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1 Introduction

The purpose of this document is to demonstrate the iHand assist/prevent and rehab gloves. The iHand assist/prevent and rehab glove systems are based on the same technology but with entirely different specifications when it comes to speed and force levels. The iHand assist/prevent glove is intended to be used by healthy individuals who are at risk of developing musculoskeletal disorders (MSDs) or who need extra strength and endurance in the grasp. The iHand rehab glove is intended to be used by individuals suffering from a weak grip or lack of endurance in the grip to enable them to get back to work or improve quality of life by compensating for the reduced function while in the meantime improving hand function.

The two systems are thoroughly described in the newly developed user manuals for the two products. These are included in their entirety in this deliverable.

Ironhand®

USER MANUAL

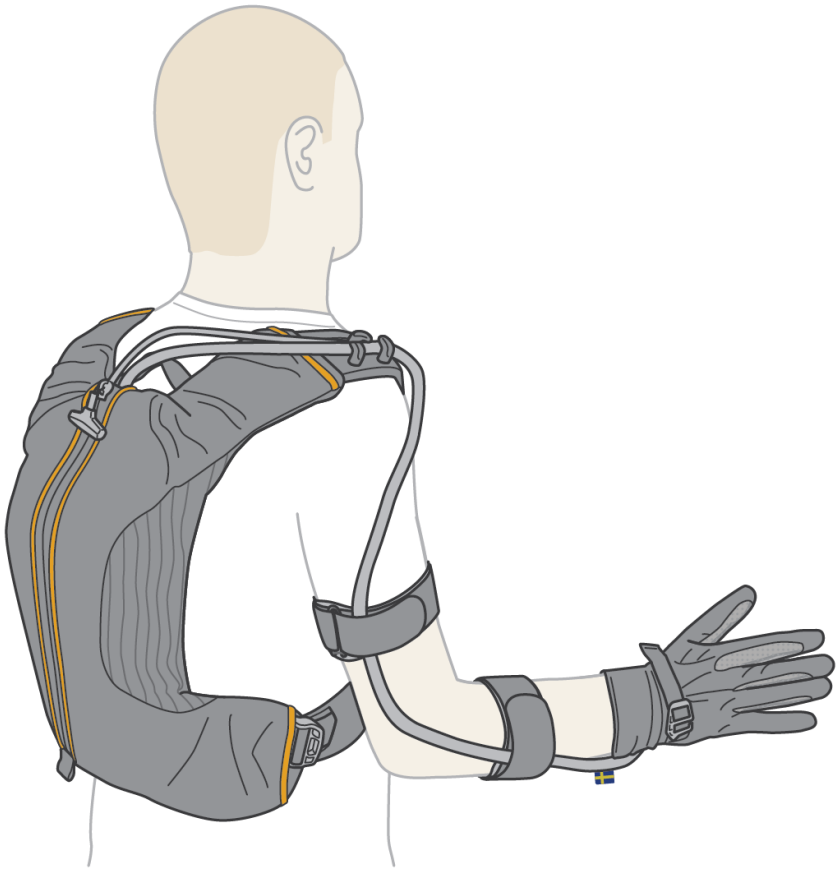


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1. Introduction

1.1 About this manual

- Read the entire user manual before you operate or do maintenance on the product.
- Always keep the user manual in a place where you can easily find it.
- If you lose the user manual, Bioservo can send you a new manual digitally on request.

1.2 About Ironhand

Ironhand is a modular system that consists of a glove, a power pack, a harness and two arm straps. The Ironhand glove mimics the user's grasp movements and gives extra strength and endurance to the grasp. This relieves the muscles and conserves the energy of the user.

Ironhand can be configured to meet the needs of each individual user. Make sure that the configuration is done before you use Ironhand.

Ironhand is intended to be used by healthy individuals who are at risk of developing musculoskeletal disorders (MSDs) or who need extra strength and endurance in the grasp.

1.3 Contact information

Bioservo Technologies AB
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www.bioservo.com
+46(0)8 211 710

1.4 Conformity

See [Declaration of Conformity](#).
For charger, see included charger manual.
For battery, see battery casing.

1.5 Symbols on Ironhand







Symbol	Description	Symbol	Description
	CE mark		Manufacturer's reference number
	Do not discard as household waste		Part that belongs to the Ironhand system
	See user guide for information		See user guide for information



Figure 1: The label on the power pack.



Figure 2: The label on the glove.

1.6 Disposal

When Ironhand becomes worn out, recycle it as electronic waste. Recycle the battery according to local regulations.

2. Safety

2.1 Risk assessment

- Qualified personnel must do a risk assessment of the work area and the work environment before Ironhand is used.
- The risk areas include, but are not limited to:
 - The risk to get caught in static or moving objects in the work area.
 - The risk to interfere with personal protective equipment.
 - Possible danger due to malfunction of the product or unintended finger contraction.

2.2 Warning, caution and note definitions



Warning! Risk of injury if instructions are not obeyed.



Caution: Risk of material damage if instructions are not obeyed.



Information for optimal use of equipment.

2.3 Warnings

2.3.1 General

- Only use Ironhand for jobs it has been approved for by Bioservo personnel or a qualified instructor.
- Only use Ironhand on the hand it is intended for.
- A protective glove must be worn on top of Ironhand.
- Do not do modifications to Ironhand.
- All service work must be done by an authorized technician.
- Stop using Ironhand if you feel that the use of it causes discomfort or an unbalanced load on your body.
- If Ironhand malfunctions, pull the red quick stop handle on the remote control downwards.
- Do not use Ironhand for tasks that can cause injury if Ironhand malfunctions. For example, do not hold a heavy container with hot liquid.
- Do not carry loads that may cause harm if dropped. Only carry objects that you would otherwise be capable of carrying.
- Always disable Ironhand before operating vehicles (bicycles included) and heavy machinery such as cranes and forklifts.



2.3.2 Battery

- ELECTRICAL HAZARD. Change in voltage supply can damage the product and cause a fire. Replace the battery with a battery of the same type and rating.
- Do not short circuit the terminals of the battery.
- Do not expose the battery to fire. This can cause an explosion.
- Do not expose the battery to temperatures above 60°C/140°F.
- Do not dismantle the battery.
- Do not use batteries that show signs of damage.
- Keep batteries out of reach of children.
- Dispose of worn out batteries according to local regulation without delay.

2.3.3 Charger

- Only use the charger specified in this guide.
- ELECTRICAL HAZARD. Earthed power supply is vital for the safe use of the battery charger. Never operate the charger without connection to an earthed power supply outlet.
- Unplug the charger when not in use. Pull the plug to disconnect the power cable. Never pull the power cable itself.
- Never use the charger with a damaged cable or if it has been dropped or damaged.
- Always keep charger and batteries clean.
- Do not dismantle the charger.
- If you have any problems with the charger while it is connected to the electric outlet, disconnect it from the power point immediately to turn off the power.

2.4 Cautions

- Use Ironhand according to the instructions. Incorrect handling can cause discomfort and void the warranty.
- Keep Ironhand clean at all times. Do not touch anything that can cause resistant stains.
- Keep Ironhand away from liquids and small particles. Liquids can easily go through the outer glove and cause damage if they enter Ironhand. To clean Ironhand, see [To clean Ironhand](#).
- Do not allow metal objects other than batteries to touch metal parts in the charger connector. A short circuit can occur and damage the charger.
- Do not use portable RF communications equipment, like mobile phones, closer than 30 cm (12 inches) to the Ironhand power pack. Otherwise, the performance of Ironhand can deteriorate.
- Use caution when operating Ironhand in environments with high levels of radio frequency noise, such as near welding equipment.

3. Product overview

3.1 Ironhand

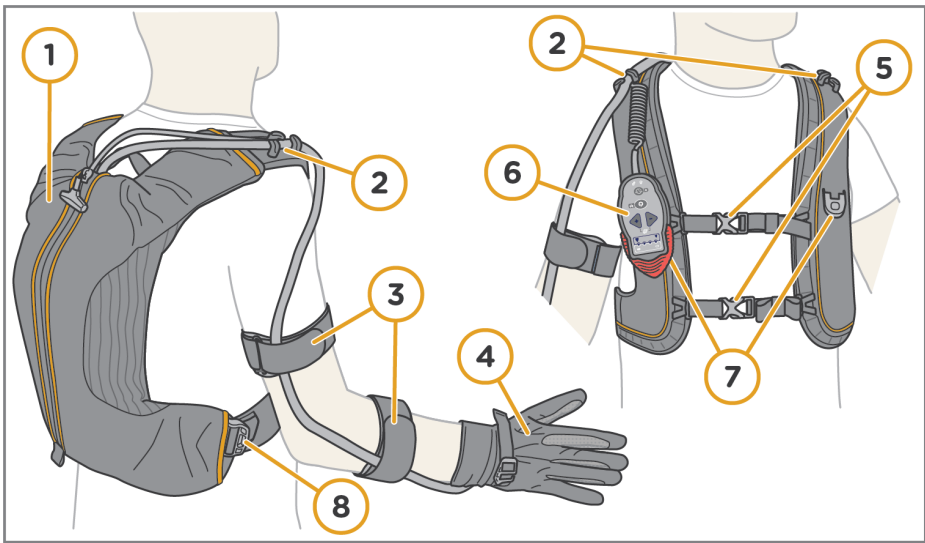



Figure 3: The components of the Ironhand system.

Item	Name	Function
1	Harness with power pack	Protects the power pack
2	Cord clamp	Holds the cords in place
3	Arm straps	Keeps the cord attached to your arm
4	Glove	Provides grasp force
5	Front closure	Connects the shoulder straps
6	Remote control	User control
7	Remote control mount	Holds the remote control in place
8	Side strap	Used to fasten the harness snugly

3.2 Ironhand power pack

 The harness must always be used to prevent damage to the power pack.

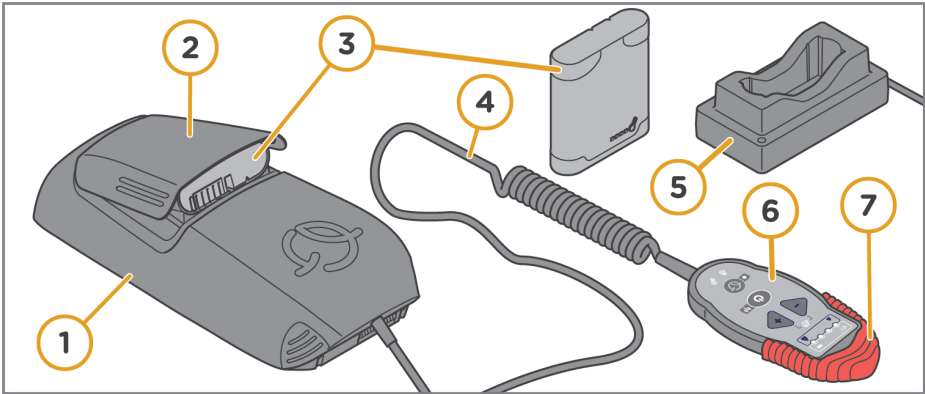


Figure 4: Ironhand power pack, remote control and battery charger.

Item	Name	Function
1	Power pack	Controls and powers Ironhand
2	Battery compartment	Keeps the battery in the power pack
3	Battery	Powers the power pack
4	Cord	Transmits commands and power between the power pack and the remote control
5	Battery charger	Charges the battery
6	Remote control	User control
7	Quick stop	Shuts Ironhand down quickly

3.3 Ironhand glove

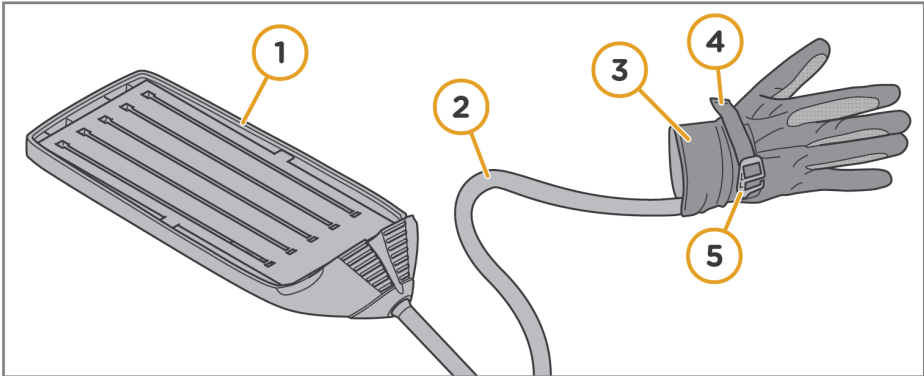


Figure 5: Ironhand glove and connector.

Item	Name	Function
1	Connector	Connects the glove to the power pack
2	Cord	Transmits sensory data and force
3	Glove	Provides grasp force
4	Strap	Secures the glove on the hand
5	Buckle	Holds and loosens the strap

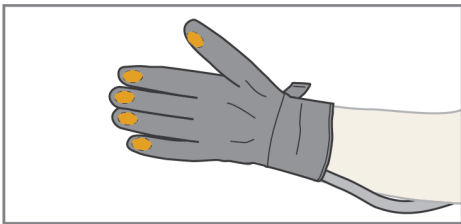


Figure 6: Sensors on Ironhand.

Name	Function
Finger sensors	Provide data to the power pack

3.4 Ironhand remote control

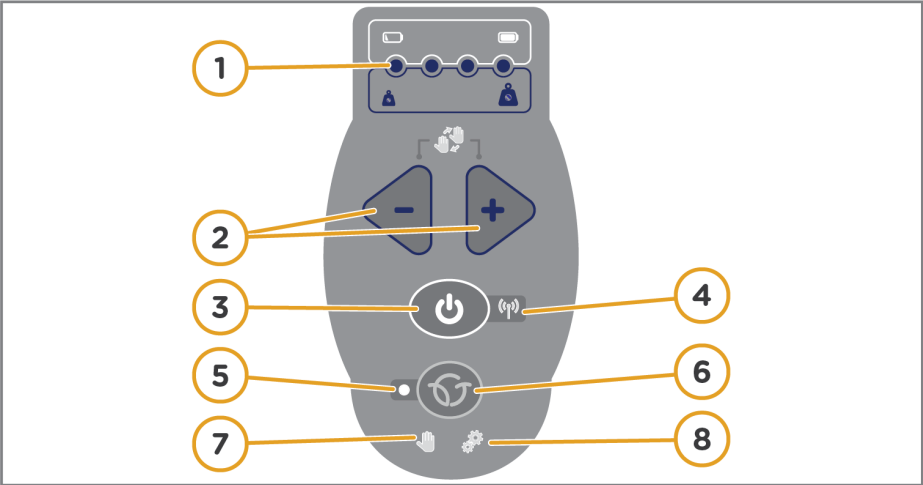


Figure 7: Ironhand remote control.

Item	Name	Function
1	LEDs	Indicates battery level in white or force level in blue
2	Force adjustment	Press to adjust the force level
3	On/off button	Hold for approximately 1 second to turn the system on or off. Double-click to enable/disable WiFi.
4	WiFi indicator	Blinking = WiFi functionality is turned on. Steady light = connected to WiFi.
5	Profile selection indicator	Off = primary profile, on = secondary profile
6	Profile selection button	Press to select profile
7	Glove status indicator	Indicates glove errors
8	Power pack status indicator	Indicates power pack errors

3.5 Charger

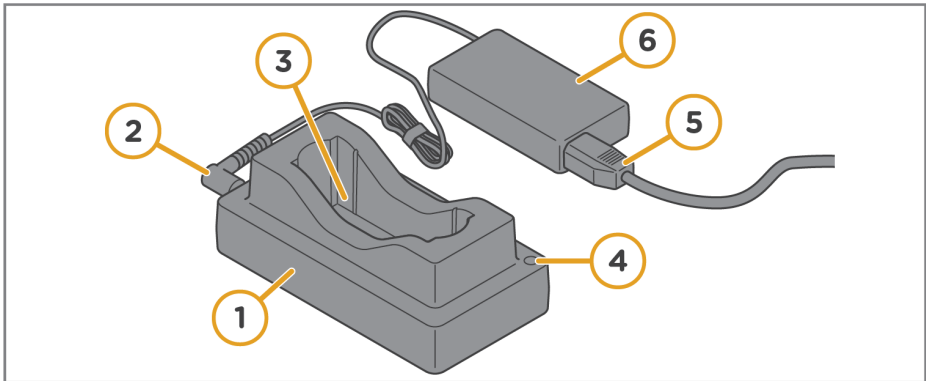


Figure 8: Charger.

Item	Name	Function
1	Battery charger	Charges the battery
2	Charger power cable	Transmits DC voltage to the charger
3	Battery slot	Holds the battery
4	Charging indicator	Indicates the status of the charger
5	Mains power cable	Transmits AC voltage to the power adapter
6	Power adapter	Converts AC to DC

3.6 Size guide

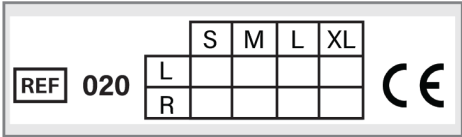


Figure 9: Ironhand size guide.

Product name	Catalogue number	Explanation	Options
Ironhand glove	020.os	o = orientation s = size	L (left), R (right) S, M, L, XL
Ironhand unit	021.0		
Arm strap	027.s	s = size	S-M, L-XL
Harness	024.s	s = size	S-M, L-XL

Example: To order a right-hand glove in size M, use the catalogue number 020.RM.

4. To assemble Ironhand

4.1 To connect the glove to the power pack

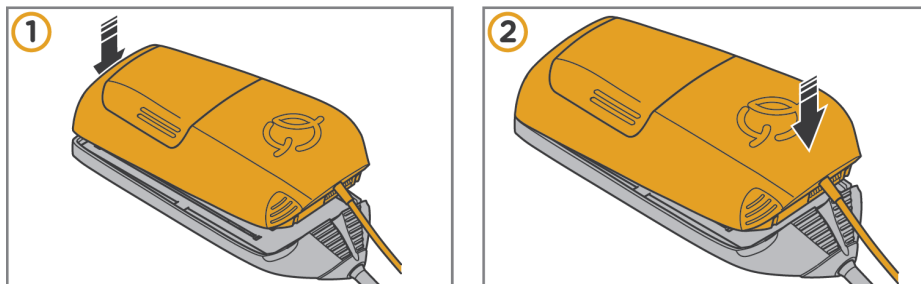
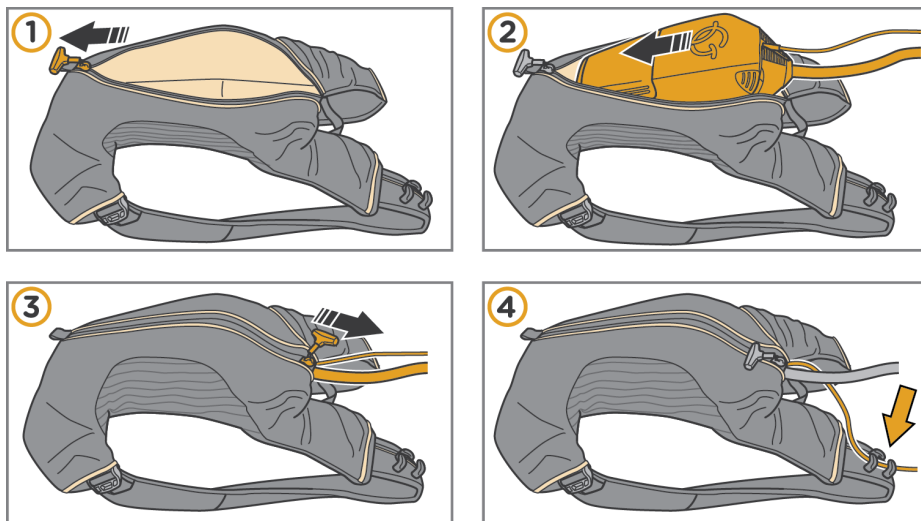


Figure 10: To connect the glove connector to the power pack.

4.2 To prepare the harness



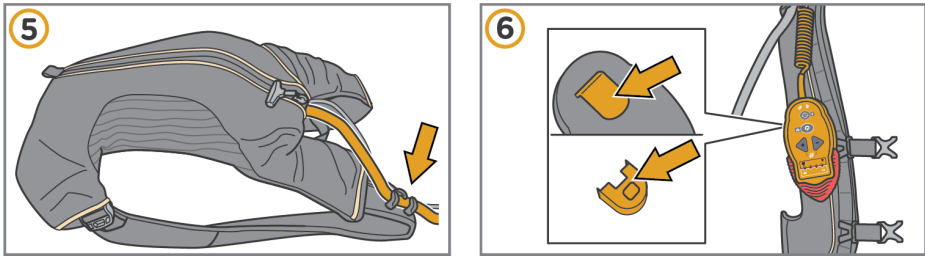


Figure 11: To prepare the harness

5. Performance test

Before use, do a performance test:

1. Inspect the Ironhand system. If it is damaged, contact the supplier.
2. Put Ironhand on according to the instructions in [To put on and start Ironhand](#).
3. Make sure that the glove status indicator and the power pack status indicator are not lit. If they are lit, Ironhand has detected an error. Contact the supplier.
4. Hold an object tightly with all your fingers. Make sure that Ironhand reacts as intended to installed profiles.
5. Release the object. Ironhand should stop adding force to your hand.
6. If Ironhand does not add force when you hold, or does not stop adding force when you release, see [Troubleshooting](#) or contact the supplier.

6. To use Ironhand



Warning! Use Ironhand according to the instructions. Incorrect handling can cause discomfort.

6.1 To charge and insert the battery



The charger becomes warm during use.

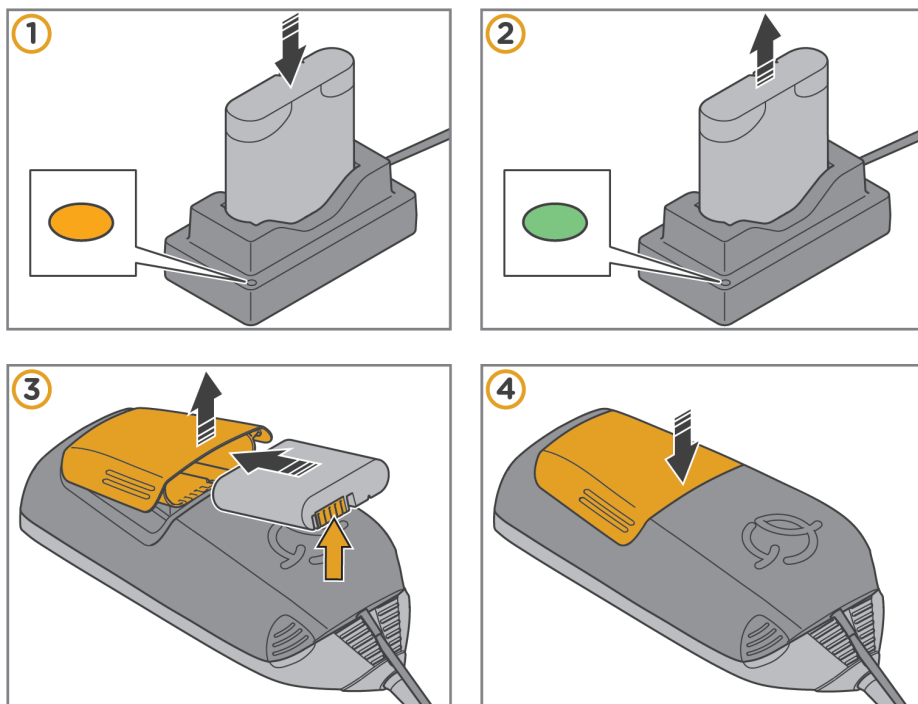


Figure 12: To charge and insert the battery.

Make sure that the battery is fully charged. The four white battery indicators on the remote control show the battery status, see [Ironhand remote control](#). You can also check the battery status on the charger.

6.1.1 Charger indicators

Light indicator	Meaning
One blink series RED/ORANGE/GREEN	Self test: the charger is ready for use.
Blinking RED/GREEN	The battery is identified.
Solid ORANGE	The battery is charging.
Solid GREEN	The battery is fully charged and can be removed.
Blinking RED	The battery is too hot or too cold to be charged.
Solid RED	The battery is damaged or of a type that cannot be recharged.

6.2 Wash your hands and use hand sanitizer



Figure 13: Before you use Ironhand, wash your hands and use hand sanitizer.

6.3 To put on and start Ironhand



If the Ironhand glove malfunctions, pull the red stop handle on the remote control downwards. This shuts down the system quickly.



Warning! A protective glove must be used on top of the Ironhand glove.



Caution: The added force can be surprising for a new user. Make sure you familiarize yourself with this extra force before you start making full use of Ironhand.

6.3.1 To put on the harness

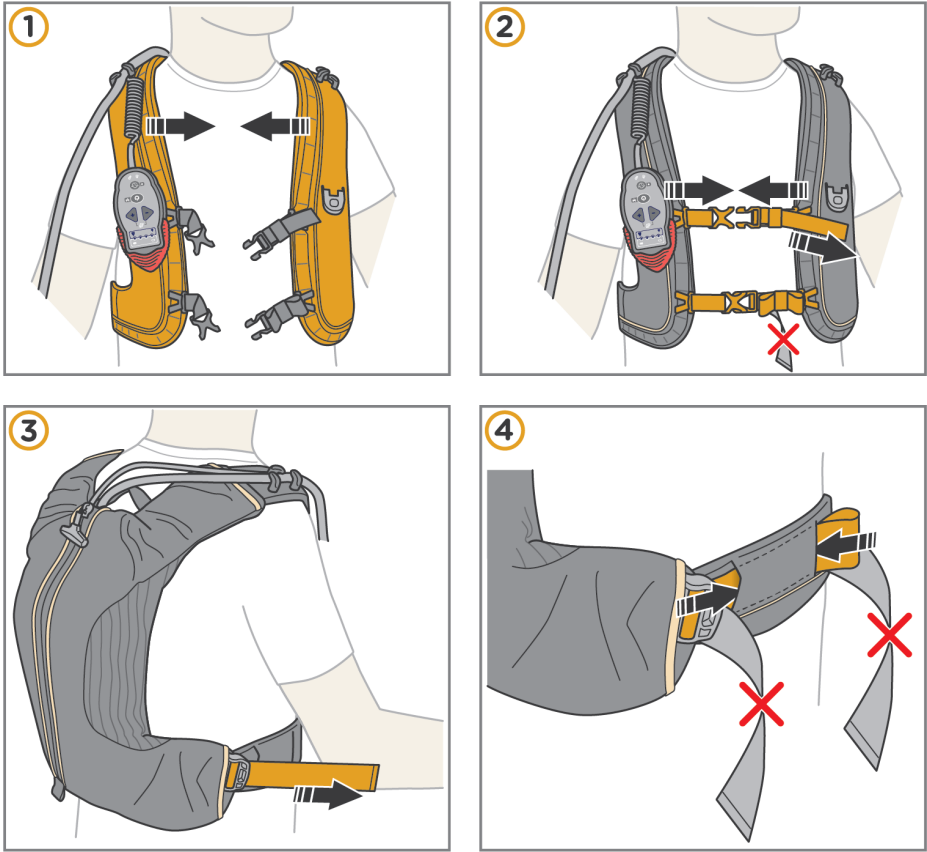


Figure 14: To put on and adjust the harness.

6.3.2 To put on the glove

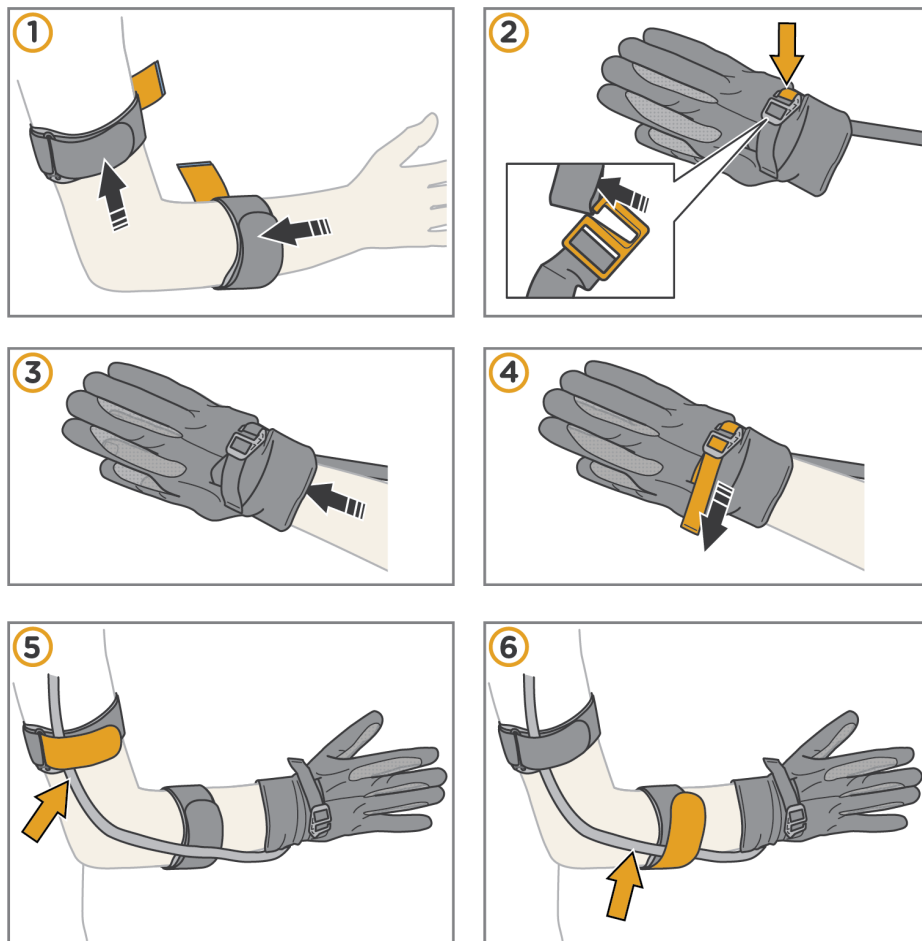


Figure 15: To put on the glove.

The glove should be tight on your wrist but not hurt. To loosen the strap, lift the buckle.



Before use, do a performance test to check the functionality. See [Performance test](#).

6.3.3 To put on an outer glove

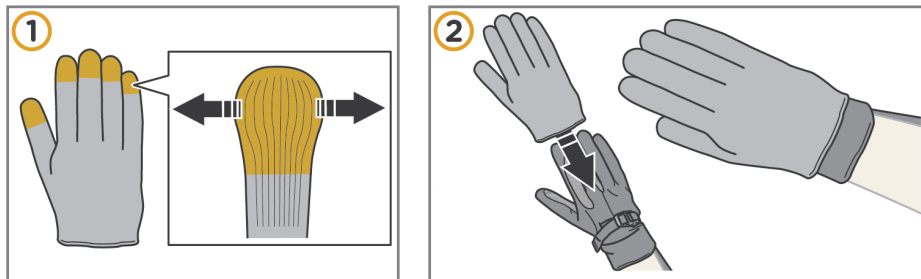


Figure 16: To put on the outer glove.

Put on the outer glove. If you experience problems with getting your fingers into the glove, try extending the fingertips of the outer glove.

6.3.4 To adjust the length of the cord

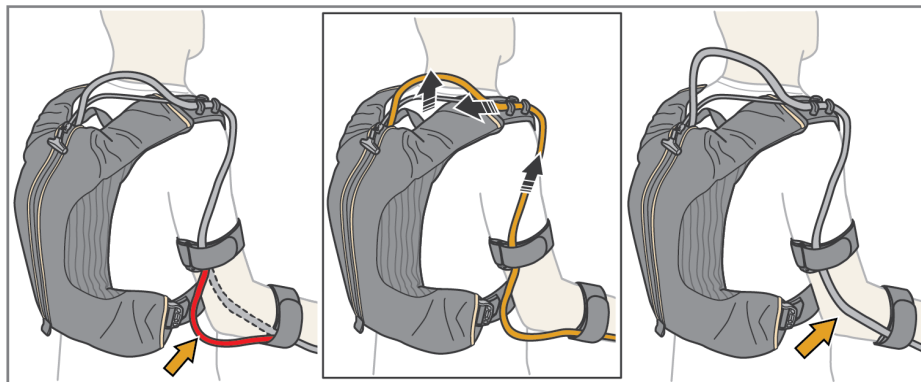


Figure 17: To adjust the length of the cord.

Slide the cord in the cord clamp to adjust the length of the cord.

6.3.5 To start Ironhand

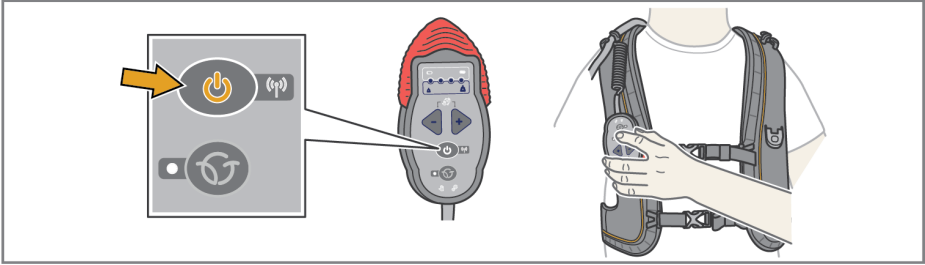


Figure 18: To start Ironhand.

Press and hold the **on/off** button on the remote control for approximately 1 second to start Ironhand.

6.4 To shut down Ironhand

Press and hold the **on/off** button on the remote control for approximately 1 second to shut down Ironhand.

6.4.1 Quick stop

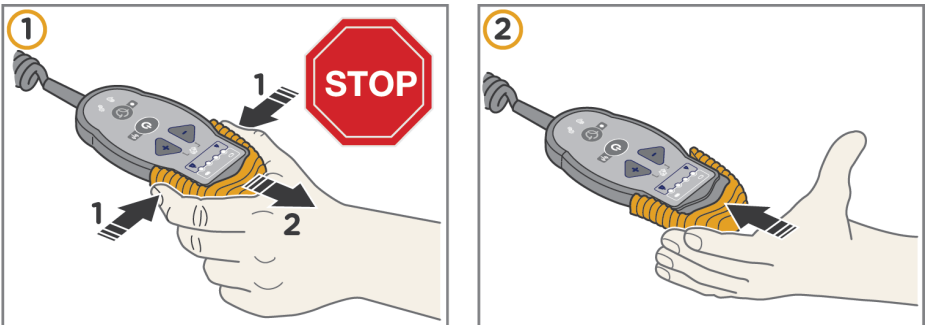


Figure 19: Quick stop.

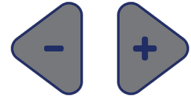
If the Ironhand on/off button does not respond, pull the red stop handle on the remote control downwards. This stops any contraction movements of the glove and shuts down the system quickly. To reset the quick stop, press the red handle to its normal position.

6.5 To change settings in Ironhand

6.5.1 To adjust the force level

You can increase or decrease the grasp force with the plus and minus buttons on the remote control.

- Press the plus button to increase the grasp force.
- Press the minus button to decrease the grasp force.



The four blue force level indicators on the remote control show which force level you have chosen, see section [Ironhand remote control](#).

6.5.2 To switch between profiles

Ironhand has two preset profiles that are accessed with the profile selection button on the remote control. Press the profile selection button to activate the profile you want to use.



The profile selection indicator (blue LED) shows which profile is active:

Off = primary profile

On = secondary profile



The profile settings can only be configured by an authorized user. Make sure that the configuration is done before you use Ironhand.

6.5.3 To connect to WiFi

You can connect a device to Ironhand using WiFi to modify settings. To do this, see separate manual.

6.6 Inspections and service



Warning! All service work must be done by an authorized technician.

Inspect Ironhand with regular intervals to make sure that it functions correctly and does not cause hazards to the user. In particular, make sure that the protective enclosure of the power pack is not damaged.

There are no parts in the power pack that can be replaced by the user. Contact the supplier for all service work.

6.7 Storage

Remove the battery if you are not going to use Ironhand for more than one week. When you keep the battery in Ironhand, it will slowly drain.

7. To clean Ironhand



No other maintenance of the product than cleaning can be performed by the user.

7.1 To clean the glove



Do not use fabric softener



Always wash the glove in a padded wash bag approved by Bioservo Technologies AB. This prevents damage to the glove and the washing machine.

Hand wash or machine wash the glove according to the below instruction. Spray the glove with isopropanol for disinfection.

	Gentle cycle for synthetics
	Do not centrifuge
	Do not use detergent with bleach
	Do not tumble dry
	Do not iron
	Do not dry clean
	Do not wring
	Hang dry in room temperature

Before use, make sure that the glove and its parts are completely dry. Straighten the fingers on the glove by pulling gently at the fingers, and attach the power pack. Check the functionality, see [Performance test](#).

7.2 To clean the arm straps

Hand wash or machine wash the arm straps according to the below instruction.



Gentle cycle for synthetics

7.3 To clean the harness

Clean the harness according to the cleaning instructions on the label of the harness.

7.4 To clean the power pack

Clean the power pack and the remote control with a damp cloth. If necessary, use mild detergent. Do not use any abrasive detergents or cleaning equipment such as scouring pad.

8. Troubleshooting

Problem	Solution
Ironhand does not start	Make sure that the battery is fully charged and inserted correctly.
Nothing happens when I grasp an object	Make sure that the force adjustment is not set to minimum and that the stop handle is not pulled down.
The system is unresponsive	If none of the above solutions are successful, press and hold the on/off button for 10 seconds to shut Ironhand down.

9. Accessories

You can order these accessories from the supplier:

Name	Product number
Battery	RRC2054
Battery charger	RRC-SMB-MBC
Arm strap small-medium	027.S-M
Arm strap large-extra large	027.L-XL
Harness small-medium	024.S-M
Harness large-extra large	024.L-XL

10. Technical specifications

Rated voltage	15 V DC
IP class	IP4X (when the glove and the power pack are connected only)
Altitude	Max 2 000 m
Total weight	2.6 kg (power pack, battery & glove 2.1 kg, harness 0.5 kg)
Max total added force	80 N
Batteries	
Type of batteries	15 V DC Li-ion
Number of batteries	1
Battery life	Approx. 8 hours, depending on usage
Contact material	
Ironhand glove	Polyamide, polyurethane, PVC, vinyl nitrile, polyethylene
Ironhand remote control	Polyamide, polyethylene
Power pack/harness	Polyamide, EVA
Ambient temperature	
Use	-5°C to +40°C
Storage	-20°C to +50°C
Ambient humidity	
Use	10% to 80% relative humidity, non-condensing
Storage	5% to 90% relative humidity, non-condensing
Expected lifetime	
Power pack	2 years or 1 000 000 cycles
Glove	2 months or 100 000 cycles
Charger	See separate manual for specifications
Wifi	
Frequency	2.4 to 2.5 GHz
Protocol	802.11 b/g/n/e/i (802.11n up to 150 Mbps)
FCC ID	2AC7Z-ESPWROOM32

11. Declaration of Conformity



DECLARATION OF CONFORMITY

MANUFACTURER **Bioservo Technologies AB**

ADDRESS **Torshamnsgatan 35, 164 40 Kista, Sweden**

DECLARE THAT THE FOLLOWING PRODUCTS:

MODEL NAME **Ironhand®**

TYPE **A0**

SERIAL NUMBER

CONFORM TO THE FOLLOWING STANDARDS:

EN 60601-1: 2006, EN 60601-1-2: 2015

FOLLOWING THE PROVISIONS OF DIRECTIVE:

2006/42/EG, 2014/30/EG, 2012/19/EG, 2011/65/EG

PLACE AND DATE OF ISSUE **Kista 2019-04-26**

Ibrahim Deregård
Quality Assurance Manager

Peter Löwendahl
Quality and Regulatory Affairs Director

Document ID: D0001880

Issue: 00



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Carbonhand[®]

USER MANUAL

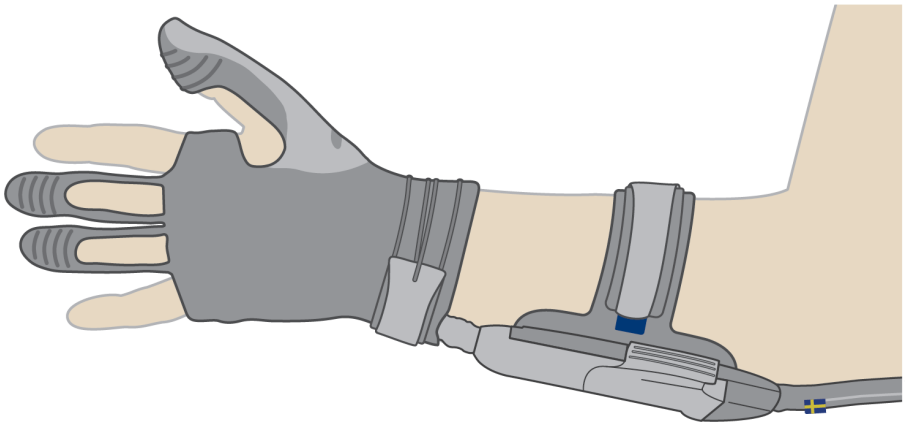


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1. About the product

1.1 Intended use

Carbonhand improves the grip of persons who have a weak or unsteady grip. The condition may be due to orthopedic or neurological problems, from birth or acquired. Carbonhand mimics the user's grip movements and gives your hand additional grip force. It is designed to make life easier at work, at home and in everyday life. It is available in several sizes and in both right hand and left hand versions.

1.2 Conformity

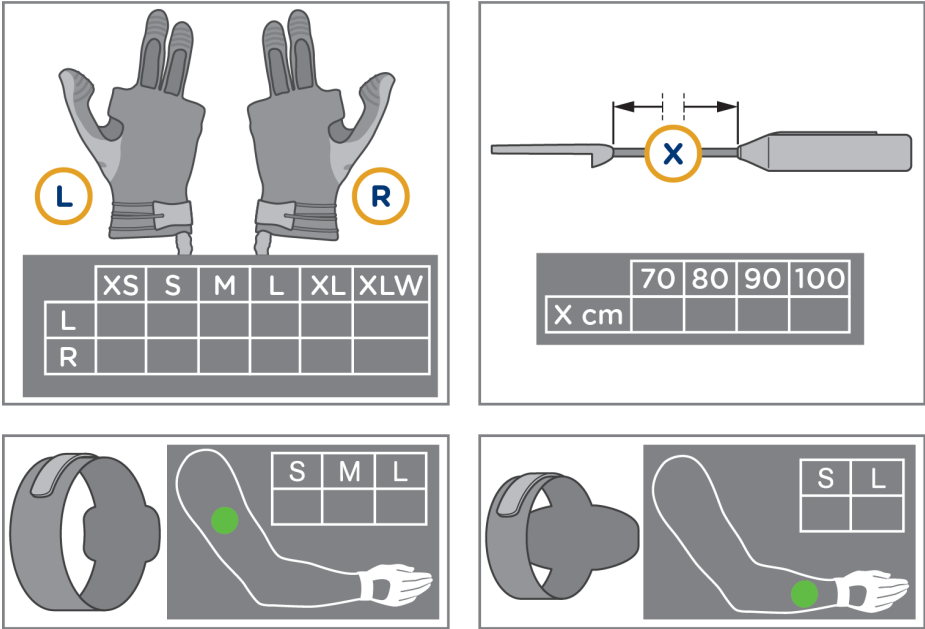
	Standard/Directive	Reference
Carbonhand		
Classification	ISO 9999: 24 18 03	Assistive products for gripping
	ISO 9999: 06 06 07	Hand-finger splints
Directive	Medical device directive	93/42/EEC
	Environmental directive RoHS	2002/95/EC
	Environmental directive WEEE	2002/96/EC
Charger		
Directive	Low voltage directive	2006/95/EC
	Electromagnetic compatibility (EMC)	2004/108/EC

1.3 Contact information

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www.bioservo.com
+46(0)8 211 710

1.4 Size guide



Product name	Catalogue number	Explanation	Options
Carbonhand® glove	0010.os	o = orientation s = size	L (left), R (right) XS, S, M, L, XL, XLW
Carbonhand® control unit	0011.x	x = length (cm)	70, 80, 90, 100
Upper arm strap	0017.s	s = size	S, M, L
Lower arm strap	0018.s	s = size	S, L

Example: To order a right-hand glove in size M, use the catalogue number 0010.RM.

1.5 Product overview

1.5.1 Carbonhand

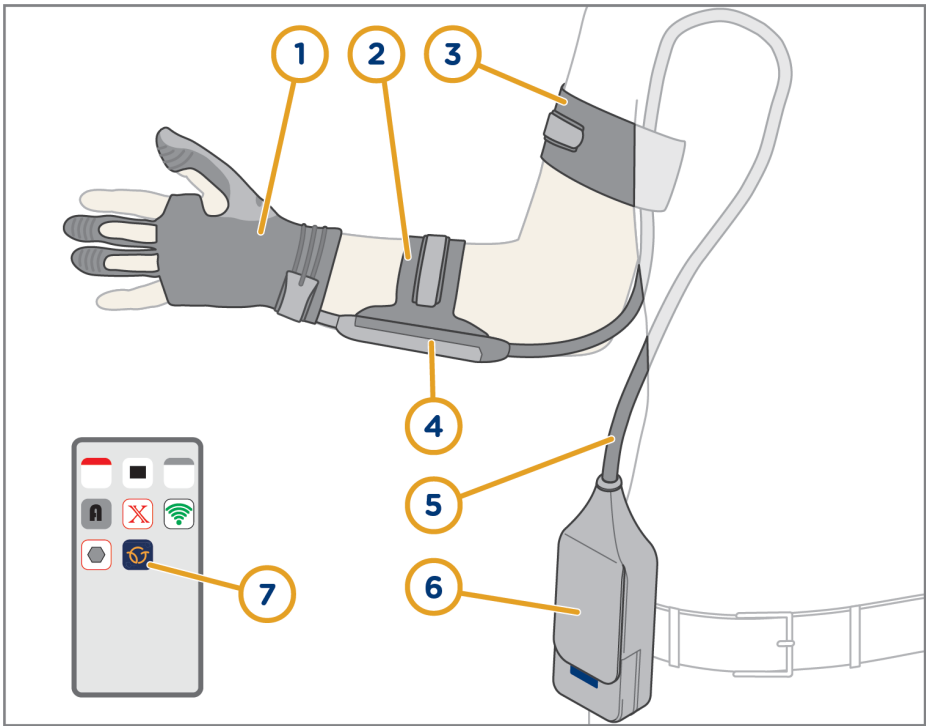


Figure 2: Carbonhand glove and control unit.

Item	Name	Function
1	Glove	Provides grip force
2	Lower arm strap	Keeps the connector attached to your arm
3	Upper arm strap	Keeps the cord attached to your arm
4	Connector	Connects the glove with the control unit
5	Cord	Transmits sensory data and force
6	Control unit	Controls grip force based on sensory data
7	Carbonhand App	Adjusts Carbonhand settings

1.5.2 Carbonhand glove

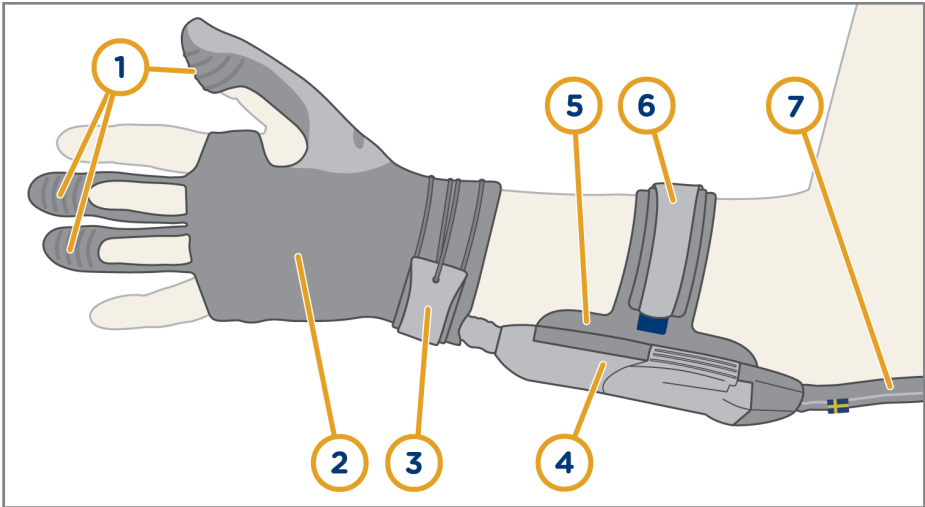


Figure 3: Carbonhand glove and connector.

Item	Name	Function
1	Sensors	Provide data to control unit
2	Glove	Provides grip force
3	Wrist strap	Keeps the glove in position
4	Connector	Connects the glove with the control unit
5	Connector attachment	Keeps the connector attached to the lower arm strap
6	Lower arm strap	Keeps the connector attached to your arm
7	Cord	Transmits sensory data and force

1.5.3 Carbonhand control unit

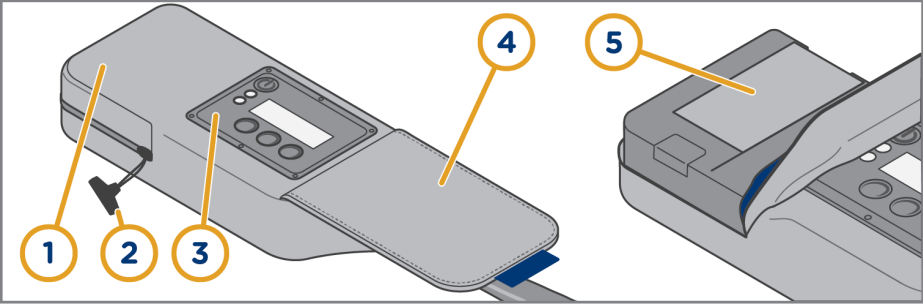


Figure 4: Carbonhand control unit.

Item	Name
1	Battery compartment
2	Zipper
3	Display
4	Lid
5	Batteries

1.5.4 Charger

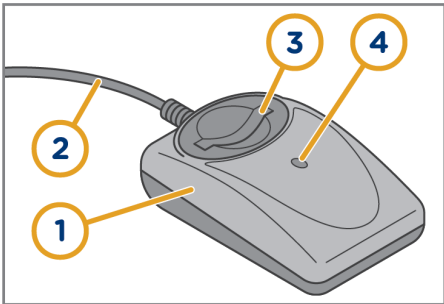









Figure 5: Charger

Item	Name
1	Battery charger
2	Electric cable
3	Battery slot
4	Charging indicator

1.6 Symbols

Symbol	Description	Symbol	Description
	Serial number		Keep the product dry
	Manufacturer's reference number		Do not discard as household waste.
	Manufacturer and date of manufacture		CE mark
	See user guide for information		

1.7 Labels



Figure 6: The label on the control unit.

1.8 Disposal

When Carbonhand becomes worn out, recycle it as electronic waste.

2. Safety

2.1 Warning, caution and note definitions



Warning! Risk of injury if instructions are not obeyed.



Caution: Risk of material damage if instructions are not obeyed.



Information for optimal use of equipment.

2.2 Warnings

- Do not use Carbonhand for tasks that can cause injury if Carbonhand malfunctions. For example, do not hold a heavy container with hot liquid in it.
- Use a protective inner glove in Carbonhand if you have cuts or scratches on your hand.
- Always follow the instructions of your doctor or therapist.
- Do not bend the cord or put heavy objects on it.
- Only use Carbonhand on the hand it is intended for.
- All service work must be done by an approved technician or the supplier.
- Do not do modifications to Carbonhand.
- Stop using Carbonhand if you feel that the use of it causes too great load or an unbalanced load on your body.
- In case of discomfort or pain, disconnect the connector or turn off the control unit.
- To shut down the Carbonhand glove, press and hold the **on/off** button or disconnect the connector.
- Only use Carbonhand with the supplied batteries.
- Do not short circuit the terminals of the battery.
- Do not expose the batteries to fire. This can cause an explosion.
- Do not expose the batteries to temperatures above 60°C/140°F.

- Do not dismantle the batteries.
- Do not use batteries that show signs of damage.
- Only use the charger specified in this guide.
- Keep batteries out of reach of children.
- Dispose of worn out batteries according to local regulation without delay.
- Unplug the charger when not in use. Pull the plug to disconnect the power cable. Never pull the power cable itself.
- Never use the charger with a damaged cable or if it has been dropped or damaged.
- Always keep charger and batteries clean.
- Do not dismantle the charger.
- If you have any problems with the charger while it is connected to the electric outlet, disconnect it from the power point immediately to turn off the power.
- It is not possible to guarantee that the charger or any other electric device does not cause interference with other electric devices. Contact the Carbonhand supplier if you encounter a problem.

2.3 Cautions

- Carbonhand is a medical device. Incorrect handling can cause discomfort.
- Keep Carbonhand clean at all times. Do not touch anything that can cause resistant stains.
- Keep Carbonhand away from liquids and small particles. They can cause damage if they enter Carbonhand.
- Do not allow metal objects other than batteries to touch metal parts in the charger connector. A short circuit can occur and damage the charger.

3. Before first use

When you start using Carbonhand, adjust the glove finger length and do a performance test.

3.1 To adjust the glove finger length

To ensure that Carbonhand works well, the glove should fit tight. Shorten or lengthen the fingers of the glove, as shown in the steps that follow.

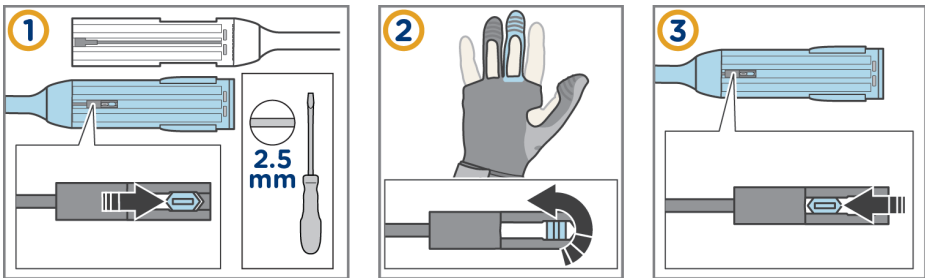


Figure 7: To adjust the glove finger length.

3.2 Performance test

1. Look at the Carbonhand glove. If it is worn or damaged, contact the supplier.
2. Put Carbonhand on your hand according to the instructions in [section 4.2](#).
3. Hold an object tightly with all your fingers. Make sure that Carbonhand adds extra force to your thumb, middle and ring fingers.
4. Release the object. Carbonhand should stop adding force to your fingers.
5. If Carbonhand does not add force when you hold, or does not stop adding force when you release, see [section 7](#) or contact the supplier.

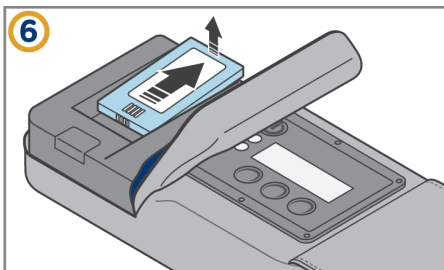
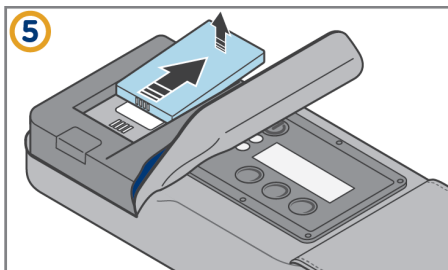
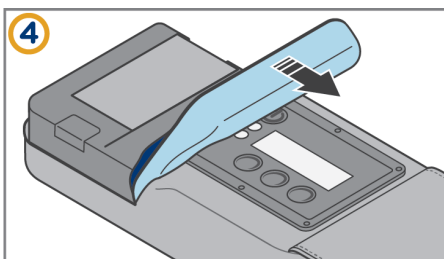
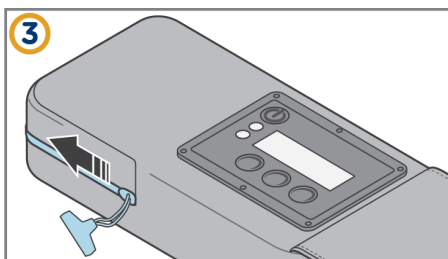
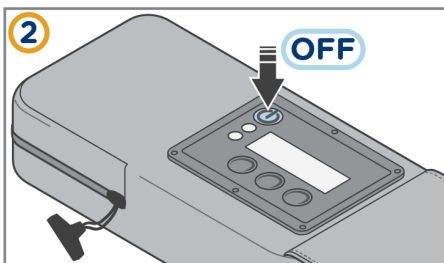
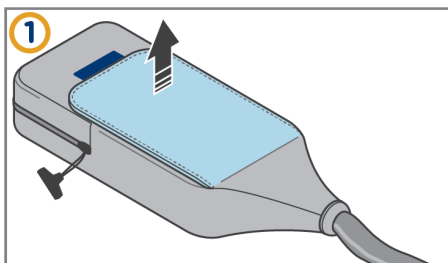
4. To use Carbonhand glove daily

4.1 Before use

4.1.1 To charge and insert the batteries



The charger becomes warm during use.



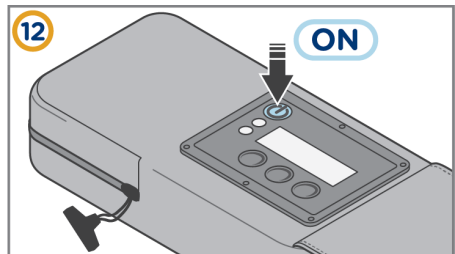
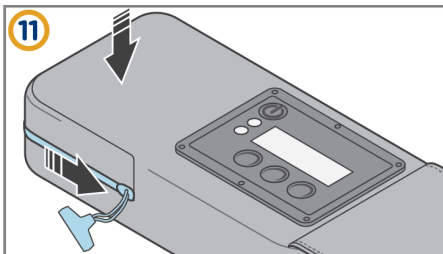
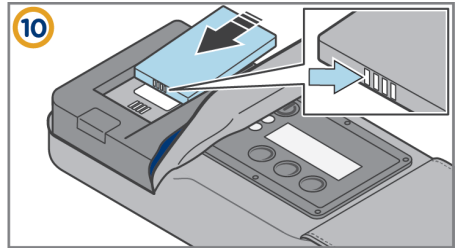
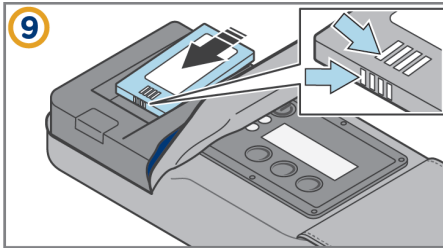
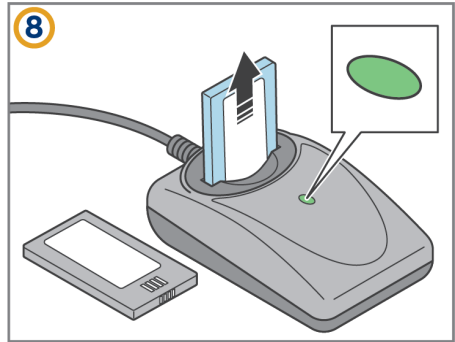
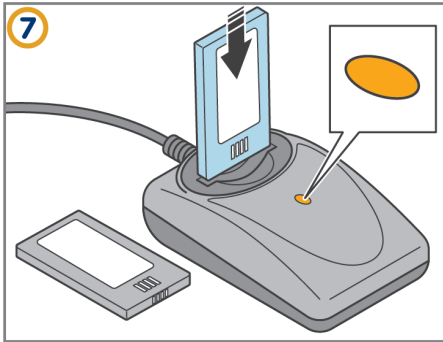


Figure 8: To charge and insert the batteries.

4.2 To connect and put on Carbonhand



Caution: The added force can be surprising for a new user. Make sure you familiarize yourself with this extra force before you start making full use of Carbonhand.

4.2.1 To connect the glove and the control unit

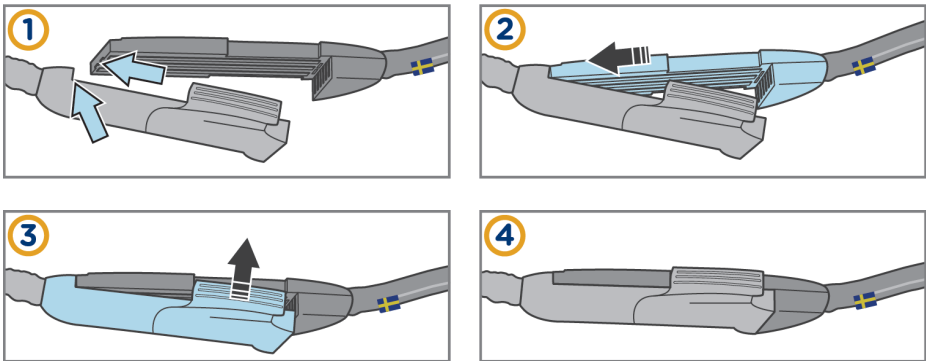


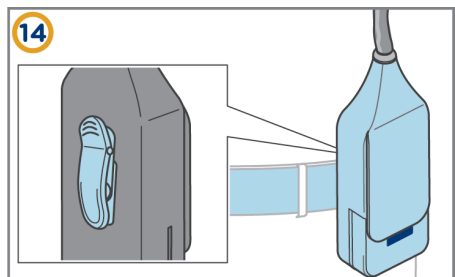
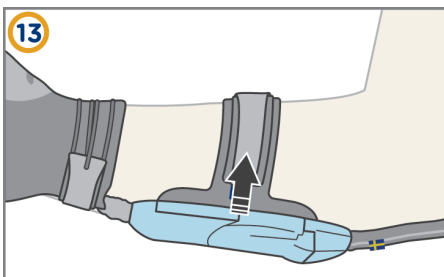
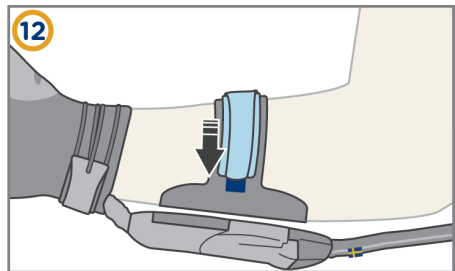
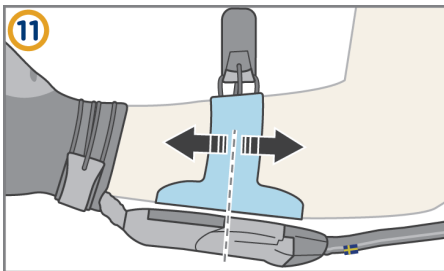
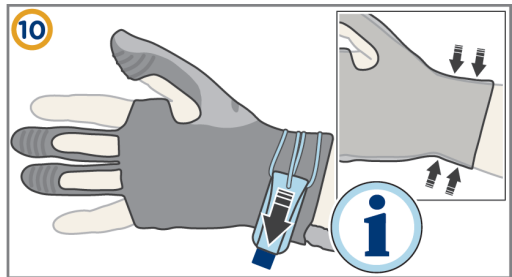
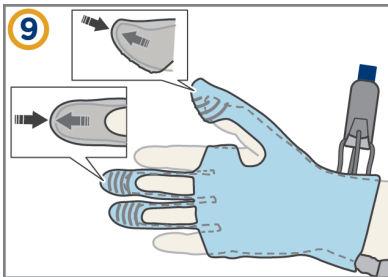
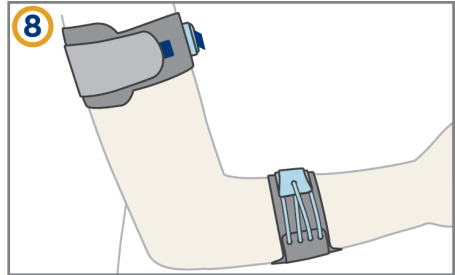
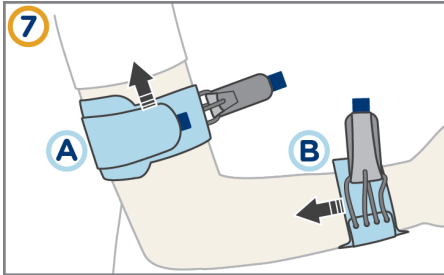
Figure 9: To connect the glove and the control unit.

4.2.2 Wash your hands and use hand sanitizer



Figure 10: Wash your hands and use hand sanitizer.

4.2.3 To put on and start Carbonhand



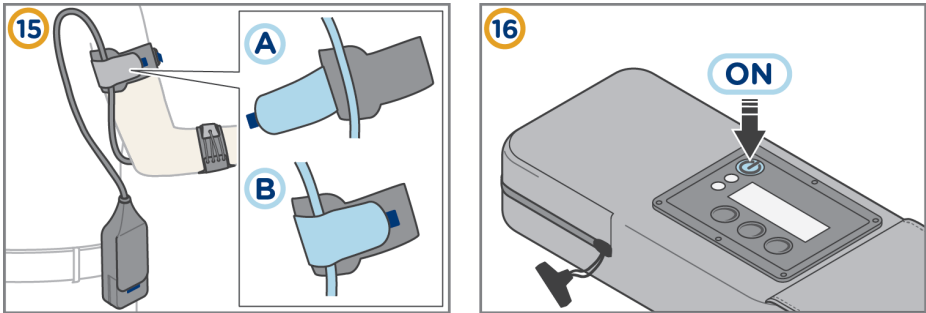


Figure 11: To put on and start Carbonhand

4.3 Protective gloves



Warning! Carbonhand does not provide protection. Use a protective inner or outer glove if it is necessary.



Use a thin glove of latex or cotton inside the Carbonhand glove to prevent direct contact and to keep the Carbonhand glove clean.



Use a protective glove on the Carbonhand glove to keep your hand warm and to keep your hand and the Carbonhand glove clean.

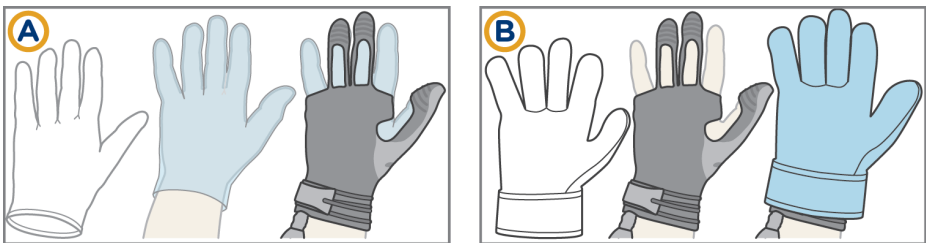


Figure 12: Optional protective glove (A) inside Carbonhand glove and (B) outside Carbonhand glove.

4.4 To shut down Carbonhand

Press and hold the **on/off** button to shut down Carbonhand.

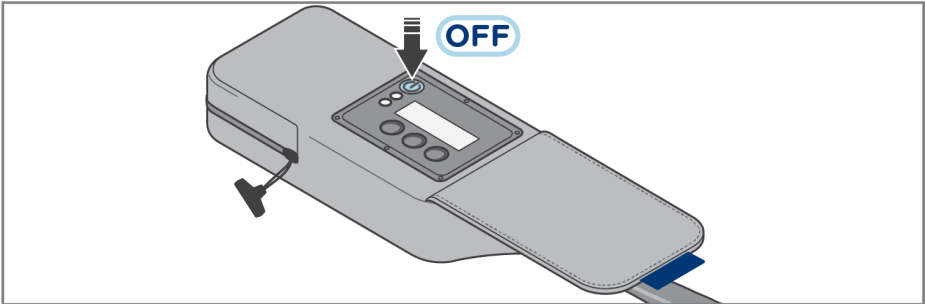


Figure 13: To shut down Carbonhand.



If the Carbonhand glove malfunctions, disconnect the connector to shut it down quickly.

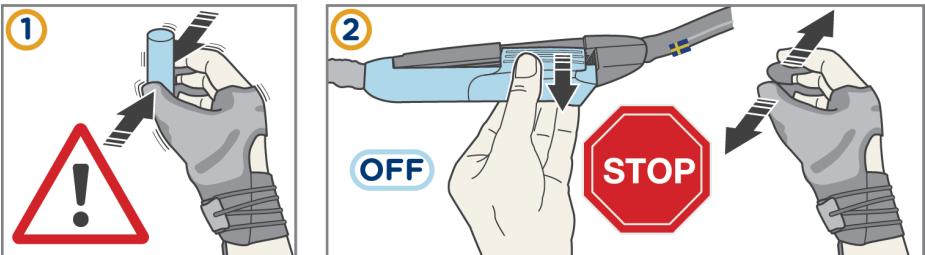


Figure 14: Emergency stop.

4.5 To change the glove

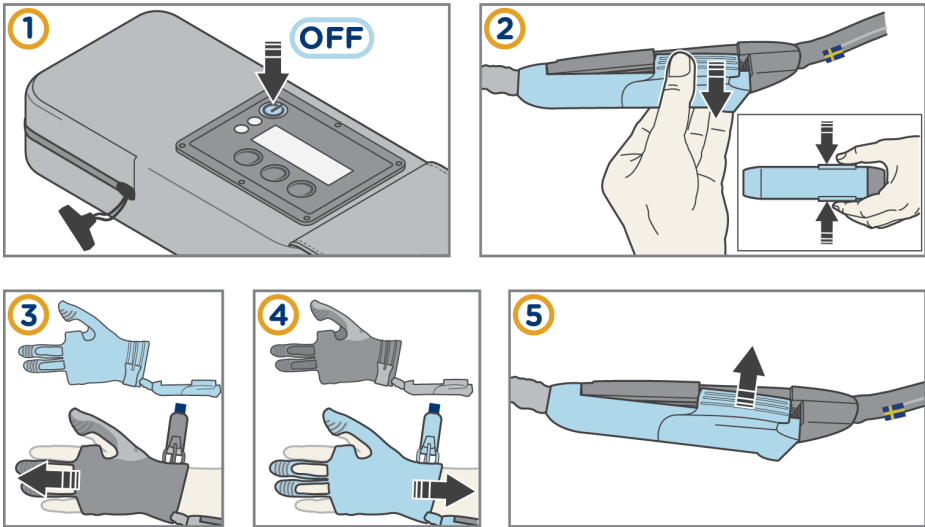


Figure 15: To change the Carbonhand glove.

4.6 To clean Carbonhand

1. Use a lint roller or soft brush to remove dust or other loose particles from Carbonhand.
2. Remove stains on the Carbonhand glove and control unit with a damp cloth. Do not make the glove wet, as this can cause it to malfunction.
3. Spray the Carbonhand glove and control unit with disinfectant to disinfect them.

4.7 Storage

Remove the batteries if you are not going to use Carbonhand for more than one week. When you keep the batteries in Carbonhand, they will slowly drain.

5. To use the Carbonhand control unit



Warning! Carbonhand is a medical device. Use it according to the instructions. Incorrect handling can cause discomfort.

Most settings on the Carbonhand are adjusted in the Bioservo Carbonhand App. Download the free app from regular app stores. Some settings are made directly in Carbonhand.

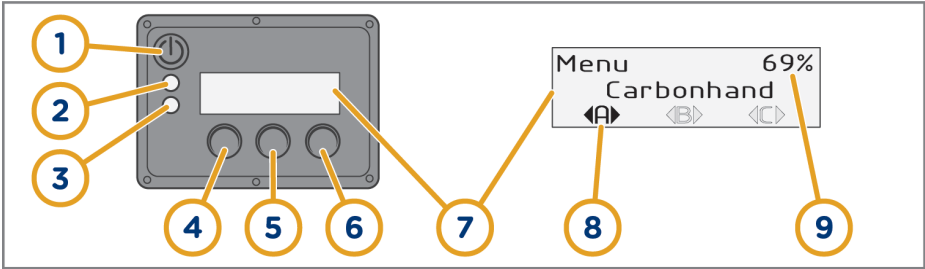



Figure 16: Display, buttons and indicators on the control unit.

Item	Name	Function	Function in Settings mode
1	On/off button	Press to start Carbonhand. Press and hold to shut it down.	Cancel or go back one step
2	Yellow/ blue indicator	See section 5.3	
3	Green/ red indicator	See section 5.3	
4	Button A	Press to select profile A	Go to the left
5	Button B	Press to select profile B	Select and confirm
6	Button C	Press to select profile C	Go to the right
7	Display	Displays information	
8	Active profile	Displays the current grip profile	
9	Battery level	Displays the remaining battery capacity	

5.1 Switch between profiles

Carbonhand has preset profiles that are accessed with the buttons on the control unit. Press button **A**, **B** or **C** to activate the profile you want to use, or activate a profile in the control unit menu.

 The profiles have names to identify them easily. You can also add your own profiles if you wish. You do this in the Carbonhand App.

Adjust the profile settings to make Carbonhand behave differently. Adjust the sensitivity, maximum force and other settings as described in [section 6](#). Carbonhand comes with pre-set profiles with different settings.

Name	Description
Johan soft	Imitates normal soft hand grip patterns and only applies force in the finger you press with.
Johan strong	Imitates normal strong hand grip patterns and only applies force in the finger you press with
Erik soft	Activates all the fingers. This gives you maximum scope to get a stable grip.
Erik strong	Activates all the fingers with a strong force . This gives you maximum scope to get a stable grip

5.2 Menu

5.2.1 Settings mode

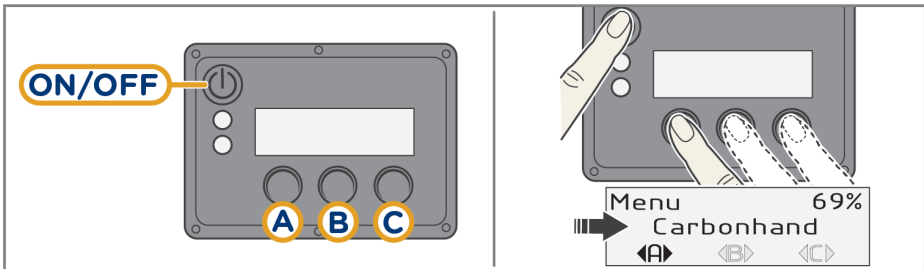
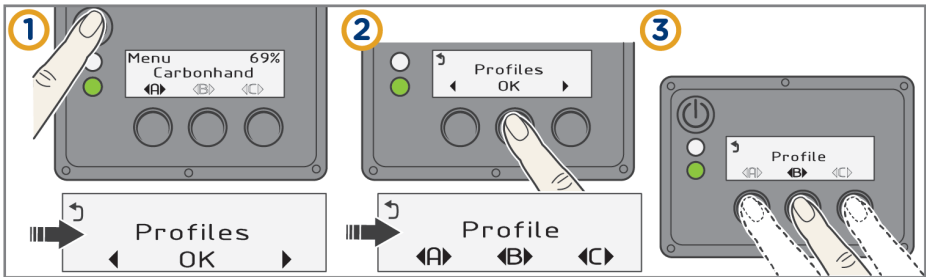


Figure 17: The Carbonhand unit display and buttons.

Use the control unit menu to make settings and to display information about the system. Launch the control unit in Settings mode to access the menu.

Press and hold button **A**, **B** or **C** and the **on/off** button to launch the control unit in Settings mode.

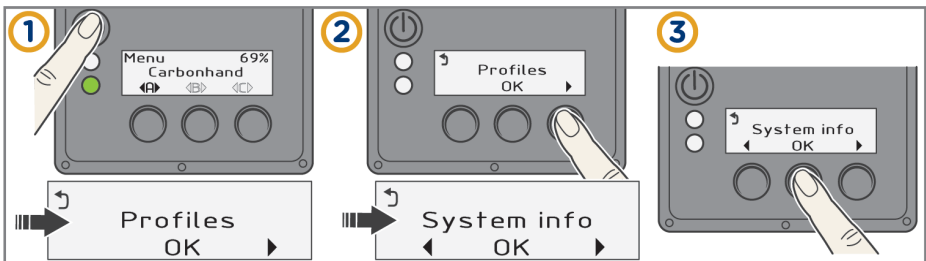
5.2.2 Profiles



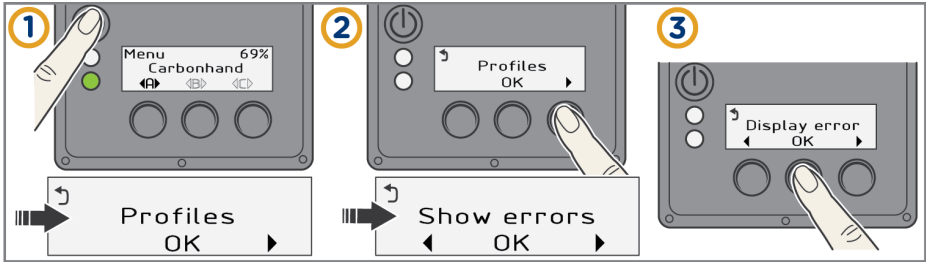
5.2.3 Wi-Fi

See [section 6.1](#).

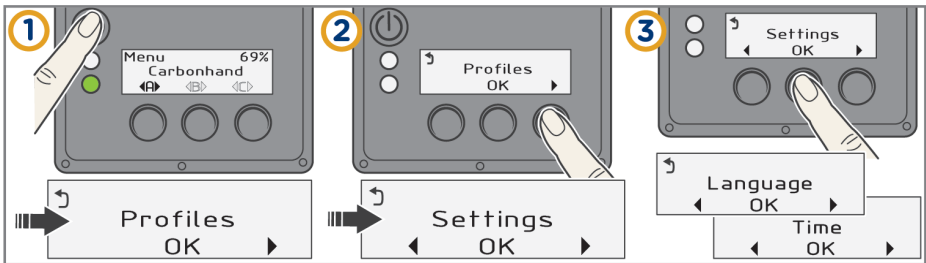
5.2.4 System info



5.2.5 Display error



5.2.6 Settings



5.3 Control unit indicators and error messages


Indication	Meaning
Green light, slowly pulsing	Carbonhand is ready to use.
Green light, rapid blinking	<ul style="list-style-type: none"> • The system is booting. • The system is turning itself off. • The connector is open. • The connector has been closed incorrectly. Open the connector, wait a few seconds and then close it again.
Red light, rapid blinking	The battery level is critically low. Carbonhand is about to turn off.
Yellow light, solid	Error warning. The system has detected that a component is not working as it should. Carbonhand can continue to be used, but will not perform as well. See section 5.2.5 .
Yellow light, slow blinking	Battery level is low. Charge the batteries.
Blue light, blinking	Carbonhand is ready for Wi-Fi connection.
Blue light, slowly pulsing	Wi-Fi connection established.


Display messages	Meaning
DISCONNECT GLOVE	The Carbonhand glove has been connected incorrectly. Disconnect the Carbonhand glove from the Carbonhand control unit and reconnect them.
CHARGE BATTERY!	The battery level is low. Charge the batteries as soon as possible.

5.4 Charger indicators

Light indicator	Meaning
Solid ORANGE	The battery charges.
Solid GREEN	Power on and no battery connected or battery fully charged.
Blinking RED	An error has occurred.

6. To use the Bioservo Carbonhand App


 Warning! Do not increase the power setting to maximum in one step. If it is set too high, you can feel discomfort. Gradually increase the power until it is right for you.

 Warning! Do not increase the sensitivity setting to maximum in one step. If it is set too high, it can be very difficult to open the grip. Gradually increase the sensitivity until it is right for you.

Configure the Carbonhand profile settings in the Bioservo Carbonhand App. Download the free app to your smartphone from the regular app stores.


6.1 To connect a smartphone to Carbonhand

1



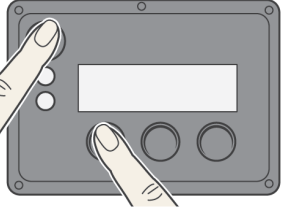
Bioservo Carbonhand app

2



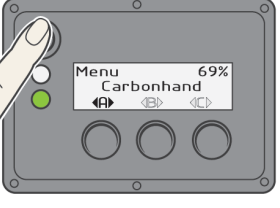
INSTALL

3




Menu Carbonhand 69%
◀ ▶

4




Profiles OK ▶

5



WIFI OK ▶

6



Carbonhand-XXX
OFF ON

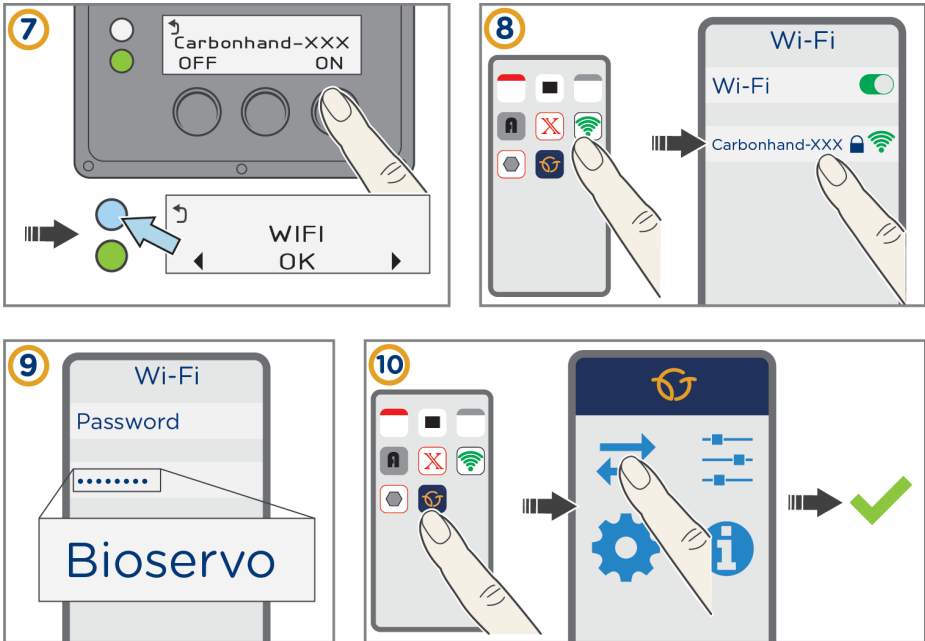


Figure 18: To connect a smartphone to Carbonhand.

6.2 To turn off Wi-Fi

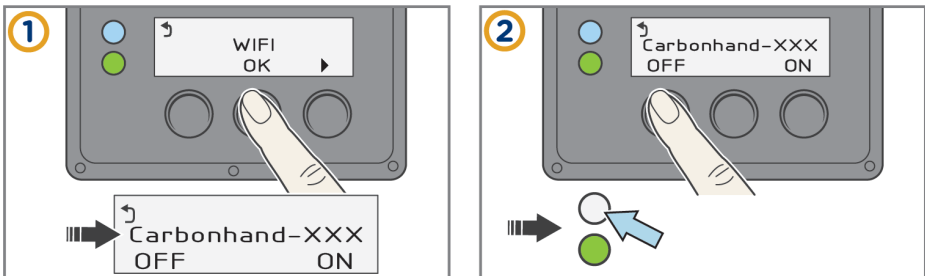


Figure 19: Turn off Wi-Fi to prolong battery life.

6.3 To assign a profile to a button

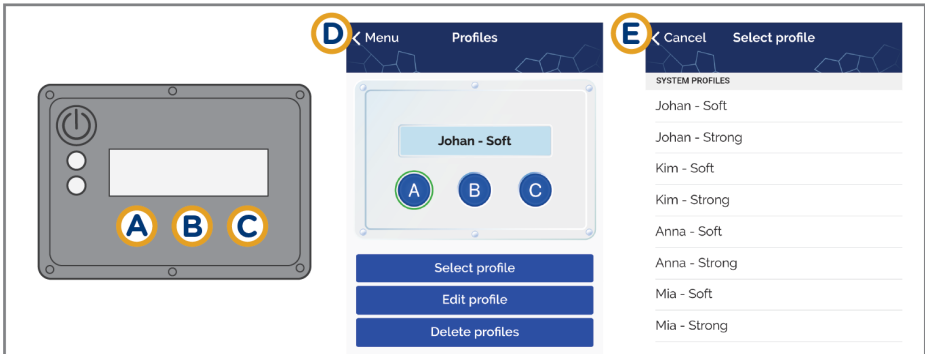


Figure 20: The Carbonhand App. To assign a profile to a button.



Make sure Simulation mode is disabled before you modify and save profiles. You can not save changes to profiles when in Simulation mode. Simulation mode gives you access to **Profiles** in the app, for demonstration purpose.

1. Switch Carbonhand on. Connect it to the Wi-Fi and to the Carbonhand App.
2. In the app, go to **Profiles**.
3. Select the button you want to assign a profile to (**A**, **B** or **C**). The selected button will be highlighted with a green circle (figure 20 D).
4. Go to **Select profile**. Select the profile you want to use with the activated button (figure 20 E).
5. Tap Menu to exit the Profiles menu.

6.4 To modify a profile

1. Switch Carbonhand on. Connect it to Wi-Fi and to the Carbonhand App.
2. In the app, go to **Profiles**.
3. Select button **A**, **B** or **C** to choose the profile you want to modify. The selected button will be highlighted with a green circle.
4. Go to **Edit profile**.
5. Select the feature you want to modify (F-I).
6. Adjust the setting to your preference. Carbonhand will react immediately to your modifications.

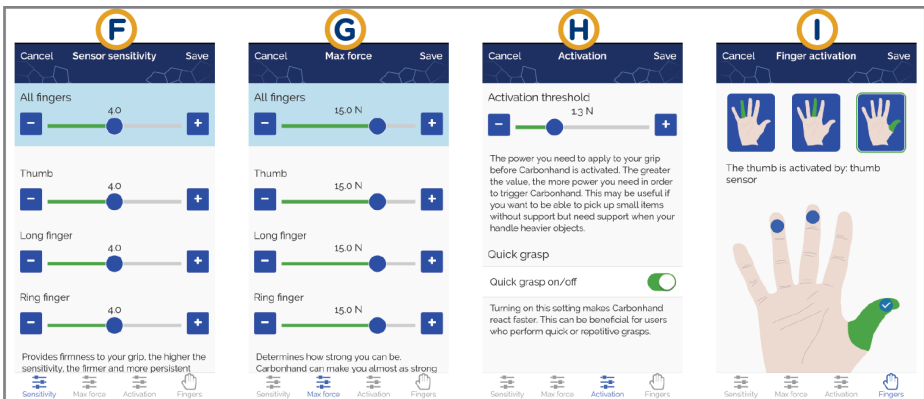


Figure 21: The Carbonhand App. The features that can be modified.

6.5 Sensitivity



Do not increase the sensitivity setting to maximum in one step. If it is set too high, the grip can become locked. Gradually increase the sensitivity until it is right for you.

1. Select **Sensitivity** (figure 21 F).
2. Slide the track bar to adjust the sensitivity of the finger sensors. You can adjust a single finger, or all three fingers at the same time.

6.6 Maximum force



At most, Carbonhand can give you approximately normal strength. However, this will depend on your own circumstances.

1. Select **Max force** (figure 21 G).
2. Slide the track bar to adjust the strength of the grip. You can adjust a single finger, or all three fingers at the same time.

6.7 Activation threshold



You can set an activation threshold for Carbonhand, so that Carbonhand only responds after a certain amount of force has been applied by the user.

1. Select **Activation** (figure 21 H).
2. Slide the track bar to adjust the necessary minimum effort to activate the grip.

6.8 Quick grasp



Quick grasp makes Carbonhand faster with short, repetitive gripping tasks.

1. Select **Activation** (figure 21 H).
2. Set the **Quick grasp** switch to the **on** or **off** position to enable or disable the quick grasp function.

6.9 Finger activation

1. Select **Fingers** (figure 21 I).
2. Select one of the three hand icons at the top of the display to select a finger. Select the sensors that will activate that finger.
3. Repeat step 2 for the other two fingers.

7. Troubleshooting

Problem	Solution
Carbonhand does not start.	Make sure that the batteries are fully charged and inserted correctly.
Nothing happens when I grip something.	The object you grip must be in contact with the touch sensors on the inside of the finger tips. If nothing happens when you put pressure on the sensors, ensure that the fingers are not disabled. See section 6.9 . If the problem persists, contact the supplier for service.
Carbonhand does not follow my intentions.	Contact the supplier for service.
The display shows an error message.	See section 5.3 .
The glove starts but does not respond.	Ensure that the glove connection has been closed.
I cannot close the glove connection.	<ol style="list-style-type: none"> 1. Straighten the cord so that it is not twisted. 2. Turn the control unit off. 3. Reconnect the glove. 4. Restart the control unit.

8. Replacement parts

Order replacement parts from the supplier.

Name	Product number
Battery	EZPack L
Battery charger	EZP06DC005
Upper arm strap	0017
Lower arm strap	0018

9. Technical specifications

9.1 Carbonhand specifications

Max added force	
Thumb	>8 N
Middle and ring fingers	>5 N
Batteries	
Type of batteries	3.7V Li-polymer
Number of batteries	2
Battery life	Approx. 8 hours, depending on usage
Dimensions	
Carbonhand glove	XS-XL Wide (XLW)
Carbonhand control unit	17 × 8 × 4 cm
Cord	70/80/90/100 cm depending on model
Weight	
Carbonhand glove	85 g
Carbonhand control unit	600 g
Total weight	700 g

Included outer materials	
Carbonhand glove	Polyester, polyamide, polyethylene, PTFE and silicone rubber.
Carbonhand control unit	Polyester, polyamide, acetal and polyurethane.
Ambient temperature	
Use	-5°C to +30°C
Storage	-35°C to +50°C
Ambient humidity	
Use	10% to 80% relative humidity, non-condensing
Storage	5% to 90% relative humidity, non-condensing
Charger	
Type	EasyPack Desktop Charger from RRC
Input voltage	100 to 240V AC 50/60Hz
Input current	Max 0.2A (100V AC)
Surge current	Max 80 A (230 V AC @25°C)
Total weight	122 g
Output voltage	4.2 V DC
Output current	0 to 1.0 A
Output power rating	Max 6 W
Operating temperature	0 to +40°C
Storage temperature	-40 to +70°C

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Issue: 1.00



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