users need to remain safely stationary to avoid potential dangers caused by movement.

⚠ Caution

When transitioning between modes, users should remain stationary and ensure a stable position to prevent any risks associated with unintended.



6.2.2. Custom Mode List

▸**Cycling Mode**:

This function requires users to master bicycle skills under safe conditions before using:

(1) Set the device to "Cycling" mode.

(2) Adjust the pedal to a horizontal position before placing the prosthesis.

(3) During the preparation stage for cycling, place the prosthesis leg on the pedal, with the healthy leg supporting the ground.

(4) As you prepare to start cycling, initiate a pedaling motion with the healthy leg, while simultaneously applying downward pressure on the pedal with the prosthetic side.

(5) When coming to a stop, lean slightly towards the healthy side. Ensure that the healthy foot touches the ground first, establishing stability before dismounting the bike.

Caution In Cycling Mode, the resistance is set to a lower level. For safety, it's advised to engage this mode in proximity to a support or structure you can lean against to minimize the risk of unintended slips or falls.

***This mode has no adjustable parameters**

▸**Elliptical Mode**:

User can use this function to work out on a elliptical machine.

By adjusting parameters, the Prosthetist can change the support force from the prosthetic knee according to the muscle strength and training level of the patient.

Caution The resistance in Cycling Mode is relatively small. It's recommended to switch to this mode on the elliptical machine while holding on to the handles to prevent accidental falls.

▸**More sport modes**:

There are 3 sport mode presets installed in the Kneuro: Ping-pong, Golf and Yoga.

The Prosthetist can adjust the resistance characteristics according to the user's muscle strength and training level.

【Flexion resistance/Extension resistance】

These two parameters adjusts the level of basic support and extension force.

【Increase in flexion resistance %】

You can modify the correlation between flexion resistance and the degree of bend in the knee. When the parameter is set to 0, the flexion resistance remains constant, regardless of the bending angle. However, as the parameter value is increased beyond 0, the flexion resistance will correspondingly increase with a greater bending angle of the knee.

【Flexion limit angle/Extension limit angle】

These two parameters adjusts the bending range of the prosthetic knee.

You can turn on or off the angle limit with the switch.

6.3. Safe Mode

▸The product will automatically enter Safe Mode under the following conditions:

- During firmware upgrade
- When the battery level is below 5%

▸In Safe Mode, the product will not switch to any other modes and will maintain a constant resistance characteristic. The resistance parameters of the Safe Mode can be changed in the basic settings.

▸Safe Mode offers fundamental support and a limited capacity for short-term walking. This mode should be employed only under specific circumstances, such as when the battery has been depleted but movement is still necessary.

6.4. System Reset

▸If you encounter malfunctions such as system crash, control failure or not responding, you can press and hold the power button for 10 seconds to reset the system.

7. Warning Signal

Function	Event	Audio	Vibration	LED	Countermeasure
Low Battery Warning	Battery Level < 20%	Medium Signal×5	Medium Signal×5	Steady Yellow	Recharge within 6 hours.
	Battery Level < 5%	Short Signal ×5	Short Signal×5	Blinking Yellow	Recharge as soon as possible
Malfunction Warning	Serious Malfunction	Continuous Beeping for 8s	Continuous Vibration for 8s Repeat until malfunction is resolved or power off.	Steady Red	Try to reset the device by power cycling. If the signal remains, stop using immediately and contact customer service.
Risk Warning	Hydraulic system overheat	None	Medium Signal + Short Signal Repeat for every 5s until cool down.	Steady Red	Reduce activity level immediately

8. Storage

▸Storing the product in a non-vertical position for extended periods may lead to air accumulation within the hydraulic system. This issue may manifest as noise production and inconsistent resistance features. However, the product's automatic air release mechanism ensures that after approximately 10-20 steps, all its functions can be utilized without any limitations.

▸When storing the product, the prosthetic leg must remain fully extended.

▸Please store in a dry and cool environment.

▸Storage temperature range is -5℃ - +30℃/Max 95% relative humidity.

9. Cleaning

▸When the product is dirty, please clean it with a damp (freshwater) soft cloth.

▸If there are water stains on the product, dry it with a lint-free cloth and let it air dry.

▸When cleaning the socket, rinse it with clean water, or wash it with a skin-friendly cleanser. It is recommended to clean the socket everyday.

10. Maintenance

▸For your own safety, operational safety and product features, maintenance (servicing and inspection) is required for every 36 months.

▸The manufacturer allows a tolerance time range of up to one month before the maintenance date or two months after.

▸Additional service charges may apply if repairs are needed during maintenance.

▸When submitting your device for maintenance and repair, it is essential to provide the prosthetist with the following components:

- The main product (prosthetic device)
- The adapter specific to the device
- The associated charging cable

Ensuring that all these components are included will facilitate a more efficient and seamless service experience.

⚠Warning

This product is equipped with a lithium battery. For your safety and to ensure the longevity of the product:

- **DO NOT disassemble the device.**

- **DO NOT apply pressure or puncture the device.**

- **NEVER throw the device into a fire.**

- **AVOID placing the device in environments with temperatures exceeding 100°C.**

⚠Warning

Do not disassemble, repair, or modify this product without authorization, as it may cause malfunctions or electric shocks.

*This product contains a lithium battery. Environmental requirements in your country or region should be considered when disposing the product.

11. Legal Notice

▸All legal conditions are subject to the respective laws of the region of use and may vary accordingly.

▸This model is only available in the United States of America.

▸Before using this product, the user is expected to carefully read the "User Manual" provided by us in order to protect his/her legal rights or interests. We reserve the right to update the above document.

▸Once starting using this product, the user is deemed to have read, understood, acknowledged, and accepted all the terms and contents of the "User Manual" of this product. The user undertakes to be responsible for his or her own actions and for any consequences that may result therefrom, particularly due to improper use or unauthorized modification, repair, or replacement the product, and/or its components. The user undertakes to use this product only for lawful purposes and agrees to abide by these terms and conditions and any relevant policies or guidelines that our company may formulate.

▸In the process of using this product, the user should strictly observe and implement the requirements, including but not limited to the "User's Manual". For all personal injuries, accidents, property damage, legal disputes, and other adverse events caused by the use or force majeure factors mentioned in the safety instructions, the user shall bear the corresponding responsibilities and losses, and our company shall not assume any responsibility.

▸All names described in the documents are unconditionally protected by applicable trademark law and are the property of the respective owners. The brands, trade names, or company names described herein may be registered brands and are the property of the respective owners. Should trademarks used in this document fail to be explicitly identified as such, this does not justify the conclusion that the denotation in question is free of third-party rights.

▸Our company disclaims responsibility for any violation of laws and regulations caused directly or indirectly by the user's use of this product.

▸Other exemptions stipulated by laws and regulations.

▸This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

▸Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

▸This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

(1) Reorient or relocate the receiving antenna.

(2) Increase the separation between the equipment and receiver.

(3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

(4) Consult an authorized dealer or service representative for help.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

▸RF Exposure Compliance

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

▸Responsible party:
Company Name: BrainPortfolio Inc.
Address: 1826 Kramer Ln. Suite A/B, Austin, TX 78758

Note:
(1) If the user is a minor under the age of 18, he or she should carefully read this agreement under the guardian's supervision, guidance and with the consent of the guardian before using this product.
(2) Minor users and their guardians understand that if minors violate laws and regulations and the content of this agreement, minors and their guardians shall bear all legal responsibilities that may arise under the law.

12. More Information

▸For any questions related to the product, please contact BrainRobotics Customer Service.
After Sales Address: 1826 Kramer Ln. Suite A/B, Austin, TX 78758

13. Symbols Used

	Manufacturer
	Type BF applied part
	Compliance with the requirements according to "FCC Part 15" (USA)
⎓	Direct current
IP67	Protected against short periods of immersion in water while under pressure between 15cm and 1m and against dust over extended time.
IP22	Protection from ingress of particulates than ≥12.5mm Dripping water falling within 15° of vertical will not have a harmful effect
	Please note the instructions for use
	Power switch
SN	Serial number
	Caution, hot surface
	Protect from moisture
	Fragile
10	Stacking Layers Limit
	This side up
UN3481	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT(including lithium ion polymer batteries)

Caution: Federal law (USA) restricts this device to sale by or on the order of a practitioner licensed by law of the State in which he/she practices to use or order the use of the device.

14. Technical Specifications

Type	Subject	Requirements
Product Basic Parameters	Degree of freedom of the product	1 DOF
	Product Height	290mm±2mm
	Product Width	76mm±2mm
	Product Thickness	107mm±2mm
	Maximum Load	330 lbs / 150 kg
	IP Rating (Prosthetic Knee)	IP67 (water-resistant)
	IP Rating (Power Adaptor)	IP22
	Product Weight (The Prosthetic Knee)	3.53 lbs±0.11lbs / 1.6kg±0.05kg
	Maximum Bluetooth Connection Range	16ft / 5m
	Firmware Upgrade	OTA
Data Transmission	Wireless Protocol	BLE5.0
	Frequency Range	2.4000-2.4835GHz
	Modulation	GFSK
	Maximum Output Power	+8dBm
Battery	Battery Type	Lithium
	Battery Rated (walking mode)	3.7V
	Battery Life（≥80% original capacity）	≥500 Cycles
	Battery Level After 1h Charging	> 50%
	Battery Level After 2h Charging	> 80%
	Battery Level After 4h Charging	100%
Power Adapter	Adapter Input Voltage	AC 90-264V
	Adapter Input Power Frequency	47-63Hz
	Adapter Output Voltage	DC 5V
	Adapter Output Current	0.01-2A
Reliability Standard	Executive Standard	ISO 10328-P7
Environment Requirements	Long Term Storage Temperature/Humidity	-5℃ to 30℃ Max 95% relative humidity 70-106 kPa (up to 3,000m without pressure equalisation)
	Operating Temperature Humidity/Air Pressure	-10℃ to 40℃ Max 95% relative humidity

		70-106 kPa (up to 3,000m without pressure equalisation)
	Charging Temperature/ Humidity/Air Pressure	+10℃ to 45℃ Max 95% Humidity 70-106 kPa (up to 3,000m without pressure equalisation)
	Transportation Temperature/Humidity	-20℃ to 60℃ Max 95% Humidity 70-106 kPa (up to 3,000m without pressure equalisation)

15. Electromagnetic Compatibility Declaration

This device requires special precautions regarding electromagnetic compatibility (EMC), and this device must be installed and used in accordance with the electromagnetic compatibility information specified in this manual.

Portable and mobile radio frequency communication equipment may affect this device.

The following cables must be used to meet electromagnetic emission and immunity requirements:

Cable name	Length
Charging cable	1m

The use of accessories and cables (transducers) other than those specified and sold as spare parts for internal components may result in increased emissions or decreased immunity of this device or system.

The use of this device adjacent to or stacked with other equipment should be avoided. If such is unavoidable, this device should be observed to ensure that it functions properly in the configuration in which it is used.

Name	Description
Working	During the immunity test, there is no significant change in the performance of this device during the measurement process; temporary degradation of performance may be allowed during the electrostatic discharge, but it can return to the pre-discharge operating condition within 10 seconds.
Charging	The green light flashes when the battery is charging, and the green light is solid when the battery is fully charged.

Directives and manufacturer's declaration - electromagnetic emission			
Directives and manufacturer's declaration – electromagnetic interference immunity This device is designed for operation in the following electromagnetic environments, and the purchaser or the user shall ensure that it is used in such an electromagnetic environment:			
Immunity test	**Test level**	**Conformance level**	**Electromagnetic environment directive**
Electrostatic discharge (ESD) IEC 61000-4-2	± 6kV contact discharge ± 8kV air discharge	± 6kV contact ± 8kV air	The floor should be made of wood, concrete, and ceramic, and if the floor is covered with synthetic materials, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV to power lines ±1 kV to input/output lines	±2 kV to power lines N/A	The power supply must be of a quality suitable for use in a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line-to-line ± 2kV line-to-ground	±1 kV line-to-line N/A	The power supply must be of a quality suitable for use in a typical commercial or hospital environment.
Voltage drop, short interruption, and voltage variation on the power input line IEC 61000-4-11	<5%Ur, during 0.5 cycles (on Ur, > 95% dip) 40% Ur during 5 cycles (on Ur, 60% tip) 70% Ur, during 25 cycles (on Ur, 30% dip) <5% Ur, during 5 seconds (on Ur, > 95% dip)	<5% Ur, during 0.5 cycles; on Ur，>95% dip) 40% Ur, during 5 cycles on Ur, 60% dip) 70% Ur, during 25 cycles on Ur, 30% dip) <5% Ur, during 5 seconds on Ur, >95% dip)	The power supply must be of a quality suitable for use in a typical commercial or hospital environment. It is advised that this device be powered by batteries or an uninterruptible power supply if the user needs it to run continuously during a power outage.
Power frequency magnetic field	3A/m	3A/m	The power frequency magnetic field should have

(50Hz) IEC 61000-4-8			the power frequency magnetic field level characteristics of a typical commercial or hospital environment.

Note: UT refers to the AC network voltage before the test voltage is applied

This device is designed for operation in the following electromagnetic environments, and the purchaser or the user shall ensure that it is used in such an electromagnetic environment:

Emission test	Compliance	Electromagnetic environment directive
Radio-frequency emission CISPR 11	Group 1	This device uses radio frequency energy exclusively for its internal functioning. Its HF emissions are therefore very low, and interference with neighboring electronic devices is unlikely.
Radio-frequency emission CISPR 11	Class B	This device is suitable for use in all facilities, including residential environments and establishments directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emission IEC 61000-3-2	N/A	Power below 75W
Voltage fluctuations/flicker emissions IEC 61000-3-3	Conformance	

Directives and manufacturer's declaration – electromagnetic interference immunity

This device is designed for operation in the following electromagnetic environments, and the purchaser or the user shall ensure that it is used in such an electromagnetic environment:

Immunity test	Test level	Conformance level	Electromagnetic environment directive
Conducted radio-frequency IEC 61000-4-6 Radiated radio-frequency IEC 61000-4-3	3V (effective value) 150kHz-80MHz 3V/m 80MHZ-2.5GHZ	3V (effective value) 3V/m	Portable and mobile radio frequency communication equipment should not be used closer to any part of this device, including cables, than the recommended protection distance. This distance is calculated by the formula corresponding to the transmitter frequency. Recommended protection distance $d = 1.2\sqrt{(P)}$ 150kHz-80MHz $d = 1.2\sqrt{(P)}$ 80MHz-800MHz $d = 2.3\sqrt{(P)}$ 800MHz-2.5GHz Where: P - the maximum rated output power of the transmitter provided by the transmitter manufacturer, in watts (W); d – is the recommended protection distance, in meters (m). The field strength of a fixed radio frequency transmitter is determined by surveying the electromagnetic field a, which should be lower than the conformance level in each frequency range b. Interference may occur near this device marked with the following symbols.

Note 1: For 80 MHz and 800 MHz frequencies, the formula for higher frequency bands is used.

Note 2: These directives may not be appropriate for all situations, and electromagnetic

propagation is affected by absorption and reflection from buildings, objects, and the human body.

a The field strength of fixed transmitters, such as base stations for wireless (cellular/cordless) telephones and terrestrial mobile radios, amateur radios, AM and FM radio broadcasts, and television broadcasts, cannot be predicted accurately in theory. To assess the electromagnetic environment of fixed radio frequency transmitters, the electromagnetic field survey should be considered. If the measured field strength of this device is higher than the applicable radio frequency conformance levels described above, this device should be observed to verify its proper operation. If abnormal performance is observed, additional measures may be required, such as reorienting or repositioning this device.

b The field strength should be less than 3 V/M over the entire frequency range of 150 kHz ~ 80 MHz.

Recommended protection distances between portable and mobile radio frequency communication equipment and this device. This device is intended for use in electromagnetic environments where radiated, radio-frequency disturbances are controlled. Depending on the maximum rated output power of the communication equipment, the purchaser or THE user can prevent electromagnetic interference by maintaining a minimum distance between portable and mobile radio frequency communication equipment (transmitters) and this device as recommended below.

Maximum rated output power	**Protection distance for different frequencies of the transmitter, m**		
of the transmitter W	150kHz-80MHz $d=1.2\sqrt{(P)}$	80MHz-800MHz $d=1.2\sqrt{(P)}$	800MHz-2.5GHz $d=2.3\sqrt{(P)}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For the maximum rated output powers of the transmitter not listed in the table above, the recommended protection distance d in meters (m) can be determined using the formula in the corresponding transmitter frequency column, where P is the maximum rated output power of the transmitter provided by the transmitter manufacturer, in watt (W).

Note 1: For 80MHz and 800MHz frequency points, the formula for higher frequency bands is used.

Note 2: These directives may not be appropriate for all situations, and electromagnetic propagation is affected by absorption and reflection from buildings, objects, and the human body.