ExoAtlet® - II

User's Manual

이 사용설명서는 사전 통보 없이 제품의 개선을 위해 개정될 수 있습니다. 이 사용설명서의 이미지는 실제 제품과 다를 수 있습니다.

Contents

1. About User's Manual

1.1. General Information

This document contains proprietary information protected by copyright.

This user manual is provided with the Powered Lower Extremity Exoskeleton (ExoAtlet®-II).

This user's guide explains how to use and precautions, and explains the possible hazards that you should be aware of and be aware of while using the Powered Lower Extremity Exoskeleton (ExoAtlet®-II).

If you have any questions about the product or need more information about the product, please contact the Customer Service Center using the contact information.

1.2. Warranty

The contents of this document are subject to change without notice.
The manufacturer is not responsible for any resulting problems, losses, or damages that result from the use of other performance specifications or other information other than those contained in this manual.

1.3. Revision history

The document and revision numbers shown in this document represent the current version.
When there is a significant change in the document number or the technical content of the document, the version number may change.

1.4. Safety sign

Symbols for safety signs are shown on the enclosure, on the packaging of the product and in this manual.

Symbols provide users with important information such as caution, warning, and prohibition. Carefully read the symbols shown below and make good use of this information for product use and storage.

 Caution	**Caution**	This safety sign means caution. This indicates a potentially hazardous situation which, if not avoided, could result in minor injury. It can also be used to warn of unsafe use or potential damage to equipment.
 Warning	**Warning**	These safety signs indicate warnings. This indicates a potentially hazardous situation which, if not avoided, could result in serious injury, including death or serious injury.
	**Notice**	This safety label indicates mandatory action. This means that the user or patient must follow mandatory instructions.
	**prohibition**	This safety label indicates general prohibitions. This is a mandatory requirement that you or your patient must obey.

* When it is deemed necessary, the manufacturer is not obligated to apply the same specification changes as those already sold in relation to the improvement to improve the performance of the product.

2. Safety sign

2.1. General instructions

	Notice
1	Pilot recommended requirements - Use for patients over 18 years old. - Please use it for the use of patient whose height is 160 cm ~ 190 cm. - Please use it for patients weighing less than 100 kg.
2	Pilot Dress Recommendations - It is recommended to use sneakers with straps or Velcro. - Put on comfortable clothes that fit well. - When using an insole, the pilot must use a pair of 1-2 cm size (10-15 mm) shoes that is larger than the pilot's shoe size. We recommend shoes with removable insole. - Do not wear boots or shoes with heels. - It is recommended to use gloves for weight training or cycling. - We recommend using an armband to prevent wrist injuries.

"Pilot" means the user(patient) wearing an exoskeleton.

2.2. General caution

Caution	Precautions before use
1	If you use this unit, be sure to read and understand the instruction manual.
2	Make sure that the power of the main unit and the tablet PC are charged and that the dedicated software of the product is installed and operating properly on the tablet PC.
3	Please use under the prescription and guidance of a specialist.
4	It is recommended to use in an independent space where it is not distracting.
5	Before using this unit, please use it in a psychologically stable condition.
6	Make sure that the battery of all devices (body, smart crutches, tablet PC) is fully charged.
7	Arbitrary disassembly and replacement of internal parts is not permitted. All information regarding the repair and replacement of the equipment shall be provided to our A / S team and carried out by our designated personnel.
8	Use accessories, adapters, and cables that are not provided by our company, which may increase the electromagnetic radiation or reduce the electromagnetic immunity of this unit, so please be sure to connect the components supplied by us. .
9	When not using the product, turn off the power and store it in an environment suitable for the storage environment.
10	Other devices may malfunction due to the electromagnetic interference generated by this unit. In addition, this unit may malfunction due to electromagnetic interference from other equipment (equipment that emits RF energy such as an electric cauter or electrosurgical instrument). Do not use it near other devices.
11	This device is a body wearable medical device that can be worn on the body. When transporting, please put it in designated storage box and carry it with care. Failure to do so may result in damage or malfunction of the unit.
12	Do not disassemble or repair or modify it. Only qualified technicians can inspect and repair the product. If the product is disassembled at will, the service will not be available within the warranty period. If technical Support necessary, contact your nearest customer support center.

Caution	Precautions when using
1	Use the exoskeleton on a flat surface.
2	Do not tap or touch the moving parts of the exoskeleton during operation.
3	Do not use the equipment if the parts are damaged.
4	Be careful not to let water or foreign matter come into the exoskeleton or into the inside of the exoskeleton .
5	Avoid places with high temperature, dust, and salt, and use in a well ventilated place.

Caution	Storage Precautions
1	Do not expose the unit to direct sunlight, heat sources, water, high humidity, or mechanical shocks. Please keep in the storage environment conditions specified in this document.
2	Do not store it in a place where water or foreign matter can enter the equipment when storing it.
3	Do not subject the product to strong impacts such as falling over or stepping on the product. It may cause malfunction.

Caution	Charging Precautions
1	You must connect the appropriate power source to charge the device. Do not disassemble the unit for service or repair while in use. For safe use, the Tablet PC and Adapter must be periodically inspected and replaced in case of failure.
2	Be careful not to touch the equipment or the cord with liquid such as water. It may cause electric shock.
3	Be careful not to damage the power cord and the cables of the adapter. If it is damaged, remove the cord immediately and ask the seller for repair.
4	Do not wrap or cover the product with a fabric such as a blanket, cloth, or cloth during charging. It may cause fire.

2.3. General warning

 Warning	Warning
1	If any abnormality is found in the device or patient, stop operation immediately, take the patient to a safe condition and consult the manufacturer or specialist.
2	Depending on the patient's pelvis, thigh, calf, and foot size, adjust the exoskeleton area to suit.
3	After using the exoskeleton, check the patient's body for scratches or injury.
4	All movements of the exoskeleton begin after three beeps. When the beep sounds, the pilot must be ready to move.
5	Do not wear the exoskeleton too tightly.
6	Do not use hard objects in your pocket.
7	Do not store any part of the equipment in places that are too cold (-20 ° C or less).
8	When connecting or disconnecting power to the unit, do not combine or remove it with wet hands.
9	Do not use the product for any purpose other than its intended use. Misuse can cause injury to the pilot (or patient).
10	Do not use liquids or detergents directly on the exoskeleton when cleaning the machine. (Clean according to the specified cleaning and storage methods.)
11	The battery requires regular inspection or replacement, and if the ME equipment is not used for a certain period of time, it is requested by the manufacturer to remove the battery or to be inspected by the manufacturer prior to re-use.

2.4. General prohibition

	prohibition
1	Do not use patients who can not normally communicate with their doctor or physical therapist due to cognitive and language disorders.
2	Do not use a patient with a muscle contracture in the hip, knee or ankle, or a patient with severe muscle cramps in the leg (Modified Ashworth Scale Grade 3 or higher).
3	Do not use a patient with low bone density or osteoporosis [BMD (t≥ -3.5)].
4	Do not use in patients with fractures or incomplete bone joints in the spine, pelvis and lower extremities.
5	Do not use in patients with severe arthritis, acute arthritis or synovitis after total or partial lower extremity joint formation.
6	Do not use in patients with dermatological conditions such as hip, leg, etc., where fixing devices are worn.
7	Do not use patients with orthostatic hypotension, essential hypertension, or conditions in which blood pressure can not be controlled.
8	Do not use in patients with myocardial infarction, angina, or ischemic heart disease within the last 6 months.
9	Do not use tachycardia, bradycardia, arrhythmia, or other patients with uncontrolled cardiac function.
10	Do not use for patients whose diabetes is not controlled.
11	Do not use in patients with infectious diseases or other serious complications.
12	Do not use patients with paralyzed whole bodies.

If you have other injuries or illnesses, please consult your doctor before using the device.

3. Main functions and appearance, specifications

3.1. Intended Use

The ExoAtlet®-II is a gait training device that improves gait performance of patients with neurological or muscular injury, disease or disability, rebuilds muscles, and restores joint motion.

The ExoAtlet®-II is a battery-powered, bionic, lower-limb orthosis system designed to assist a patient with a walking disability (neurogenic, muscular, or osseous in origin) regain lost motor function by manipulating the legs through a normal walking pattern during ambulation including stand, walk, ascend and descend stairs. The system includes an exoskeleton structure made of metal with electric motors, mechanical actuators, an on-board computer, controls; it is typically strapped to the patient over clothing. The ExoAtlet®-II is intended for multiple-patient use, typically in a controlled clinical setting (e.g., gait lab, rehabilitation centre) under professional supervision.

3.2. Operating principle

Normal gait movements rely on the functional integrity and interactions of sensory neural networks at the spinal and vertebral levels. This complex system can be hampered by a number of neurological conditions, such as stroke or spinal cord injury (SCI), in limited mobility or gait, which is a major challenge in nerve rehabilitation. Intensive, iterative task-based training can lead to beneficial nerve regeneration, improve functional recovery, and improve end results.
Treadmill training and gait machine training, which partially support weight or not support, have been used to improve walking after SCI and SCI, among which repetitive walking exercises and more active involvement of pilots An exoskeleton gait training device is designed to allow induction, voluntary, autonomous motion modes and various training programs.

This product is designed for walking (walking) with deceleration (flexion) and increase (extension) extension of the angle between the two joints of the Knee joint around the hip joint of the human body Training equipment. It consists of a control box that controls the physical energy by controlling the electric left and right gait joints, a smart control device for start / stop control, a built-in rechargeable battery, and crutches, etc..

3.3. Intended patient population and use environment

Powered Lower Extremity Exoskeleton (ExoAtlet®-II) is designed for adults 18 years and older who have no mental disability and can read and understand the characters on the display screen. They can be used by a clinic or hospital under the prescription and guidance of a specialist.

This product is not intended for use as a rehabilitation device. The pilot is for a group of patients with at least 4/5 (Harrison) upper limb movement in both arms and is performing a walking exercise at the rehabilitation center under the supervision of a trained physical therapist.
It is used to improve the gait function of patients with neurological or muscular injuries, diseases or disabilities, to rebuild muscles, and to restore joint motion.

3.4. Eligibility

This product may only be handled by a professional trainee (such as a physical therapist) or an expert assigned to the task. The user of the product must observe the following when handling.

3.4.1. You must be a certified professional (physiotherapist, doctor, etc.) who can read, understand, and perform the user's manual.
3.4.2. Be familiar with the basic structure and functions of the product.
3.4.3. You should be able to detect abnormal behavior and take action if necessary.

3.5. Frequently used functions

Primary function	SECONDARY FUNCTION
Exoskeleton: - Execution of the rehabilitation exercises	**Back:** - Mechanical connection of the right and left femoral drive. - Fastening of the spine-sacral corset. - Fastening of shoulder straps. - Battery placement. - Location of the central microcontroller. Location of the central computer module - Placement of handles to insure the patient with an accompanying person (assistent). - Placing control buttons exoskeleton, incl. emergency stop buttons. - Placement of indicators of the state of the exoskeleton. - Adjusting the height of the straps. - Adjust the width of the pelvis. - Adjustment of the angle of lead / hip reduction. - Supporting element. **Thigh:** - Mechanical connection with back and shin. - Flexion / extension of the legs of the patient in the knee and hip joints - Adjust the length of the thigh of the exoskeleton. - Fixation of the thigh bindings. - Adjustment of the position of the femoral mounts along the sagittal axis (forward-backward). - Mounting the sciatic harness. - Supporting element. **Shin:** - Mechanical hip joint and exoskeleton foot. - Adjustment of the length of the shin of the exoskeleton. - Fixation the shin bindings. - Adjustment of the position of the shin bindings along the sagittal axis (forward-backward). - Adjustment of the position of the shin bindings along the front axis to the left and to the right). - Providing a hinged connection with a stack of exoskeleton with adjustable elasticity. - Supporting element. **Foot:**

Primary function	SECONDARY FUNCTION
	- Mechanical connection with the exoskeleton shin. - Fastening the patient's foot (together with shoes). - Support function. **Central computer module software:** - Monitoring the state of all electronic modules; - Database management; - Setup trajectories for drives; - Update firmware of all electronic modules; Calculation of statistical information about the current **training;** - Connection with exoskeleton control modules via Bluetooth; - Web-interface for configuring the settings of all exoskeleton modules, displaying the status of modules, connecting new Bluetooth control modules, downloading firmware, a command for service launch of the exoskeleton. **Central microcontroller software:** - Integrity control of the onboard computer network; - Control of the state of all electronic modules; - Accept and processing commands to control the movement of the exoskeleton from the central cleaning module; - Generation of control signals for engine control modules; - Control of the means of light and sound indication of the skeleton; - Processing of button presses exoskeleton. **Engine control module software:** - Receiving data for controlling the drive motor from the bus interface from the central microcontroller; - Drive motor control; - Functions of drive control electronics self-testing; - Indication of module operation; - Update firmware to a new one, received from the central device.
Set of the belts: - Fixation of the patient in the exoskeleton.	**Thigh fixing kit:** - Fixation of the patient's thigh. - Adjustment to the patient's thigh. **Shin fixing:** - Adjustment to the patient's shin.. **Lumbosacral corset:** - Fixation of the lumbosacral region of the patient.

Primary function	SECONDARY FUNCTION
	- Adjustable to the waist circumference of the patient. - Adjusting the depth of the pelvis (due to replaceable liners) **Shoulder straps:** - Fixation of the thoracic part of the patient. - Adjustment for different patient growth **Sciatic band:** - Holding the torso from falling through with a sciatic strap while standing up. **Set of insoles:** - Function of the support surface for the patient's foot. - Adjusting the size of the foot
"Smart" crutch: - support - remote control	**Crutch:** - Support function for maintaining balance **Remote Control:** - Management of exoskeleton - System status indication **"Smart" crutch software:** - Connect to the exoskeleton via the Bluetooth module; - Receive and display information about the state of the skeleton, the level of battery power and supported models of traffic; - Giving the user the ability to select by the control buttons the necessary motion model and send an exoskeleton command to launch the desired motion model.
Tablet PC: - Display of information on last training - Exoskeleton management, execution training - System status indication - Software update via Web-based interface	Android app: Bluetooth connection to the exoskeleton; Obtaining information about the state of the exoskeleton, the level of charge of its batteries; Receiving and displaying the training base on the exoskeleton; establishment of new training; an integer for changing the exoskeleton poses, triggering and motion remains.

3.6. Specifications

Product name	Powered Lower Extremity Exoskeleton
Model name / Type Ref.	ExoAtlet®-II / EA2010
Protection against electric shock	INTERNALLY POWERED, B type applied part
Applied parts	Corset and strap for fixing the body
Device classification	Class IIa (According to council Directive 93/42/EEC AnnexIX Rule 9)
Packing unit	1 set
Expected Life Time	5 years
Rated Power	1. Main Body - Charger Input: 100-240 V~, 50-60 Hz, 3 A - Input Power: 29.4 V-, max. 7.0 A - Rechargeable batteries: 25.55 V-, 5700 mAh x 2PCs 2. Remote control crutch - Charger Input: 100-240 V~, 50-60 Hz, 0.2 A - Input Power: 5.0 V-, max. 1.0 A - Rechargeable battery: 3.63 V , 2600 mAh
Communications	Bluetooth Ver. 4.0, Wifi Ver. 802.11 b/g/n
Dimensions of outer shape	1. Main body: 43~80 cm(W) x 27~50 cm(D) x 110~160 cm(H) 2. Crutch Size: 74 ~ 94 cm
Weight	Main Body: Appr. 25 kg, Crutch: Appr. 615 g
Classification of installation and use	Body-Worn(신체착용형)
Maximum continuous operating time	< 4 hour
Charging time	< 4 hour(At 100% full charge.)
Exercise range specification	1. Hip joint - Flexion 108°, Extension 21° - Adjustment of abduction angle 0°-3° - Adjustment of adduction angle 0°-4° 2. Knee joint - Flexion 112°, Extension 2° 3. Ankle joint - Plantar flexion 25°

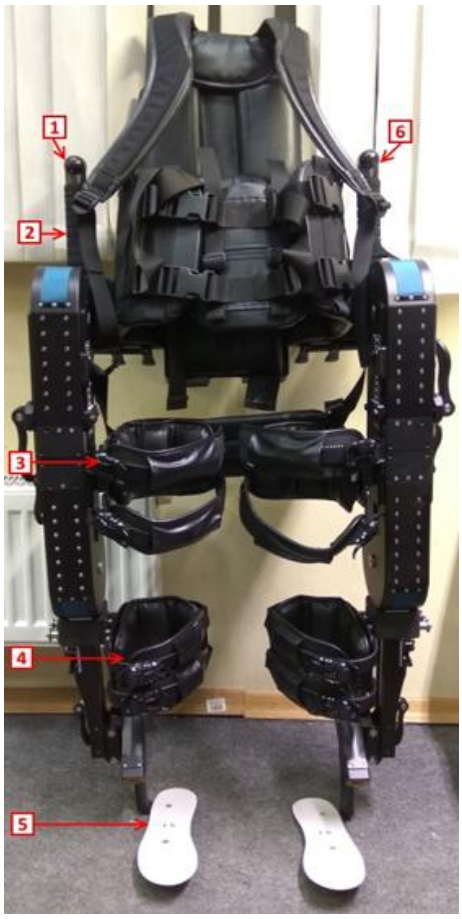
	- Dorsiflexion 15° - Adjustment of eversion angle 0°-5° - Adjustment of dorsiflexion limit 0°-15°
Tablet PC requirements	Mobile software is compatible with tablet PC that meet the following specifications. - Operating system: Android v5.1 (Lollipop) or higher - CPU: Quad core, 1.5 Ghz or higher - RAM / Internal memory: 1.5 GB / 16 GB or higher - Display resolution: 1280 x 800 (16:10) - Blue-tooth version: v4.0 - Wifi version: 802.11 b/g/n - Adaptor set: Certified EN/IEC 60950-1

3.7. Applied safety standards

IEC 60601-1:2012	Medical electrical equipment - Part 1: General requirements for basic safety and essential performance
IEC 60601-1-2:2014	Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances - Requirements and tests
IEC 60601-1-6:2016	Medical electrical equipment – Part 1-6: General requirements for safety – Collateral standard :
IEC 62304:2008 EN 62304:2006/AC:2008	Medical device software - Software life-cycle processes
IEC 62366:2007 EN 62366:2008	Medical devices - Application of usability engineering to medical devices
EN ISO 15223-1:2016	Medical devices - Symbols to be used with medical device labels, labelling and information to be supplied - Part 1: General requirements
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
IEC 62321:2008	Electrotechnical products - Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)

3.8. Appearance and function

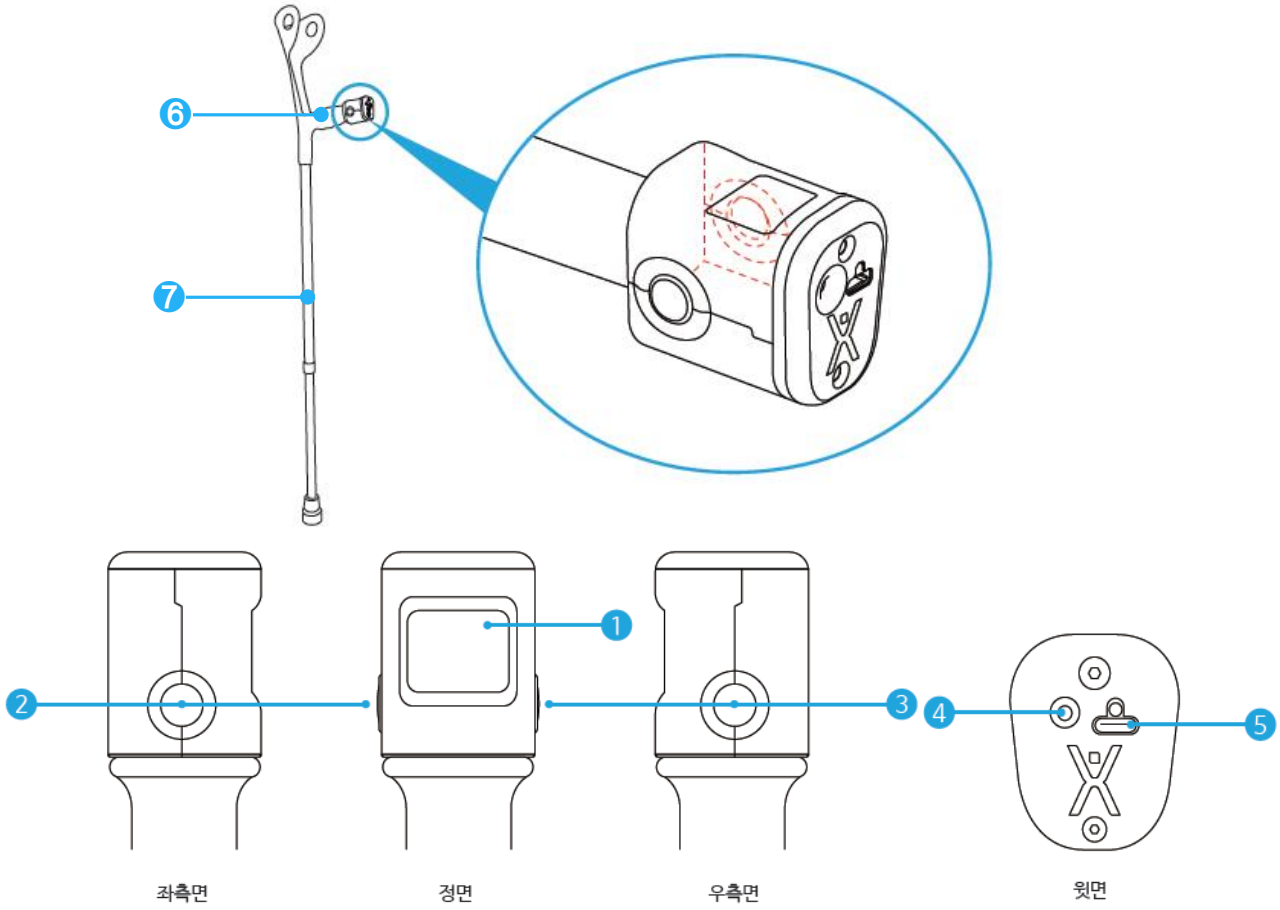
3.8.1. Main Body



No.	Name	Function
1	Emergency stop button	In the event of an emergency, the button can be used to stop the operation of the device.
2	Handle	It is a handle that an assistant can hold when supporting the product.
3	Thigh fastener.	It is a device that can fix the user's thighs.
4	Shank binding.	It is a device that can fix the user's calf.
5	Insole	Secure the shoes with the sole that is adjusted to fit the foot size of the pilot.
6	Stop button	When the button is pressed during operation with the button for temporarily stopping the operation of the machine, the machine stops in the state where both feet are standing upright.
7	Shoulder straps	It is worn on the shoulder with a strap that can fix the user's upper body.
8	Corset	It is worn on the body as a belt that can fix the body of the user.
9	Cam levers	Adjust the thigh, calf and pelvic size to the correct position for your body and turn the lever to fix it.

3.8.2. Remote control crutch

: A left / right 1 set is provided as a crutch for supporting the patient's body.

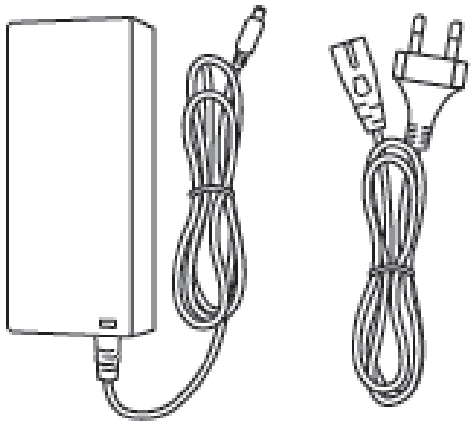


No.	Name	Function
1	display	A screen to check the mode or connection status of the product.
2	Run / Stop button(Left button)	Button used to instruct the operation of the product or to stop the device in operation.
3	Mode change button (Right button)	Button to select the operation of the product.
4	Power button	Button to turn on / off the product power.
5	Charge connector	Port used to charge the product.
6	handle	A handle that can be held by the user.
7	support fixture	Supports to support the user's load or adjust the length.

3.8.3. Components

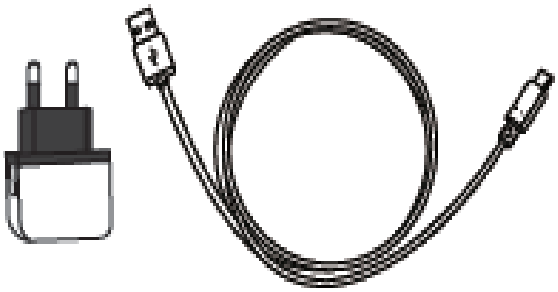
1) Body charger set (I-type socket)

: Adapter set for charging the main body battery (complied with EN/IEC 60950-1)



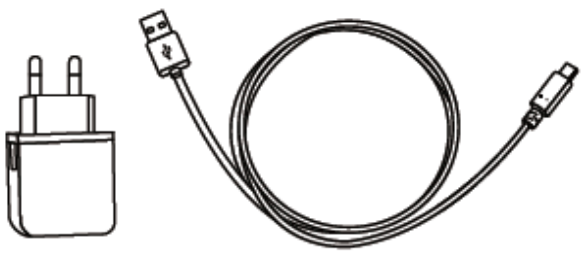
2) Smart car battery charger set(C-type USB)

: Adapter set to charge the smart crutches battery (complied with EN/IEC 60950-1)



3.8.4. Sold separately

1) Tablet PC set: A portable PC that installs an application to run products, and includes an adapter. (complied with EN/IEC 60950-1)



3.9. Operating Environment

- Temperature: 10 ℃ ~ 40 ℃
- Relative humidity: 20 % ~ 80 % (Non-condensing)
- Pressure: 70.0 KPa ~ 106.0 KPa
- Altitude: Less than 2,000 m

3.10. Storage Environment

- Temperature: +5 ℃ ~ 40 ℃
- Relative humidity: ≤ 80 % (Non-condensing)
- Pressure: 50 kPa ~ 106 kPa

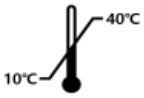
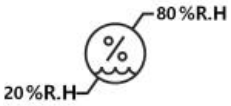
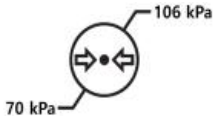
3.11. Transportation condition

Caution	
1	Before carry the device, separate all components and carry them in the designated box packed with buffer.
2	Please carry more than one person while holding the bottom of the packing box with both hands.
3	Transportation Environment - Temperature: -30 ℃ ~ 60 ℃ - Relative humidity: ≤ 90 % (Non-condensing)

3.12. Symbol (Include safety sign)

The following symbols describe the symbols used in the accessory document, product exterior, and product packaging. Read the product carefully before use and follow the instructions.

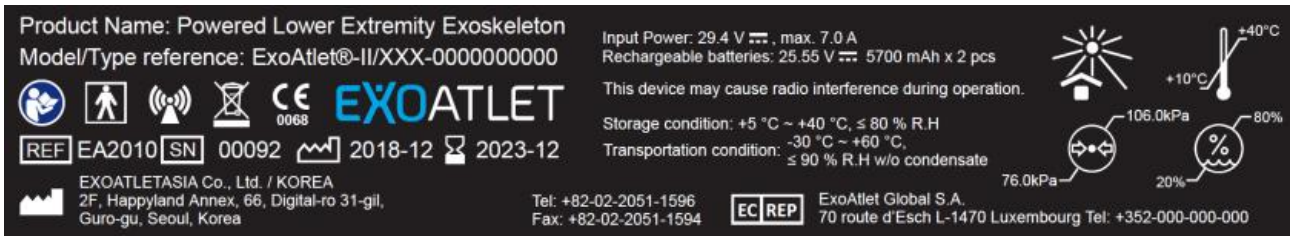
No	Symbol	Explanation	Position
1		Serial number	- Product label and Packaging label
2		Catalogue number	- Product label and Packaging label
3		Date of Manufacture	- Product label and Packaging label
4		Manufacturer	- Product label and Packaging label
5		Use-by date	- Product label and Packaging label
6		TYPE BF APPLIED PART	- Product label and Packaging label - User's manual
7		Generation of RF Electromagnetic Wave Energy	- Product label and Packaging label - User's manual
8		Ban of general disposal (Disposal of designated disposal facilities)	- Product label and Packaging label - User's manual
9		Refer to instruction manual/booklet (Safety sign)	- Product label and Packaging label - User's manual
10		General warning sign (Safety sign)	- User's manual

No	Symbol	Explanation	Position
11		General mandatory action sign	- User's manual
12		Ban (Safety sign)	- User's manual
13		The risk of fingers can pinch.	- Moving part
14		Direct current (D.C.)	- charge terminal connection of device side - Product label
15		Can be recycled as corrugated paper	- Product packaging
16		Keep dry	- Product packaging
17		Keep away from sunlight	- Product packaging
18		Temperature limit (10℃ ~ 40 ℃)	- Product label
19		Humidity limitation (20% ~ 80 %)	- Product label
20		Atmospheric pressure limitation (70kPa ~ 106 kPa)	- Product label

No	Symbol	Explanation	Position
21		Direction of load	- Product packaging
22		Fragile, handle with care	- Packaging label
23		Stand-by	- On the product's power button
24		Authorized representative in the European Community	- Product label and Packaging label
25		EU CERTIFICATION MARK	- Product label and Packaging label - User's manual

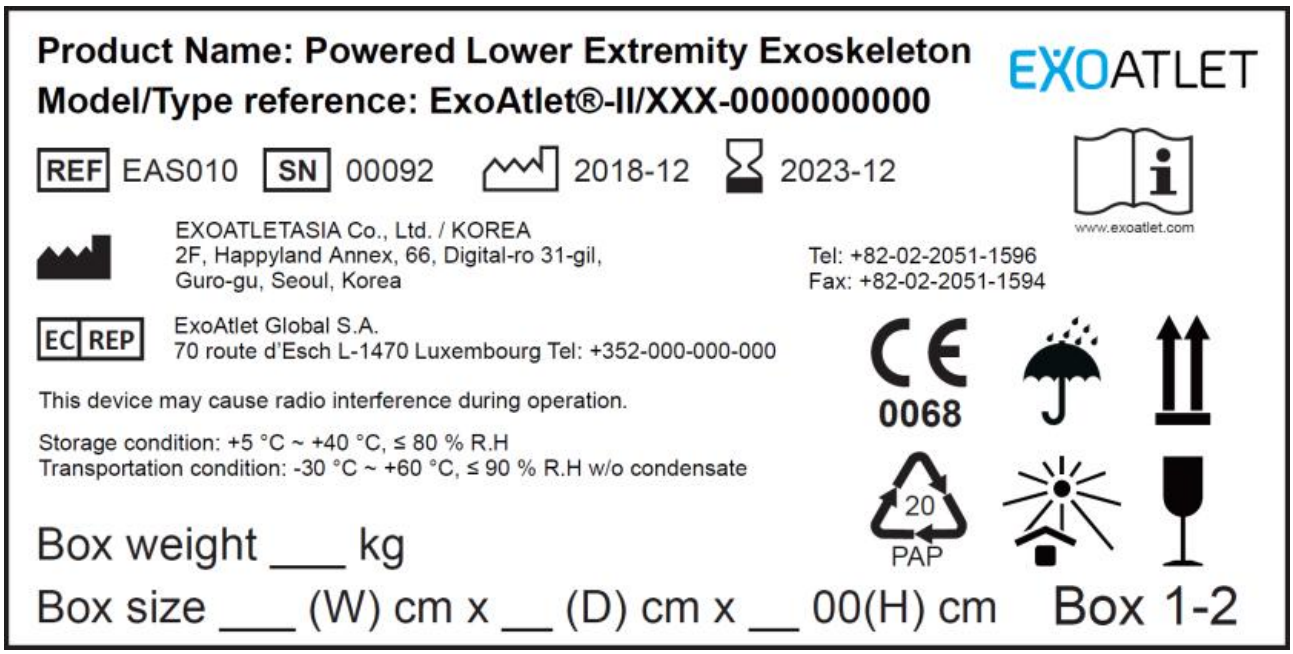
3.13. Label

3.13.1. Main Body



3.13.2. Remote control crutch

3.13.3. Packaging label



4. Size adjustment

4.1. Shoe insole/Shoe sole

4.1.1. Choose the relevant insole/sole from the set and place it on the bracket.

[Figure 1]

4.1.2. Fasten the screws with the enclosed driver. In case of using soles, you should use longer screws from the tools kit and fasten the screws from the other side.

[Figure 2]

4.2. Calf length adjustment

4.2.1. As shown in [Figure 3], Pull out and loosen two cam levers.

4.2.2. As shown in [Figure 4], Adjust sizes by the size lines and push down the cam levers to fix them.

[Figure 3]

[Figure 4]

4.3. Calf depth adjustment

4.3.1. As shown in [Figure 5], Pull out and loosen the cam lever.

4.3.2. As shown in [Figure 6], Adjust sizes by the size lines and push down the cam lever to fix it.

[Figure 5]

[Figure 6]

4.4. Thigh length adjustment

4.4.1. As shown in [Figure 7], Pull out and loosen the cam lever.

4.4.2. As shown in [Figure 8], Adjust sizes by the size lines and push down the cam lever to fix it.If the lower drive is not positioned right it will be difficult to fix cam lever.

[Figure 7]

[Figure 8]

4.5. Thigh depth adjustment

4.5.1. As shown in [Figure 9], Pull out and loosen the cam lever.

4.5.2. Adjust sizes by the size lines.

4.5.3. As shown in [Figure 10], Push down the cam lever to fix it.You can adjust the pressure by rotating cam lever before pushing it down.

[Figure 9]

[Figure 10]

4.6. Pelvic floor depth control

4.6.1. As shown in [Figure 11], Remove the previous back pad. Place the required back pad.

[Figure 11]

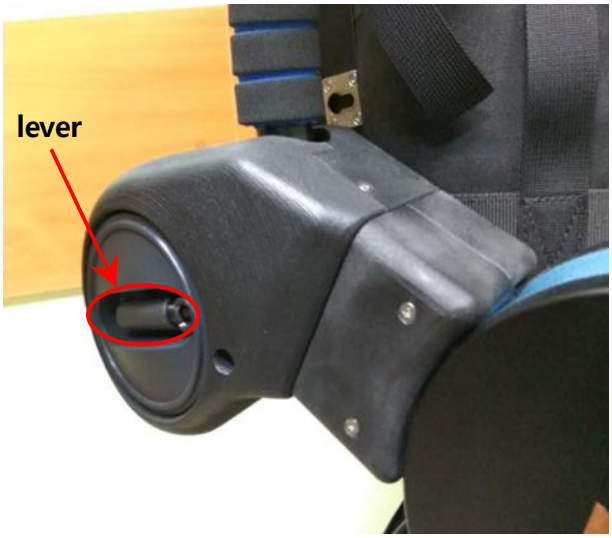
[Figure 12]

4.7. Adjust pelvic floor area

4.7.1. As shown in [Figure 13], Pull out and loosen two cam levers.

4.7.2. As shown in [Figure 14], Pull out the lever. Rotate the lever to adjust the desired width (rotating clockwise widens the pelvis).

[Figure 13]



[Figure 14]

4.7.3. As shown in [Figure 15], Adjust sizes by the size lines and push down two cam levers to fix them. Repeat the same procedure from the other side.

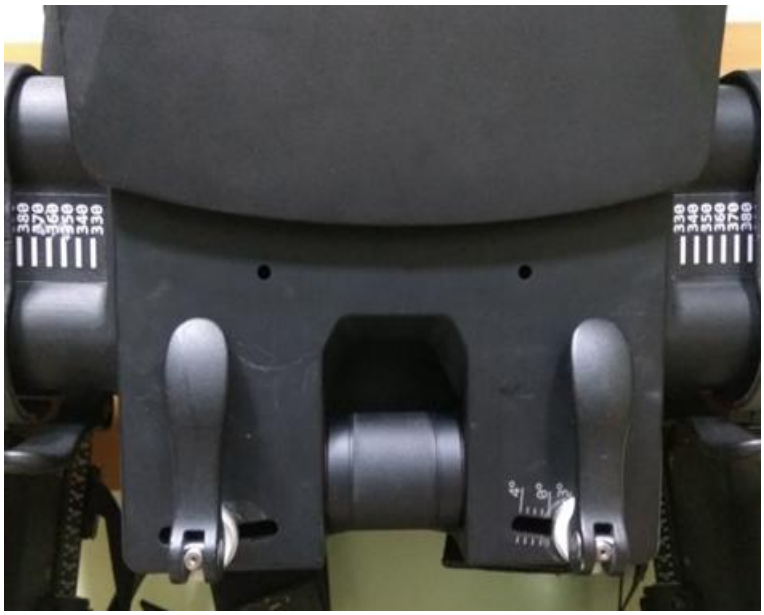
[Figure 15]

Note: it is necessary to adjust both sides similar.

4.8. Hip Abduction / Adduction

4.8.1. Pull out and loosen two cam levers.

4.8.2. As shown in [Figure 16], Adjust the right angle by rotating cylindrical handle and then push down two cam levers to fix them.



[Figure 16]

4.9. Ankle joint angle adjustment

4.9.1. As shown in [Figure 17], Pull out and loosen the cam lever

4.9.2. As shown in [Figure 18], Adjust sizes by the size lines and push down cam lever to fix it. Repeat the same procedure from the other side.

[Figure 17]

[Figure 18]

Note: it is necessary to adjust both sides similar.

4.10. Height adjustment of back

4.10.1. As shown in [Figure 19], Pull out and loosen two cam levers.

[Figure 19]

4.10.2. As shown in [Figure 20], Adjust the size according to the height of the patient and then push down two cam levers to fix them.

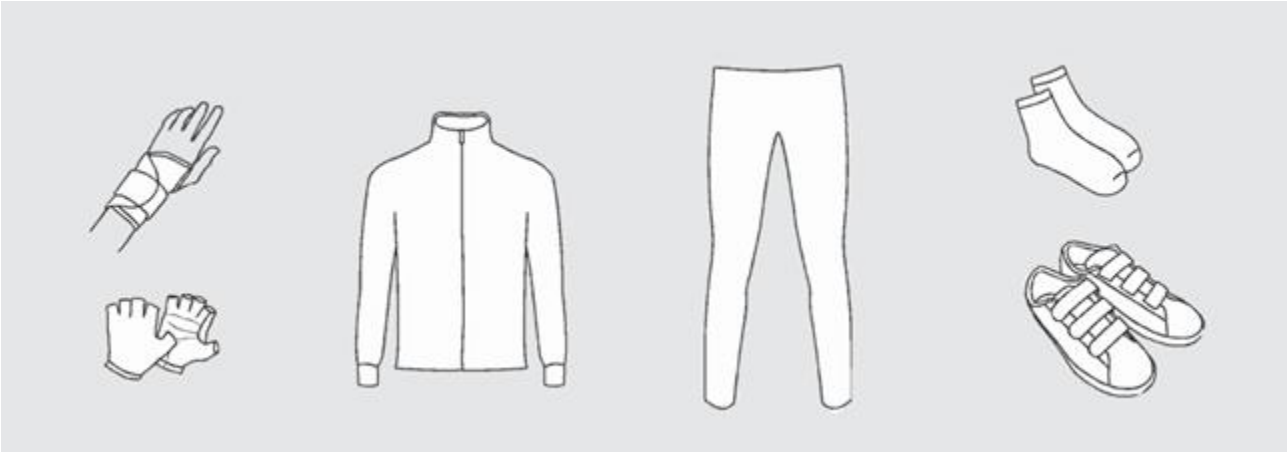
[Figure 20]

5. Wearing

5.1. Precautions before wearing

5.1.1. Exoskeleton should be adjusted strictly according to the body sizes of the pilot.
5.1.2. Incorrect body size measurement and incorrect size adjustment of exoskeleton can cause malfunctioning.
5.1.3. Confirm if the exoskeleton is adjusted at the same size in both sides.
5.1.4. Do not let the belts or straps fasten the body too tightly
5.1.5. Make sure that pilot's toes are not bended in the shoes.

5.2. Clothes recommendation



5.2.1. Please wear well-fitted and comfortable clothes.
5.2.2. In case of using insoles, pilot should use a pair of shoes 1-2 sizes (10-15 mm) bigger than pilot's common shoes. The shoes with detachable insoles are recommended.
5.2.3. Do not wear boots or shoes with high heels.
5.2.4. Wearing nylon socks is easier to wear.
5.2.5. It is better to use gloves for weight training or cycling.
5.2.6. It is better to use the armbands to prevent injuring of the wrist.

5.3. Getting ready

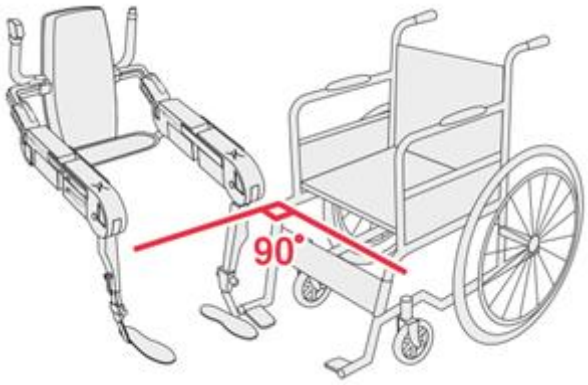
5.3.1. Place exoskeleton on the stool firmly.
5.3.2. Make sure that there are no foreign materials in the shoes. Undo the Velcro or the shoelaces.
5.3.3. Put a pair of shoes on the insoles of the exoskeleton.
5.3.4. Place the soft insole on the metal insole of exoskeleton in case if you are using insoles.
5.3.5. The legs of ExoAtlet should be in the right angle.

5.3.6. Change the tightness of the buttock belt using bindings on the bottom side of the belt – they should be set on the same size (you can check it by the numbers).

5.4. Transferring to exoskeleton

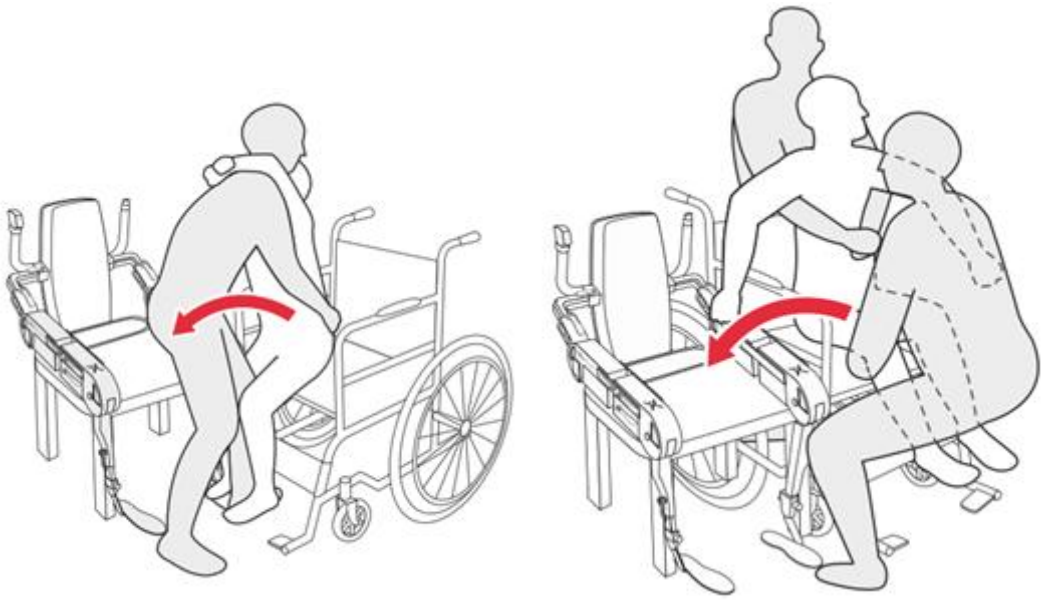
5.4.1. Check that exoskeleton sits on the stool firmly (thighs are parallel to the surface).

5.4.2. Position the wheelchair on the right sideclosely to the knee joint of the exoskeleton (in case of right-handed pilot).



5.4.3. Place right hand on the far (right) thigh of the exoskeleton andtransfer the body. At the same time assistant should keepexoskeleton firmly in order not to let it sway.

5.4.4. If the pilot cannot moveto the exoskeleton by himself, one assistant can transfer the pilot to the device. Also it is possible for two assistants to transfer pilot – in that case one should grab the pilot's upper body and another should grab the legs and transfer patient to the device.



5.5. Putting on exoskeleton

5.5.1. If you use insoles put on shoes. After finished carefully check the fingers of the patient to prevent bending of the fingers. Proceed from the both sides.

5.5.2. If you use soles fix patients leg with three straps. First release the strap, insert the metal binding into relevant hole and fix it. Straps should be fixed very tight in order not to allow undoing. Proceed from the both sides.

5.5.3. Fix shank bindings using two straps. It is necessary to put soft pads under the straps in order to prevent damaging of the patient's skin.Proceed from the both sides.

5.5.4. Fix thigh bindings using two straps. It is necessary to put soft pads under the straps in order to prevent damaging of the patient's skin. Proceed from the both sides.

5.5.5. Fix corset using two belts from each side and put on shoulder straps.

6. Operation

6.1. Preparation before use

6.1.1. Make sure you have all the components.

6.1.2. Make sure that the Tablet PC and the application running on the product are installed.

6.1.3. Press the power button on the main unit to check if power is supplied normally.

6.1.4. Make sure that the straps that secure the torso and legs of the pilot are secure.

6.2. General functions

6.2.1. Turning on

1) Check the Emergency Stop switch on the right handle of exoskeleton – it should not be pressed. If it is pressed, please release it before turning on exoskeleton.
2) Turn on exoskeleton using button on the right side of the back. Light will turn green and LED bar will show current charge of the exoskeleton.

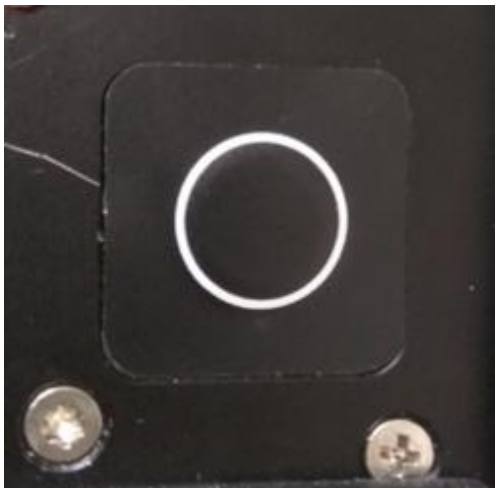
6.2.2. Stop function

It is possible to stop motion of the exoskeleton ("Stop" command) if you will press button on the left handle of the exoskeleton. After pressing exoskeleton will make a final step and then finish its motion.

6.3. Emergency Stop Function

In case of malfunction or other unexpected situation it is possible to immediately stop exoskeleton. For that purpose, use red switch on the right handle of exoskeleton. After pressing exoskeleton will immediately stop its motion and freeze in current position until the switch will be released and then "OK" button will be pressed in a pop-up screen on Tablet PC. After that exoskeleton state will be restarted within several second and it will be possible to operate exoskeleton again. In most cases you will have to reset pose before proceeding.

While emergency stop is active motors will allow exoskeleton to slowly get down. In this case it is necessary to place a chair under the patient and then press a "release" button near the hip drives to allow exoskeleton to sit on the chair. After that it is necessary to bend knees of the patient pressing "release" button near the shin drives.



6.4. How to clean and store after use

6.4.1. When not in use, position the unit in a chair and turn off the unit by pressing the main power button for 3 seconds.

6.4.2. How to clean the product is as follows.

1) Make sure that the power is off before cleaning the product.
2) After using the product, be sure to clean it and store it in the product storage case. If it is not cleaned frequently or the product is exposed to direct sunlight, it may be discolored.
3) Wipe the contaminated part of the outer surface of the appliance with a mixture of neutral non-abrasive detergent and water with a soft cloth or cloth. At this time, do not allow liquid to penetrate inside the machine.
4) Dry the exterior with a dry towel.

6.4.3. If it is determined that there is a problem with the operation of the equipment, or if it is broken, do not disassemble or detach it.

7. Tablet PC operating

7.1. Starting

Software already runs on the Tablet PC. You can check the connection to the exoskeleton by looking at the indicator in the top left side of the screen (red light on Figure 39 shows that there is no connection).

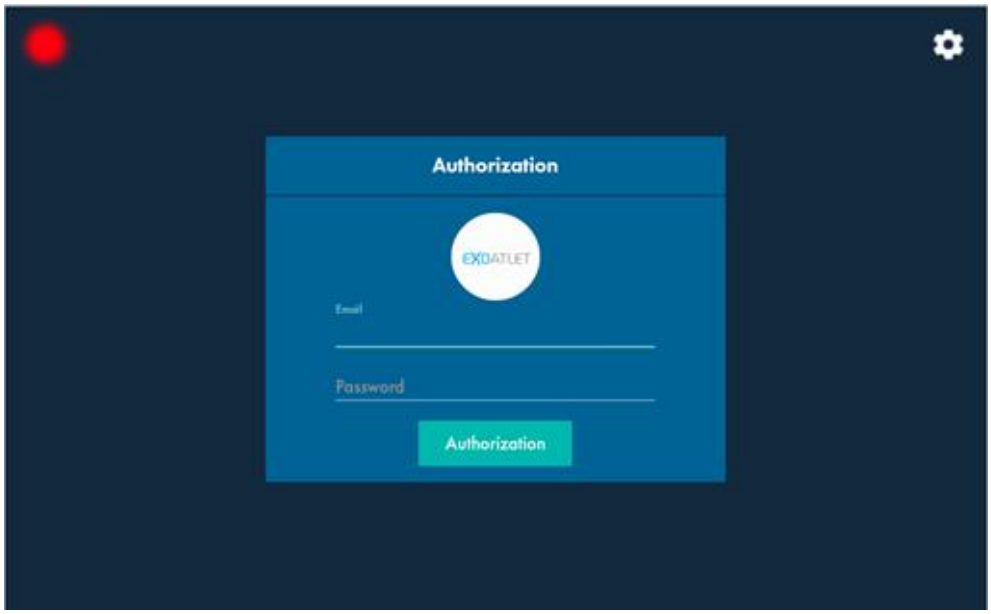


Figure 39

Turn on exoskeleton and wait for connection to be set (green light on Figure 40 shows that exoskeleton is connected).

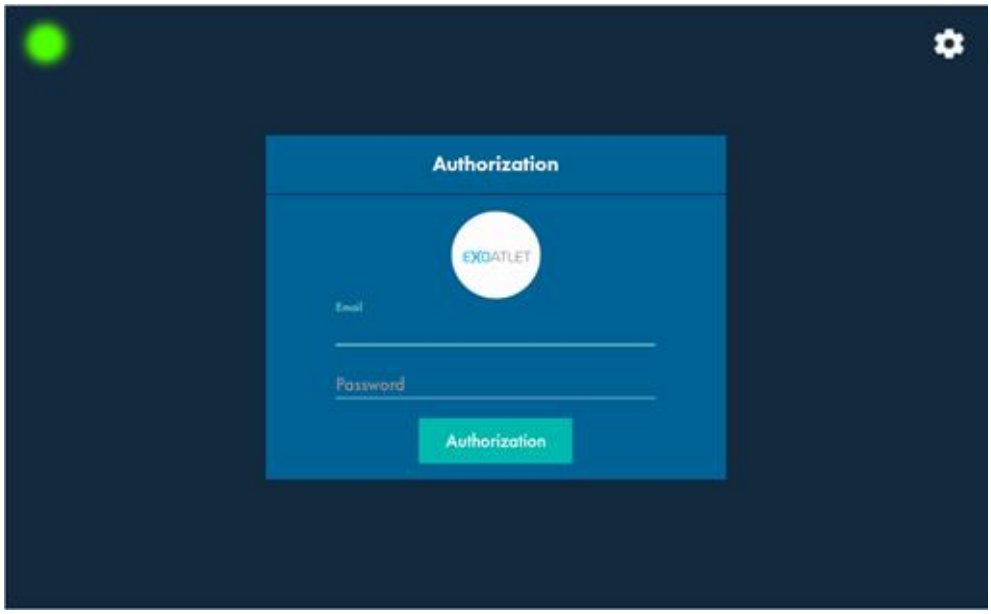


Figure 40

Input login doctor and password doctor and then press Authorization button. Currently only default login is available.

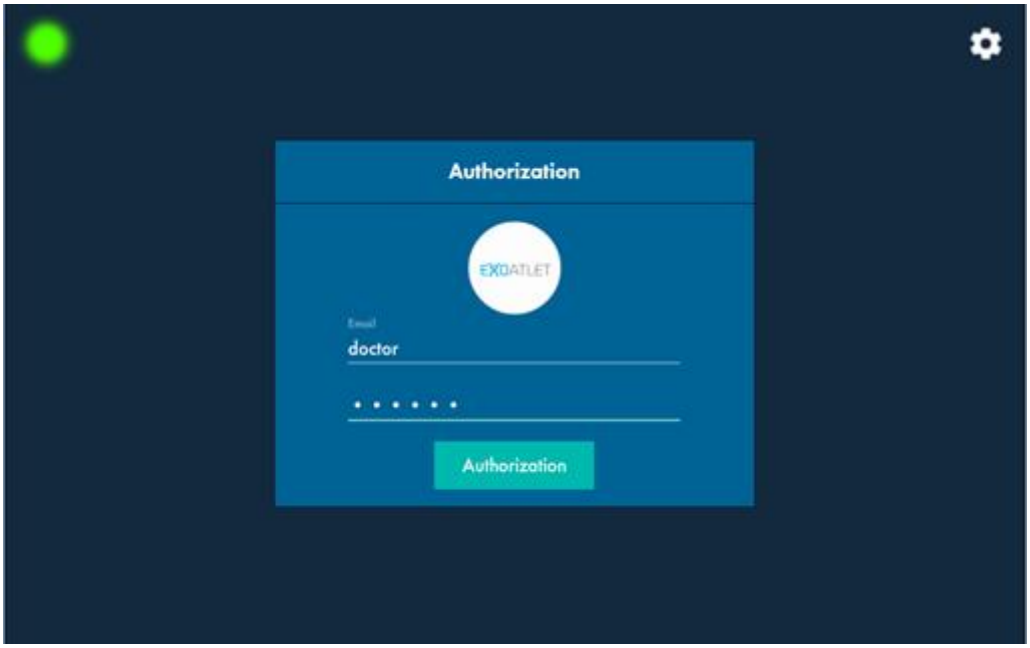


Figure 41

After successful authorization main menu will be shown.

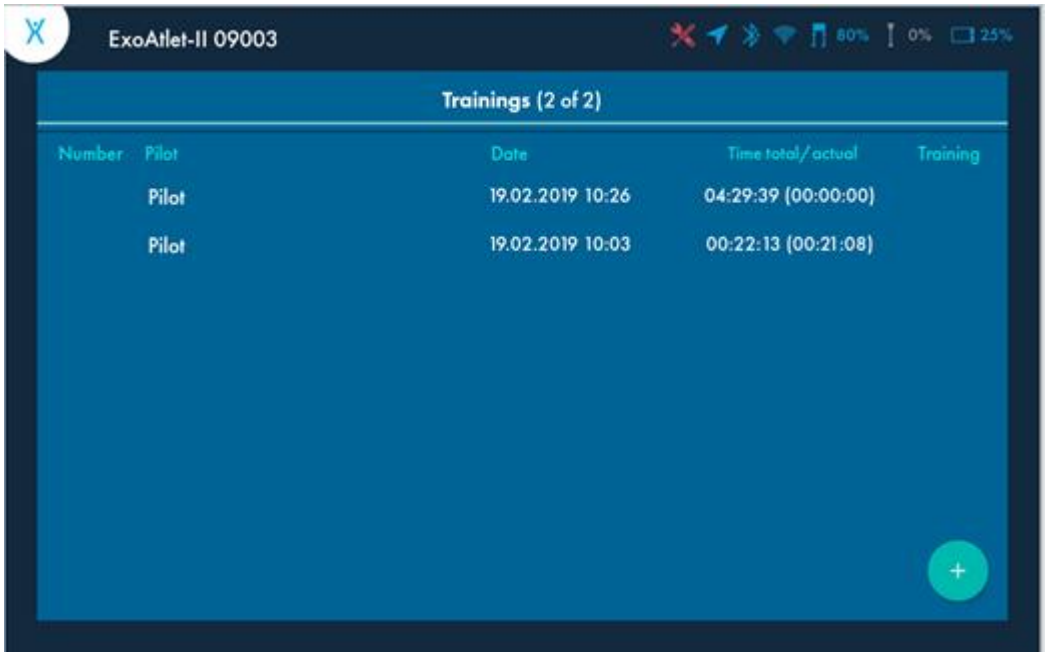


Figure 42

Press on the logo in the top left side of the screen. You will see the list of the sections: Training, Service, Settings, About, Exit.

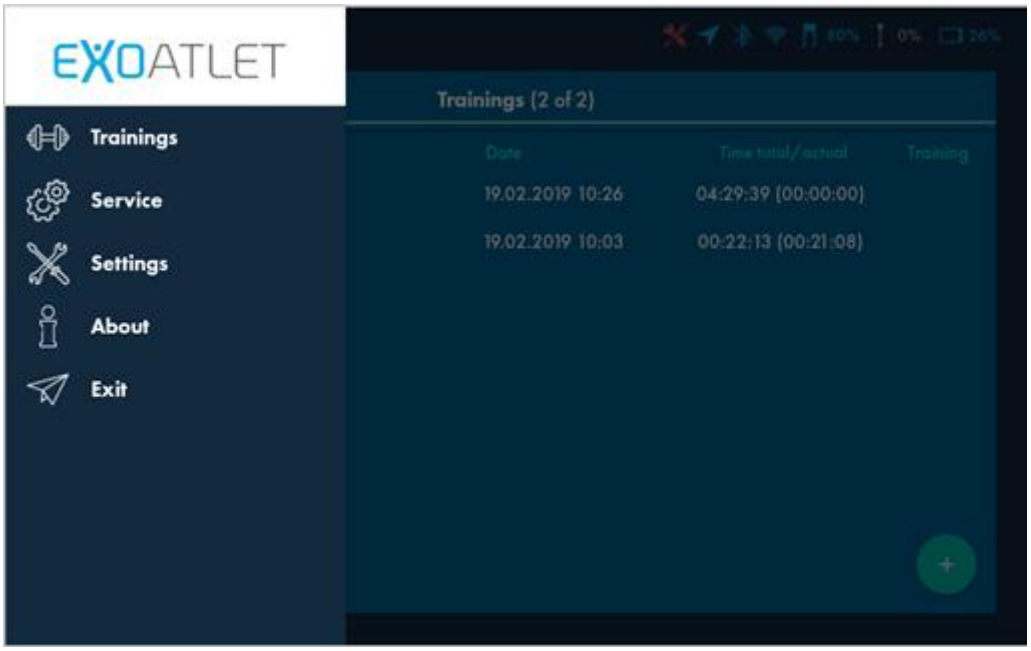


Figure 43

7.2. Trainings

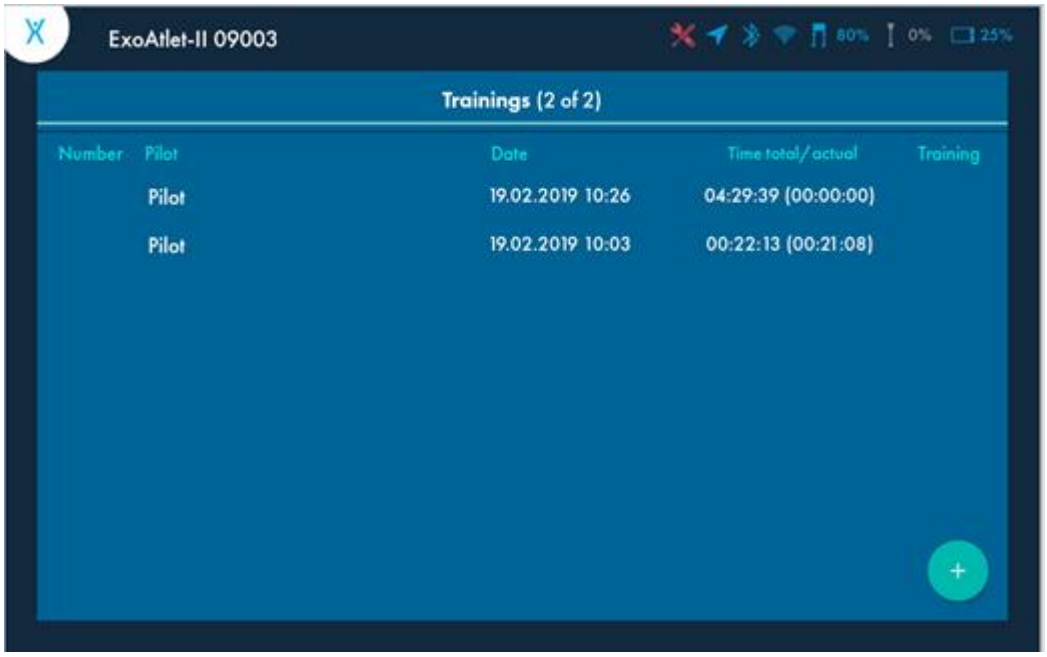


Figure 44

In the Trainings section you can open all the finished training and see the basic information about it (more details in 8.2.2). You can exit training by pressing arrow button in the top left side of the screen (See Figure 45) and then you will return to the Trainings screen.

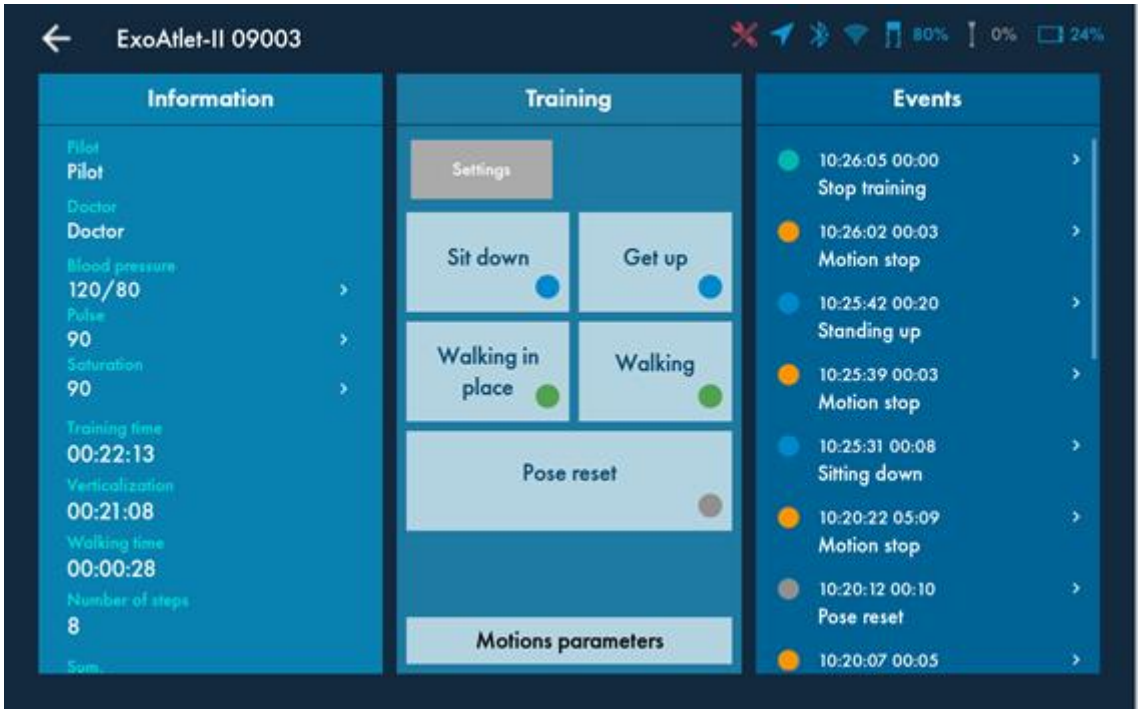


Figure 45

7.2.1. Starting training

Press + button in the bottom right side of the screen to create new training session.

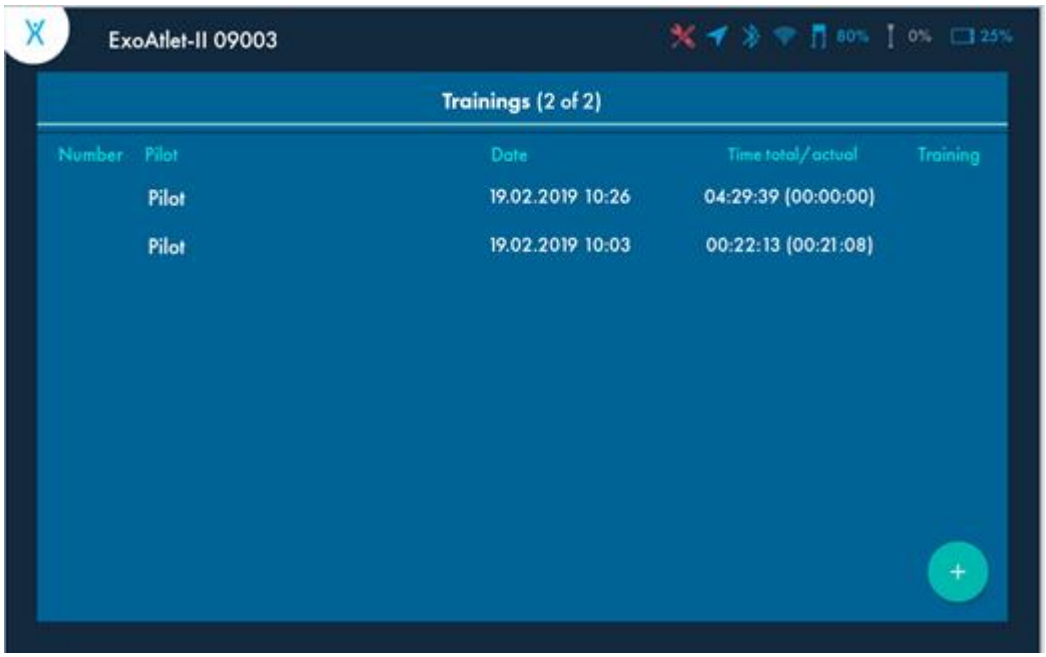


Figure 46

1) Pilots

Choose the pilot to train with by pressing on his name. Currently only default pilot is available.

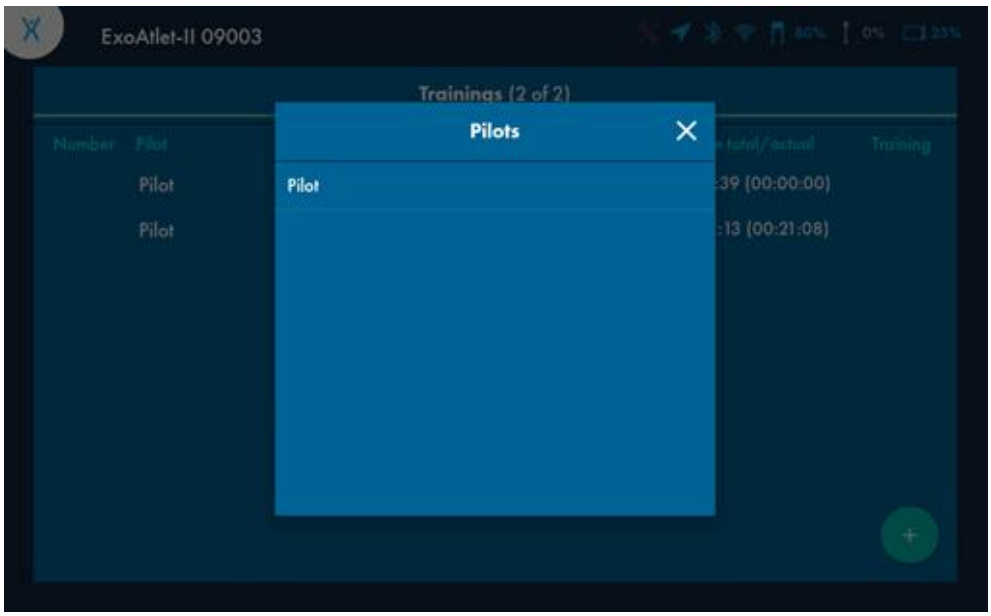


Figure 47

2) Parameters of training

Enter current values of pulse, blood pressure, saturation by pressing the buttons with arrow in the right side from the value. Then press "OK". You will get to the training screen.

Warning: please pay attention that device does not measure these values by itself. User should measure them using appropriate equipment and then type them.

Warning: there is a range of the values that you can enter. If one of the vital values of the patient exceeds the range, it is a contraindication.

Figure 48

7.2.2. Main training screen

Main training screen consists of the sections:

- Information: describes the current doctor and pilot that were chosen, vital values that were input and statistics of the training.
- Training – consists of the motion buttons, different settings buttons and remote control switch.
- Events – shows the log of the events that were performed during training.

Before pressing "Start training" button all the buttons are unavailable. Press "Start training" to start training session and get access to the motion buttons.

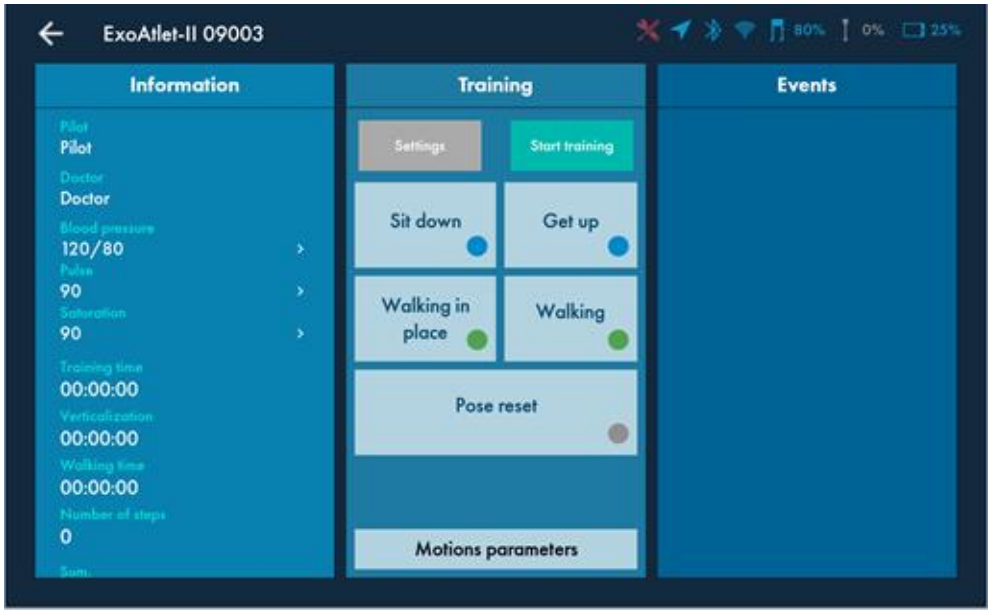


Figure 49

After pressing "Start training" button main buttons will become available (see Figure 50).

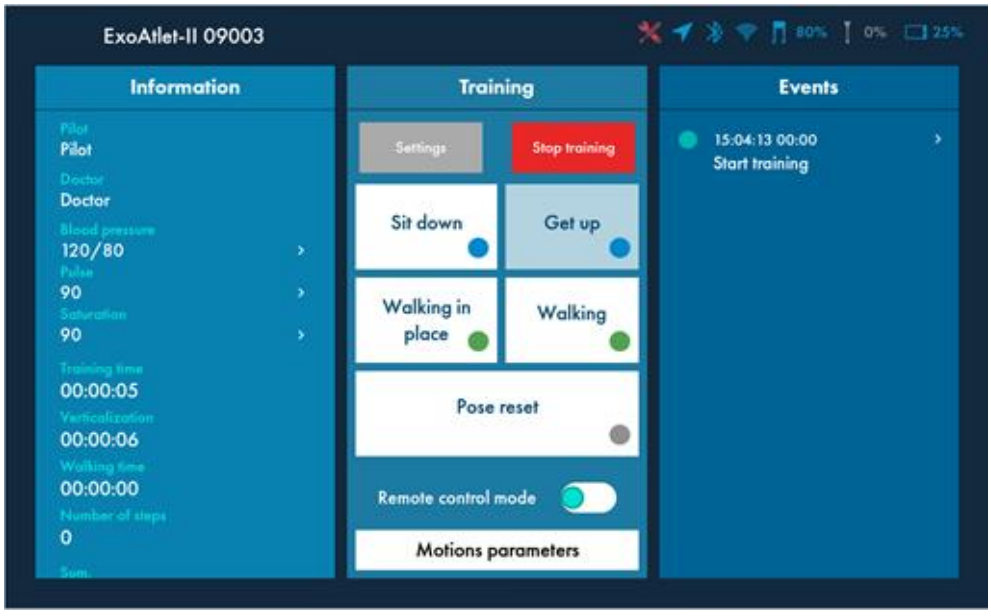


Figure 50

1) Settings

After pressing "Settings" button you will get to the Settings screen (more details in 8.2.3).

Warning: you should carefully check that shank length and thigh length in the settings are similar to the ones that set on exoskeleton. Otherwise it may result in incorrect walking and even injury of the patient because exoskeleton calculates the walking pattern according to these values.

2) Stop training

After training you should press "Stop training" button. After pressing it will be proposed to enter current values of pulse, blood pressure and saturation again.

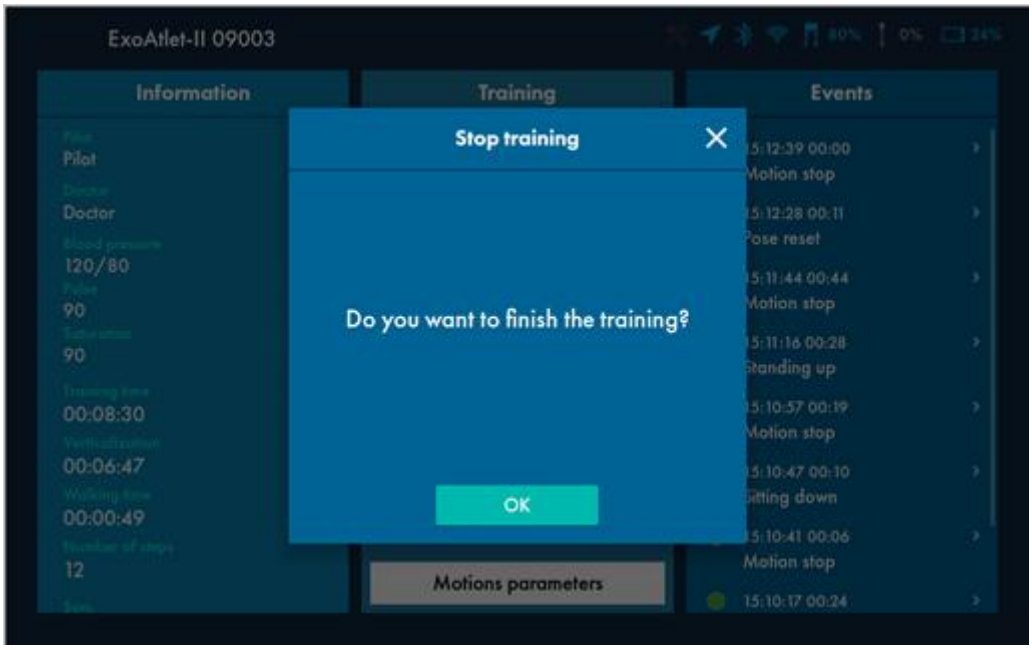


Figure 51

Also you may leave a comment for the training (more details in 8.2.2.6). Then you should press "Save" button if you wrote a comment or "No" button if you don't want to leave a comment. You will get back to the Training screen.

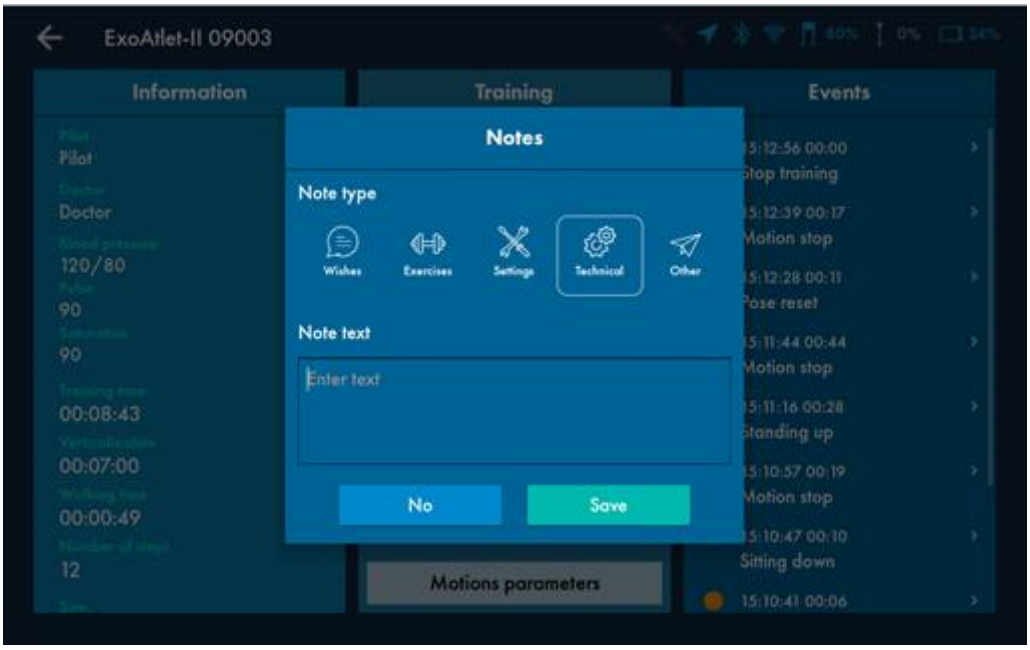


Figure 52

3) Motion buttons

Available motion buttons depend on the current pose of the exoskeleton. There are 3 available poses:

① Undefined pose – when limbs of the exoskeleton are not in standard sitting or standing pose. If you moved some of the limbs before turning on exoskeleton, it will probably be in this pose. In this pose only "Pose reset" (more details in 8.2.2.3.5) motion is available (see Figure 53).

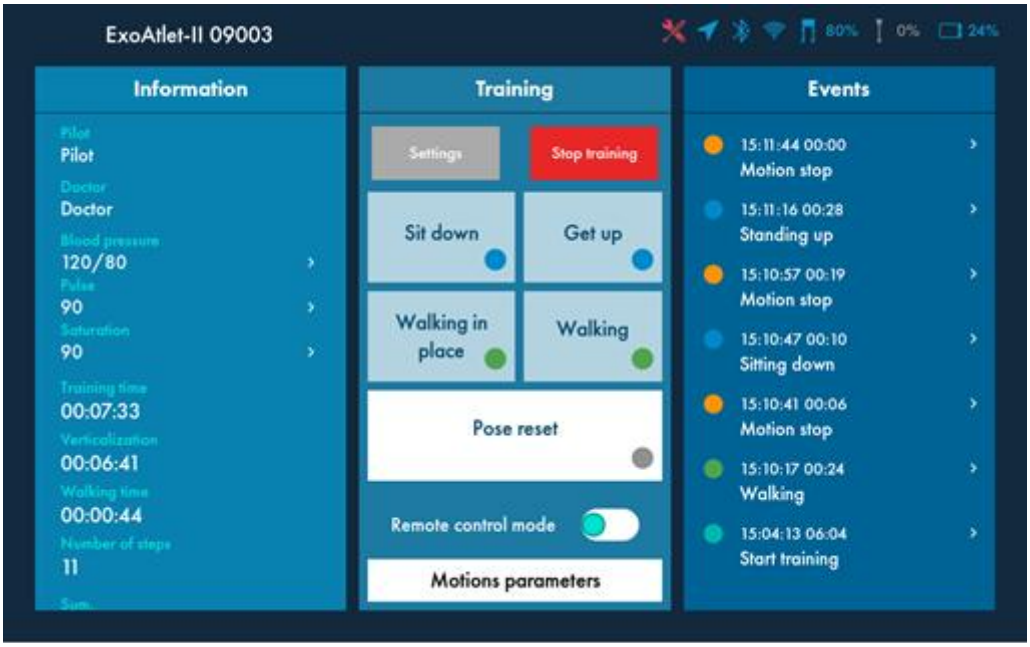


Figure 53

② Sitting pose – the pose when limbs of the exoskeleton are in standard sitting position. In this pose motions "Get up" (more details in 8.2.2.3.2) and "Pose reset" (more details in 8.2.2.3.5) are available (see Figure 54).

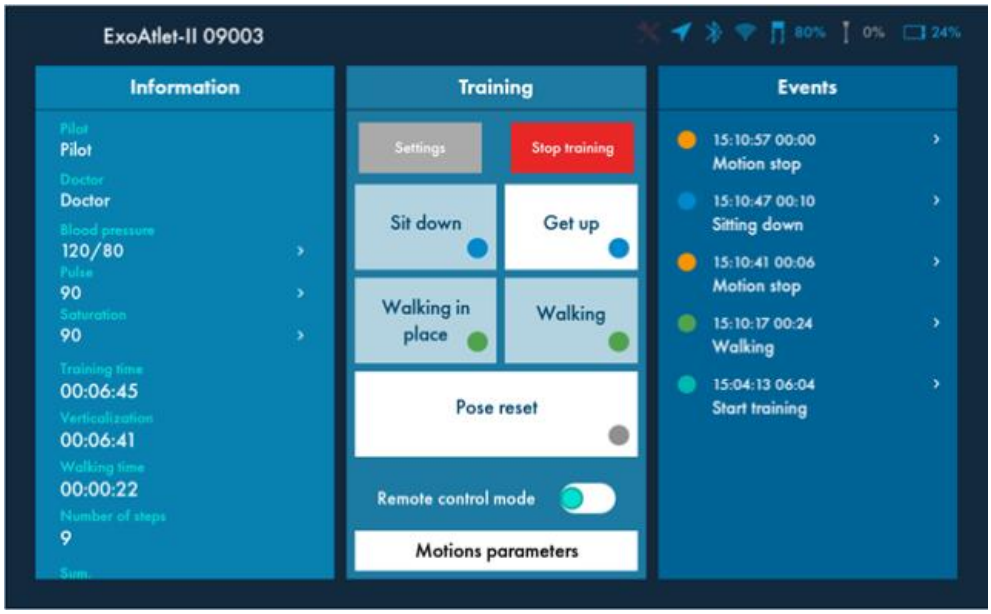


Figure 54

③ Standing pose – the pose when limbs of the exoskeleton are in standard standing position. In this pose motions "Sit down" (more details in 8.2.2.3.1), "Walking in place" (more details in 8.2.2.3.4), "Walking" (more details in 8.2.2.3.3) and "Pose reset" (more details in 8.2.2.3.5) are available (see Figure 55).

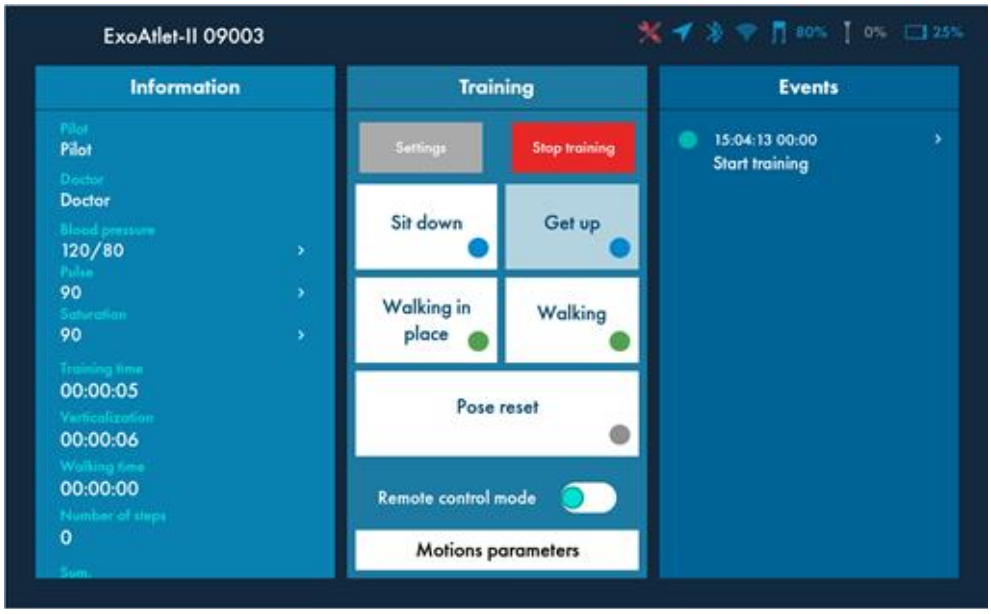


Figure 55

Warning: before pressing any motion button you have to check the selected motion parameters (more details in 8.2.4) to react properly.

Warning: before pressing any motion button you have to warn patient about the upcoming action for him to be ready for the action.

④ Sit down

In accordance with the selected settings (more details in 8.2.4.4) after pressing "Sit down" button exoskeleton will perform 3 beeping sounds and then will get into sitting pose. When finished, it will beep one more time to show that device is ready for the next motion.

⑤ Getup

In accordance with the selected settings (more details in 8.2.4.3) after pressing "Get up" button exoskeleton will perform 3 beeping sound and then will bend its legs (first left, then right) and then the "Confirm action" window will appear (see Figure 56). Only after pressing "OK" button and after 3 beeps standing up will be initiated and exoskeleton will get into standing position. When finished, it will beep one more time to show that device is ready for the next motion.

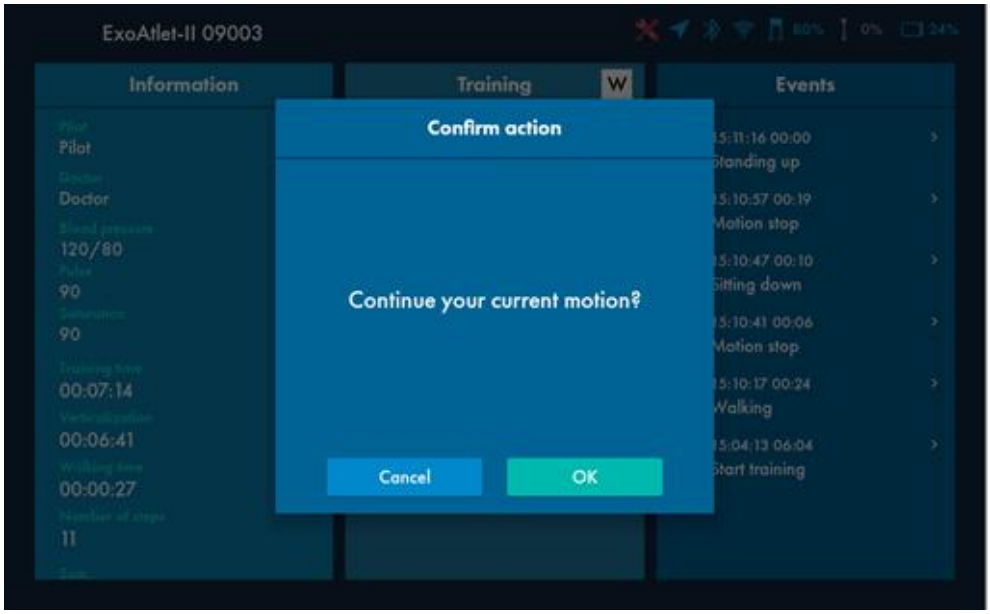


Figure 56

If you will press "Cancel" exoskeleton may get into undetermined pose or sitting pose (depending on the chosen settings).

⑥ Walking

In accordance with the selected settings (more details in 8.2.4.1) after pressing "Walking" button exoskeleton will perform 3 beeping sound and then will initiate the chosen mode.

Warning: before initiating walking carefully read the "Motion setting" clause.

⑦ Walking on place

In accordance with the selected settings (more details in 8.2.4.2) after pressing "Walking in place" button exoskeleton will perform 3 beeping sound and then will initiate the chosen mode.

Warning: before initiating walking carefully read the "Motion setting" clause.

⑧ Pose reset

After pressing "Pose reset" button "Resetting the pose" window will appear where you will be able to choose the desired pose you want to transfer exoskeleton to (see Figure 57). After pressing "Reset" exoskeleton will perform 3 beeping sounds and then will slowly get to the desired position. When finished, it will beep one more time to show that device is ready for the next motion.

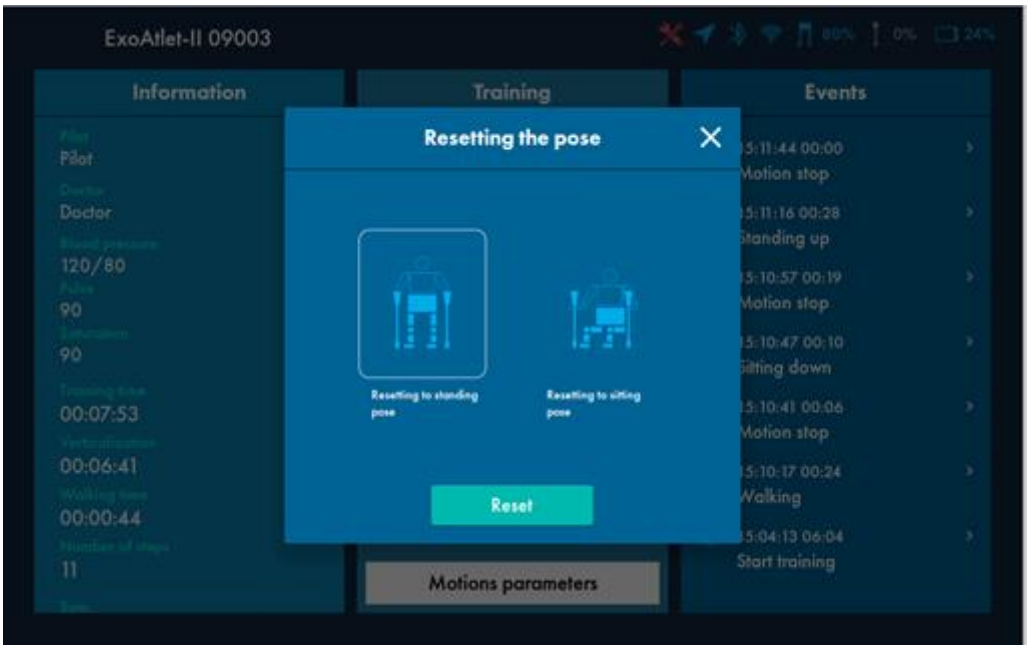


Figure 57

4) Remote control mode

Switching to «Remote control mode» will allow control from remote control on the crutch (More details in clause 9). Motion buttons on Tablet PC will become unavailable. It is only available to control exoskeleton from one remote. To return control to Tablet PC, press on "Remote control mode" switch again. It is only available when exoskeleton is not in a motion.

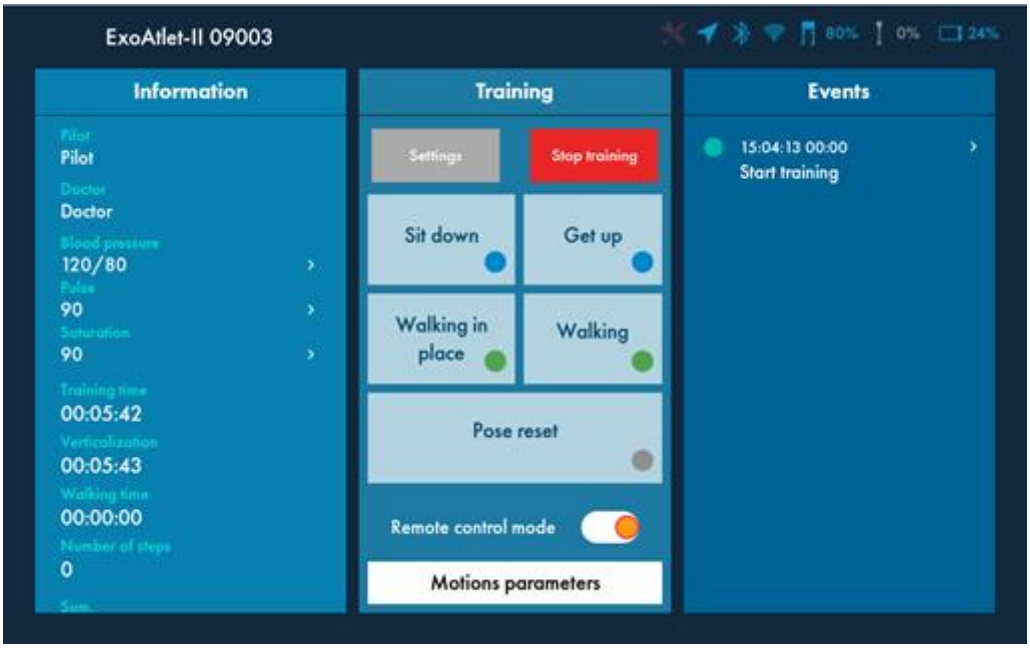


Figure 58

5) Motion parameters

After pressing "Motion parameters" button you will get to "Motion Parameters" screen (more details in clause 8.2.4)

6) Leaving note

If you will press on one of the events in "Events" section, you will open "Notes" window. It will be possible to choose the type of the note for this event:

① Technical
② Wishes
③ Exercises
④ Settings
⑤ Other

After typing the comment and then pressing "Save" button the note will be saved and the symbol (according to the type of the note) near the chosen event will appear – it shows that there is a note for this exact event. Pressing "No" button will not save any note.

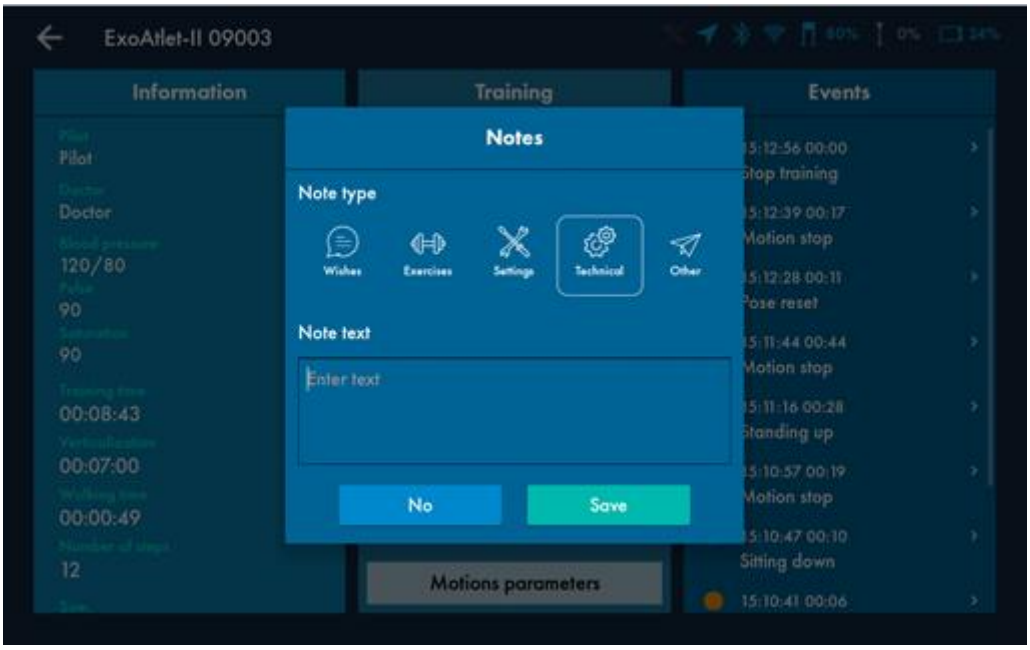


Figure 59

7.2.3. Settings

After pressing «Settings» button settings screen appears. You should input at least shank length and thigh length to be able to initiate motions of the exoskeleton. Press "Save" button in top right side of the screen to save current parameters. Press back arrow in the top left side of the screen to close settings screen without keeping the changes.

Warning: you should carefully check that shank length and thigh length in the settings are similar to the ones that set on exoskeleton. Otherwise it may result in incorrect walking and even injury of the patient.

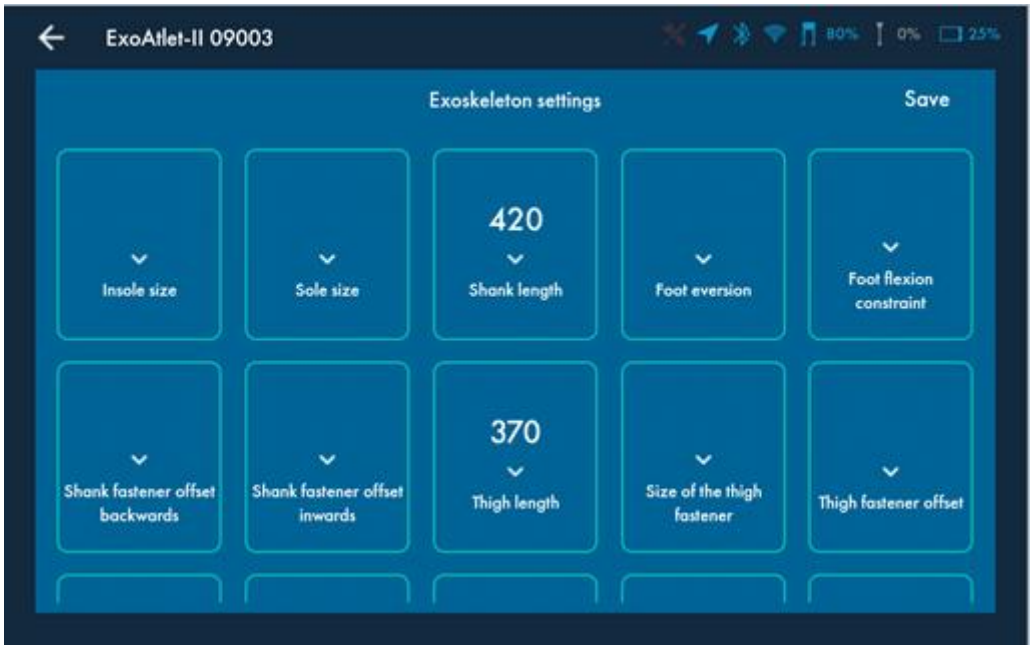


Figure 60

You can write all the settings that are available to adjust on the exoskeleton or may be useful for the training purpose:

1) Insole Size. min = 33, max = 45, step = 1. You can leave it blank if soles are installed on the device.
2) Sole Size. Available values: 36-38, 39-41, 42-45, -. You can leave it blank if insoles are installed on the device.
3) Shank length – min = 420, max = 590, step = 5.
4) Foot eversion - min = 0, max = 5, step = 1.
5) Foot flexion constraint - min = 0, max = 15, step = 1.
6) Shank fastener offset backwards - min = 0, max = 40, step = 1.
7) Shank fastener offset inwards - - min = 0, max = 30, step = 1.
8) Thigh length - min = 370, max = 490, step = 5.
9) Size of the thigh fastener - Available values: S, M, L.
10) Thigh fastener offset - min = 0, max = 50, step = 1.
11) Hip width - min = 320, max = 460, step = 1.0
12) Hip abduction/adduction - min = -3, max = 4, step = 1.
13) Back height - min = 160, max = 190, step = 5.
14) Pad under the belly - S,M, L, -.
15) Pad under the back - S, M, L.
16) Straps position - ↑ - for upper position of the straps, ↓ - for lower position of the straps.
17) Buttock belt length - min = 0, max = 15, step = 1.
18) Height of the crutches - min = 1, max = 10, step = 1.
19) Height of the bars - min = 1, max = 7, step = 1.

Warning: the shank and thigh lengths affect on the available range of length and height of the step during walking. There are 3 ranges: Low – the sum of shank and thigh lengths are below 80 cm, Middle – the sum of shank and thigh lengths are within 80.1 - 87 cm, High - the sum of shank and thigh lengths are more 87 cm.

7.2.4. Motion parameters

After pressing «Motion parameters» button motion parameters screen will appear, where you can adjust the motion parameters of walking, walking on place, standing up, sitting down. Press on the desired motion to get access to the settings of this motion.

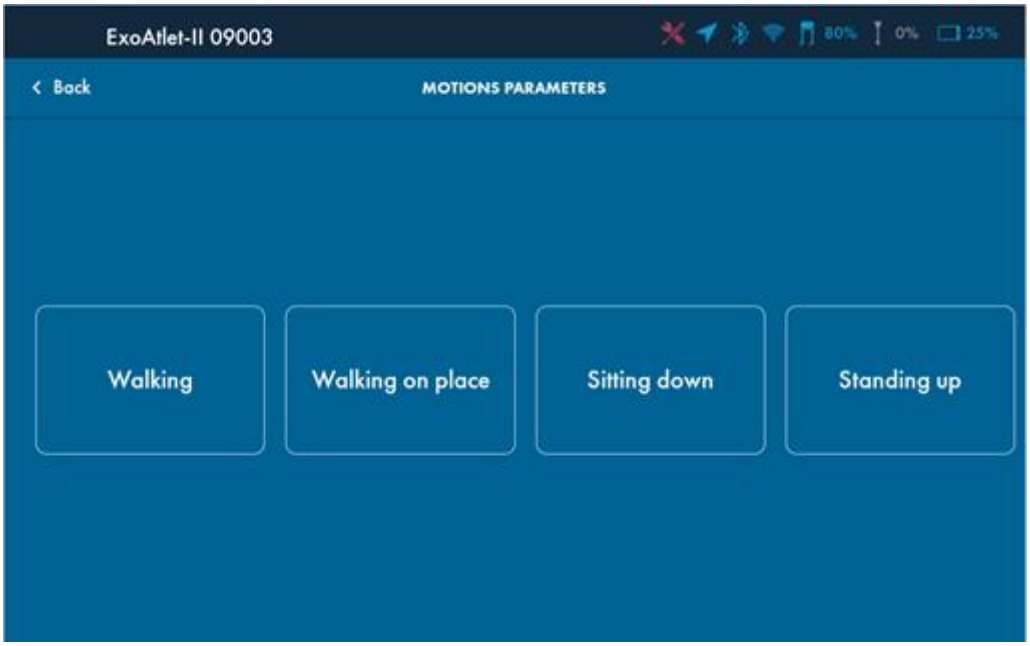


Figure 61

1) Walking

After pressing "Walking" button you will get access to the parameters of walking (See Figure 62).

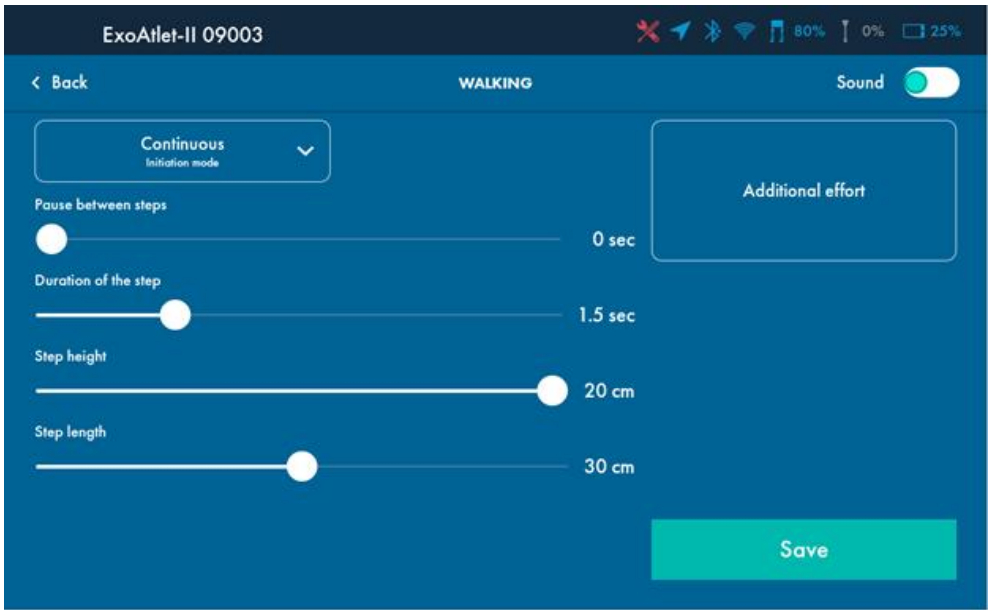


Figure 62

Press "Back" button in top left side of the screen to leave the settings without any changes.

You can adjust various parameters:

① Pause between steps – parameter defines the time between ending one step and starting another step (available only in "Continuous mode"). Min = 0, max = 1 s, step = 0.1 s.

② Duration of the step - parameter defines the time of performing one step. Min = 1.2 s, max = 2 s, step = 0.1 s.

③ Step height – parameter defines the height that exoskeleton feet will reach during every step. Min = 10 cm, Max = for low patients 20 cm, for middle patients 22 cm, for high patients 25 cm. Step = 1 cm.

④ Step length – parameter defines the length of one exoskeleton's step. Min = 20 cm, max = for low patients 40 cm, for middle patients 50 cm, for high patients 60 cm, step = 2 cm.

⑤ Sound indication – when switch is turned on, it activates a short beeping sound before every step of exoskeleton. It helps some patients to understand when exactly the step will start.

⑥ Additional effort of the exoskeleton – when the button is pressed "Additional effort" screen will appear (see Figure 63). It is possible to define the degree of support from the exoskeleton on every limb from 5% (minimal assistance, exoskeleton almost doesn't help to perform movement) to 100% (maximal assistance, exoskeleton makes the whole movement by itself). After changing the degree of support of exoskeleton it is necessary to press "Apply" to save the settings or "Cancel" to discard changes.

Figure 63

Warning: if the patient doesn't have any movement in the legs it is not allowable to set additional effort below 100% on every limb.

2) Mode.

After pressing on "Initiation mode" button you will get access to three modes (see Figure 64):

Figure 64

Continuous mode: the mode when walking initiates immediately after pressing "Walking" button on Training screen – after 3 beeps exoskeleton starts continuous walking starting from the left leg. "Motion stop" button will appear on the screen, also "M" indicator will appear on the top right side of "Training" section showing that exoskeleton is currently in motion. You will be able to see the chosen mode in the bottom side of "Training" section -(see Figure 65). Exoskeleton can be stopped using stop button on Tablet PC or stop button on the left handle. After pressing one of the stop button exoskeleton will make the last step and then get into standing pose. When finished, it will beep one more time to show that device is ready for the next motion.

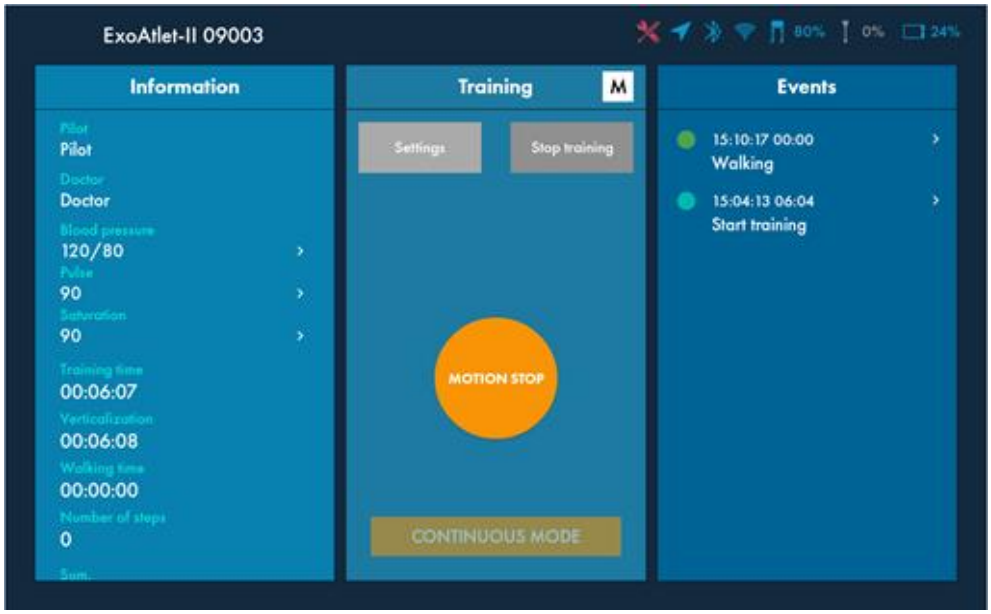


Figure 65

Step-by-step mode: after pressing "Walking" button there will 1 short beep showing that exoskeleton got into step-by-step walking mode. In order to make one step you should press the button on the left handle of exoskeleton. After 3 beeping signals exoskeleton will make a first step from the left leg and will stop in this pose. You will be able to see the chosen mode in the bottom side of "Training" section. To make a next step you should press the button on the left handle again and exoskeleton will make a step right after pressing (without 3 signals). All the next steps will be also initiated without additional signals (in case of Sound indication is not activated). To stop walking and make a final step you should hold the button on the left handle and after 1 second exoskeleton will make a final step and get into standing pose. After finished, it will beep one more time to show that device is ready for the next motion. If you will hold the button before making first step exoskeleton will immediately get into standing pose and wait for the next motion.

Warning: in this mode you will not be able to initiate or stop motion using Tablet PC.

By effort mode: When you first choose this mode in "Walking" settings "Effort" screen will appear (see Figure 66). You should choose the degree of effort on every limb that patient should perform in order to initiate a step from 0% (no efforts from the patients, operation is similar to continuous mode) to 100% (it is necessary to apply very serious effort in order to initiate movement).

Figure 66

After pressing "Walking" button on Training screen exoskeleton will perform 3 beeping signals and then will wait for the patient to start movement. You will be able to see the chosen mode in the bottom side of "Training" section. Patient should try to move his left leg forward to initiate first step. If patient exceeds the chosen effort limit exoskeleton will immediately make a step with left leg and then stop. After finishing first step, patient should try to make a step with right leg and so on. In order to stop walking you should press "Stop motion" button on Tablet PC or button on the left handle. After it patient will have to initiate one last step to get exoskeleton into standing pose. After finished, it will beep one more time to show that device is ready for the next motion. If you will press stop button before first step exoskeleton will immediately return to standing pose waiting for the next motion.

Warning – initiation by effort should be used only with patients that can move their lower limbs by themselves.

Warning – if patient needs to initiate, for example, step with left leg he should provide an effort only with left leg.

3) Walking on place

After pressing "Walking on place" button you will get access to the parameters of walking on place.

Press "Back" button in top left side of the screen to leave the settings without any changes.

You can adjust various parameters (see Figure 67):

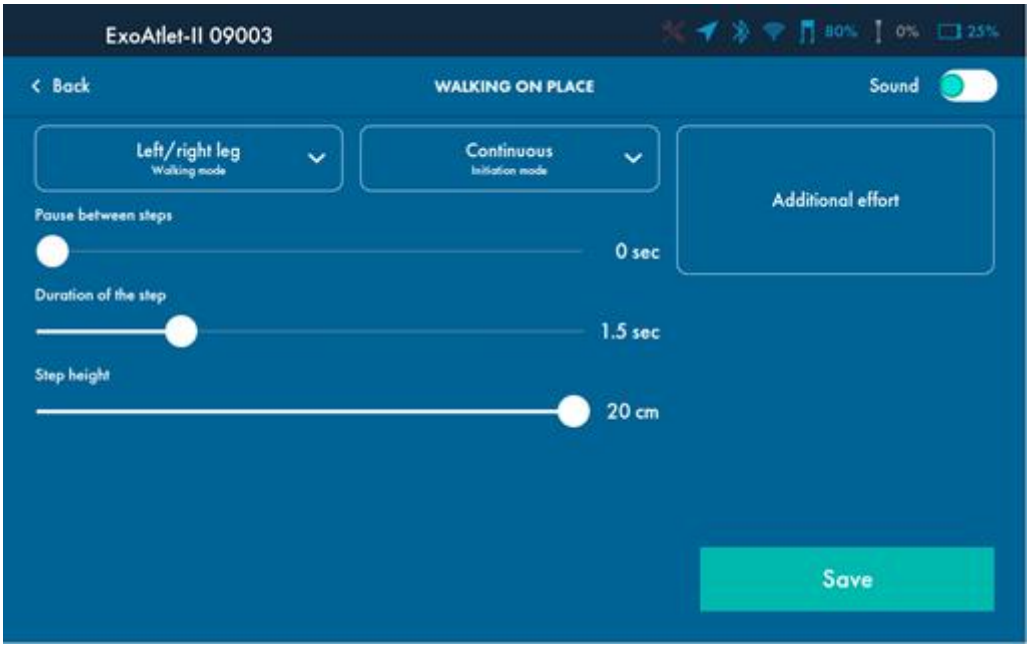


Figure 67

① Pause between steps – parameter defines the time between ending one step and starting another step (available only in "Continuous mode"). Min = 0, max = 1 s, step = 0.1 s.

② Duration of the step - parameter defines the time of performing one step. Min = 1.2 s, max = 2 s, step = 0.1 s.

③ Step height – parameter defines the height that exoskeleton feet will reach during every step. Min = 10 cm, Max = for low patients 20 cm, for middle patients 22 cm, for high patients 25 cm. Step = 1 cm.

④ Sound indication – when switch is turned on, it activates a short beeping sound before every step of exoskeleton. It helps some patients to understand when exactly the step will start.

⑤ Additional effort of the exoskeleton – when the button is pressed "Additional effort" screen will appear (see Figure 63). It is possible to define the degree of support from the exoskeleton on every limb from 5% (minimal assistance, exoskeleton almost doesn't help to perform movement) to 100% (maximal assistance, exoskeleton makes the whole movement by itself). After changing the degree of support of exoskeleton it is necessary to press "Apply" to save the settings or "Cancel" to discard changes.

⑥ Walking mode – it is possible to choose "Left leg", "Right Leg", "Left/Right leg" modes. It defines both legs or not will be involved in walking on place or not. For example, with "Right leg" mode after pressing "Walking on place" exoskeleton will make steps only with right leg.

⑦ Initiation mode – it is possible to choose three different modes – continuous mode, step-by-step mode, by effort mode. Their operation is similar to "Walking" modes description (more details in 8.2.4.1).
The only difference is that when walking on place is stopped in Step-by-Step or By effort mode exoskeleton will not make a final step and will immediately get into standing pose awaiting for the next motion.

4) Standing up

After pressing "Standing up" button you will get access to the parameters of standing up.

There are several parameters to change (See Figure 68):

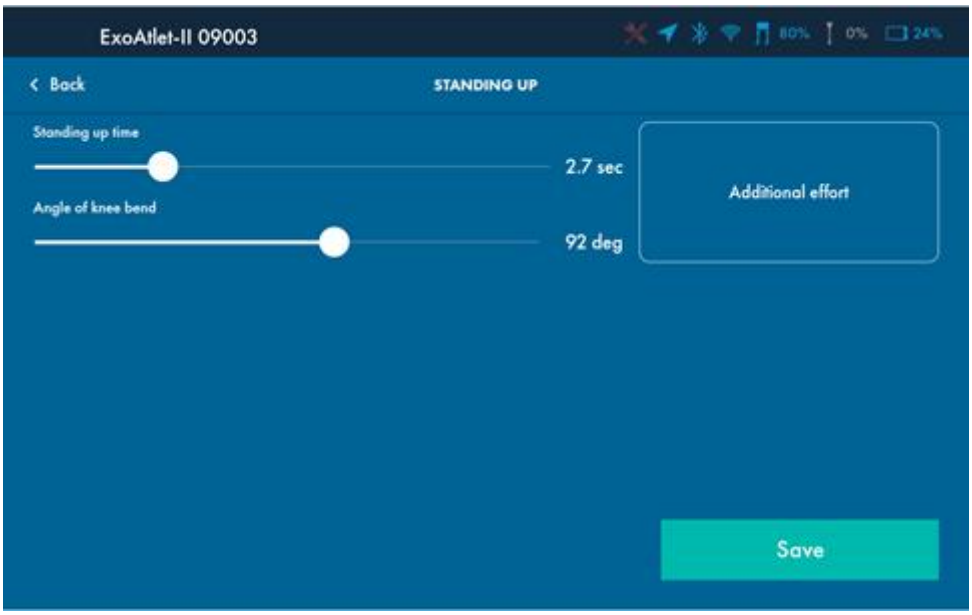


Figure 68

① Standing up time – parameter defines the time that exoskeleton will need to get from sitting to standing position. Min = 2 s, max = 5 s, step = 0,1 s.
② Angle of knee bend – parameters defines how much exoskeleton will bend its knees before standing up. Min = 80 deg, max = 100 deg, step = 2 deg. Use minimal value in case of high stool and max value in case of the low stool.
③ Additional effort – definition is similar to the description in "Walking" settings (more details in 8.2.4.1).

5) Sitting down

After pressing "Sitting down" button you will get access to the parameters of sitting down.

For this movement only one parameter is available (see Figure 69).

Sitting down time – parameter defines the time that exoskeleton will need to get from standing to sitting position.

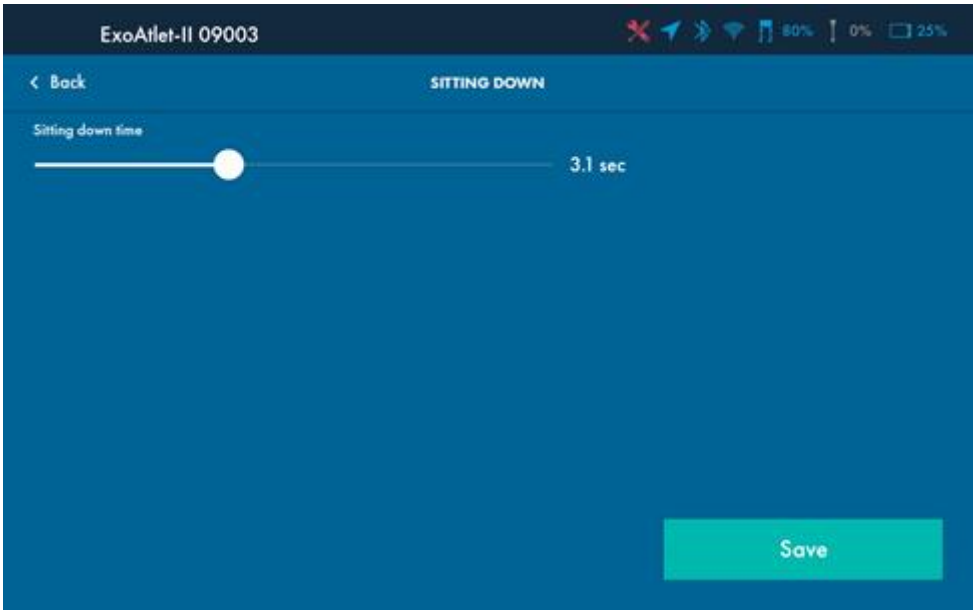


Figure 69

6) Saving changes

If you will press "Save" button on one of the movement settings all the changes will be kept and you will get back to the motion parameters screen. You will see that motion was changed by an orange tag in the bottom side of the button (see Figure 70). Pay attention, that if you will change parameters of only one of the movements tag will appear only below the exact button.

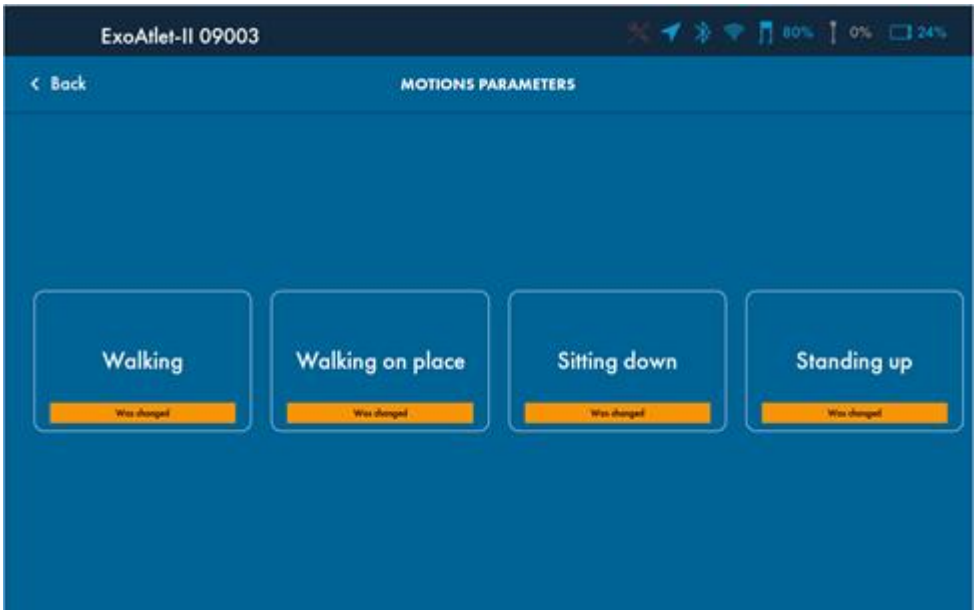


Figure 70

7.2.5. Errors

During exoskeleton operating some errors may appear (for example, in case of not correct transition of the mass of the patient). In that case a message will appear on the screen. You can reset the error pressing "Ok" button. In most of situations after it you will have to return exoskeleton to the standard pose using "Pose reset" button. If error will appear continuously you should remember the error code and contact technical support by the phone number displayed on the screen.

Warning: check if the patient is not entrapped and there is no excessive pressure on the patient. Check if the position of the patient is normal in the exoskeleton. After that you can continue training.

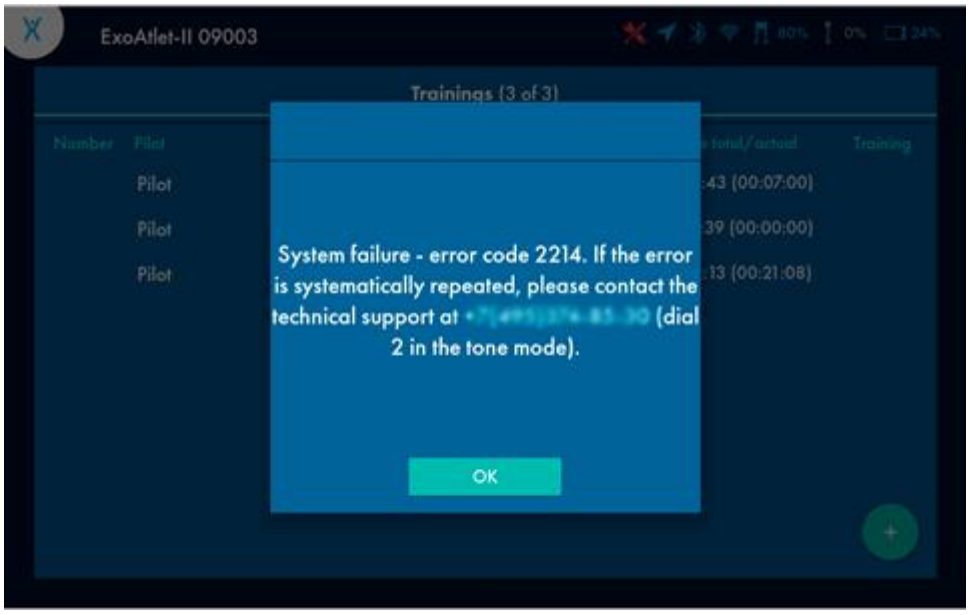


Figure71

If case of unexpected disconnection between Tablet PC and exoskeleton a message appears on the screen. Exoskeleton will automatically send a stop command and if it was in a motion after 1 short beep will make a final step.

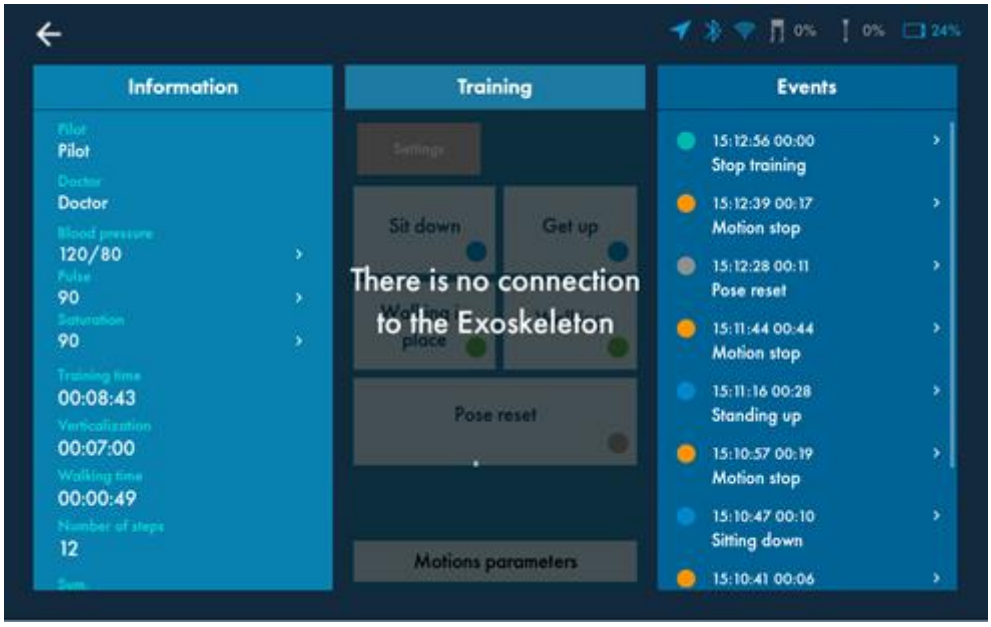


Figure 72

7.3. Service

Service section allows user to create backup file and send it via e-mail. It may be needed for a technical support. After pressing "Make a backup" button exoskeleton will start to create a backup file and it will take some time.

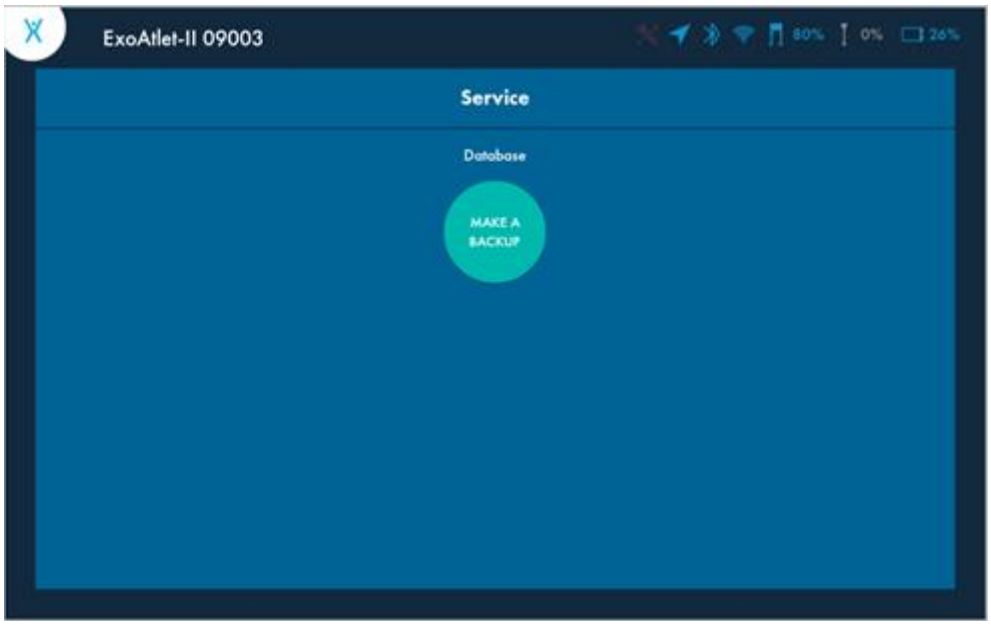


Figure 73

During creating of the backup file some errors may appear (for example, in case of lack of connection between Tablet PC and exoskeleton). In that case you will see an error message on the screen. You can try to create it again or leave without creating a file. After successful creating of the backup file you will get an option to send file via e-mail, delete it or send it later.

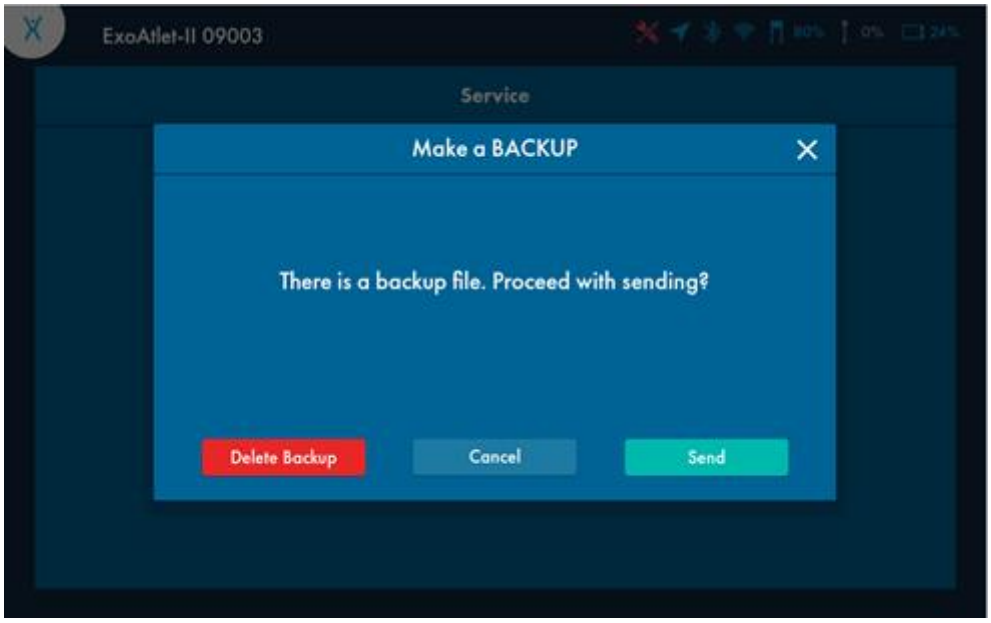


Figure 74

7.4. Settings

Settings section allows user to connect Tablet PC to a wi-fi or change the language.

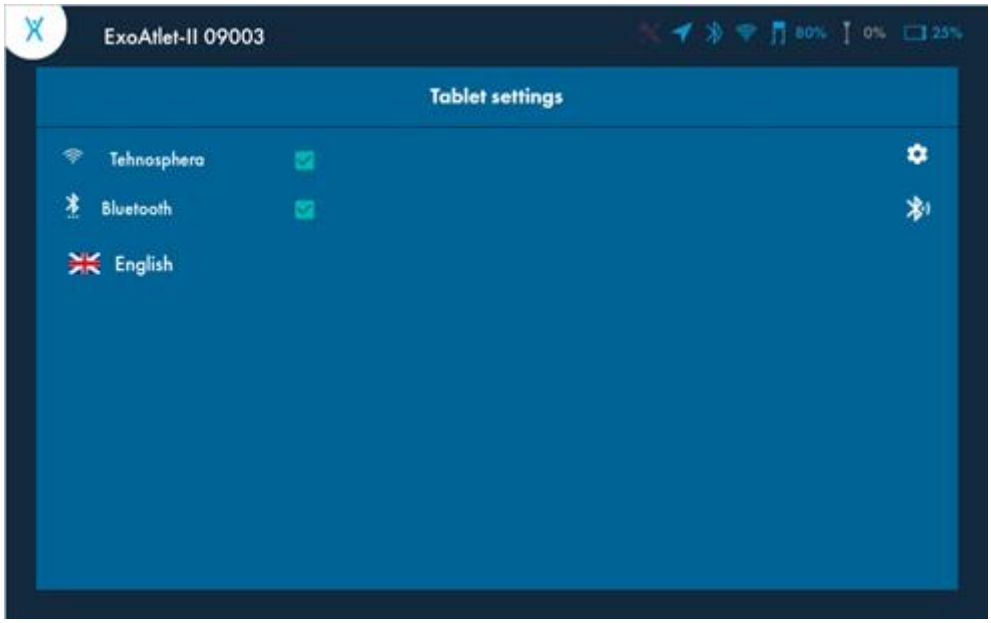


Figure 75

7.5. About

About section shows user the current version of the Tablet PC software. This information may be helpful for a technical support.

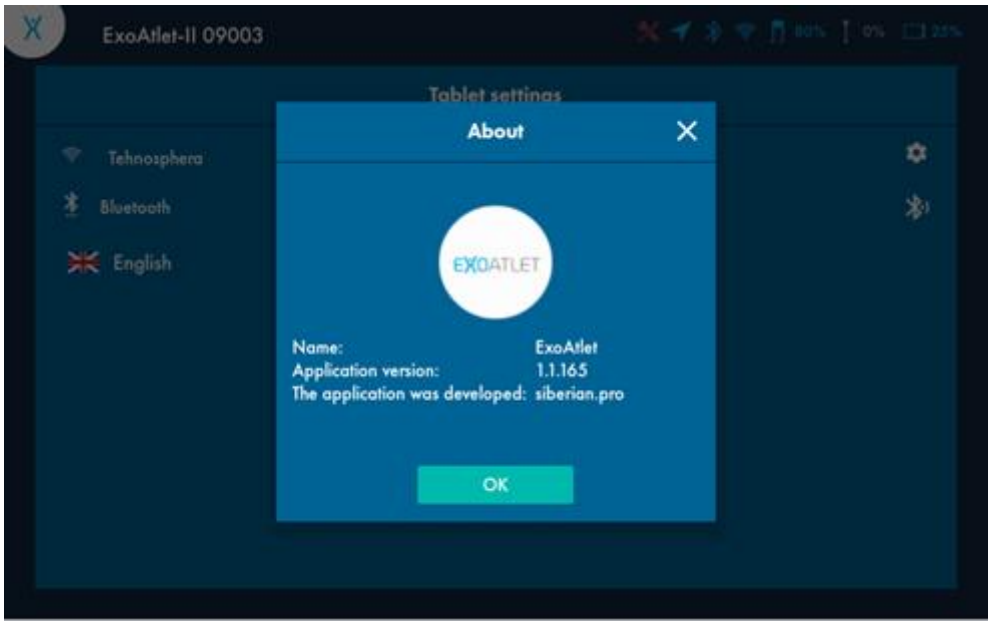


Figure76

7.6. Exit

Pressing "Exit" button will return user to the log screen (see 8.1).

8. ExoCrutch operation

8.1. ExoCrutch structure

ExoCrutch contains of 6 main components:

8.1.1. "Turn ON" button.

8.1.2. LED-indicator.

8.1.3. Charging port (USB type-C)

8.1.4. Display.

8.1.5. "Mode change" button.

8.1.6. "Action" button.

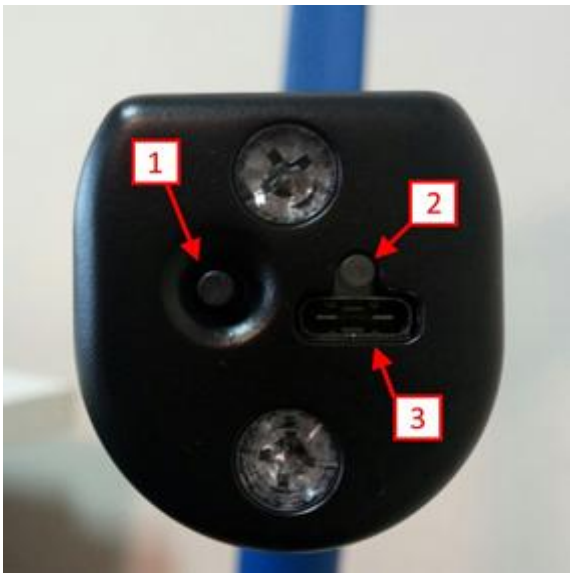


Figure 77

Figure 78

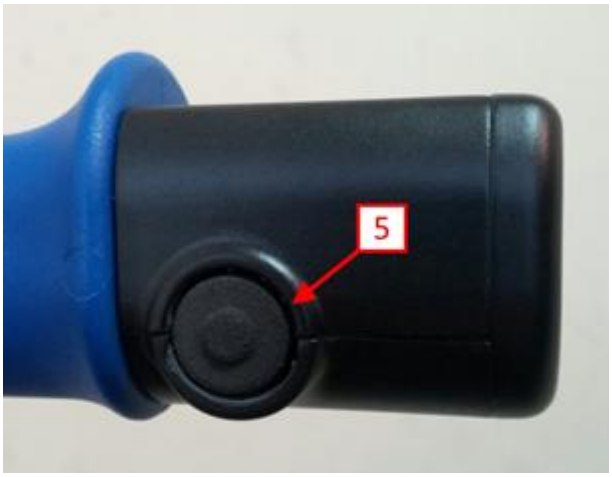


Figure 79

Figure 80

Display have 4 main elements:

- ExoCrutch charge indicator.
- Exoskeleton charge indicator.
- Exoskeleton current condition indicator.
- Selected motion/mode.

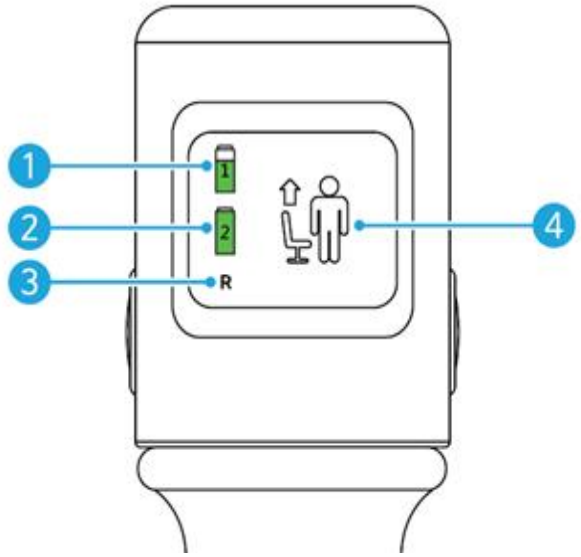
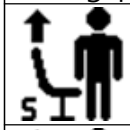
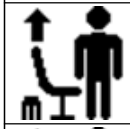
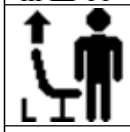
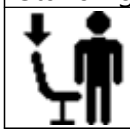
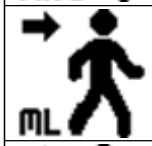


Figure 81

8.2. ExoCrutch available motions:

Icon	Value
Not defined pose	
	Pose reset to sitting pose
	Pose reset to standing pose
Sitting pose	
	Standing up (Low)
	Standing up (Middle)
	Standing up (High)
Standing pose	
	Sitting down

	Walking in place (high step)
	Walking in place (low step)
	Walking (short and high step)
	Walking (short and low step))
	Walking (middle and high step)
	Walking (middle and low step)
	Walking (long and high step)
	Walking (long and short step)

8.3. ExoCrutch operation

8.3.1. Turning ExoCrutch on

1) Turn exoskeleton on (see clause 7.1.1).
2) Start training sessions with the pilot on Tablet PC (More details in 8.2.1) and allow remote control operation using switch on the bottom side of the display (more details in 8.2.2.4).
3) Turn ExoCrutch on using "Turn ON" button on the front side of the device. You will see that device is in the process of connecting to exoskeleton.

Figure 82

Note: if remote control operation is not activated on the Tablet PC you will see an error icon on the display after ExoCrutch initialization.

Figure 83

4) After successful initialization you will see a working screen.

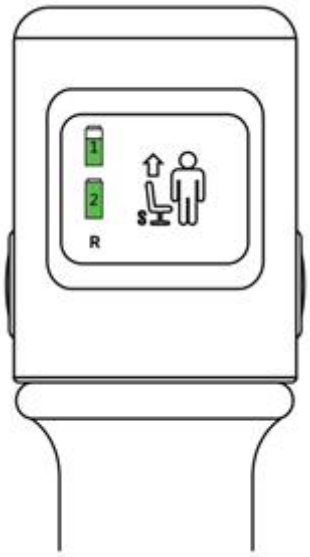


Figure 84

8.4. ExoCrutch operation

8.4.1. Depending on the current pose you have different available motions (see clause 9.2 for reference).

8.4.2. Using "Mode change" button choose the desirable motion.

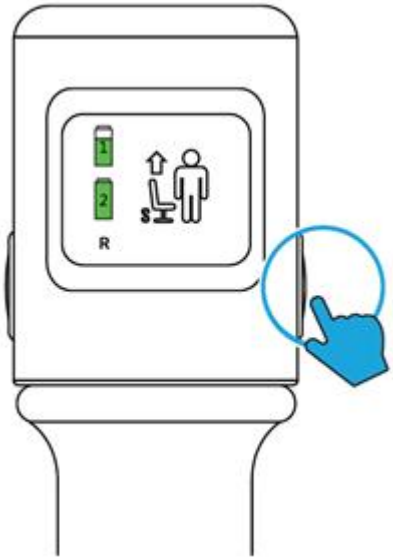


Figure 85

8.4.3. Confirm the motion by pressing "Mode change" button at least for 1 second. You will see a green frame around the selected motion.

Figure 86

Warning: you should confirm motion only when you change the desirable motion. If you walked and then pressed stop it is not necessary to confirm the motion again if you didn't change it.

8.4.4. Press "Action" button to execute selected mode/motion.

Warning: it is possible to initiate only continuous mode with ExoCrutch (more details on operation in 8.2.4.1).

8.4.5. Press "Action" button again during walking to stop it. Or just wait for motion to end if you chose, for example, sitting down.

8.5. Error reset

Sometimes an error may appear during walking (for example because of the spastics of the patient). In this situation exoskeleton will start to provide error signals and you will see an error message on the display of ExoCrutch.

Figure 87

8.5.1. Press "Action" button to reset error. Error signals will stop.

8.5.2. Choose the desirable pose for exoskeleton to come to. Press "Action" button and after 3 signals exoskeleton will get into the desirable pose.

Warning: if an error appeared during walking you should choose "Standing pose". If an error appeared during standing up or sitting down, you should choose "Sitting pose".

Warning: check if the patient is not entrapped and there is no excessive pressure on the patient. Check if the position of the patient is normal in the exoskeleton. After that you can continue training.

9. Charging the battery

9.1. Charging exoskeleton

9.1.1. Connect the charger to the port on the right side of the exoskeleton.

Figure 88

9.1.2. Plug the charger into the outlet. Lights will turn red on the chargerand exoskeleton and LED bar on the exoskeleton will show the current charge (1 bar = 20%).

Figure 89

9.1.3. When charging will be finished LED bar will be full and lights will turn green.You can pull the plug out.

Note: it is forbidden to use any other charger except the one that comes with the device.

Note: it is forbidden to charge exoskeleton with the patient inside the device.

9.2. Charging Tablet PC

9.2.1. Tablet PC has a port on the bottom side so it charges from exoskeleton.

Figure 90

9.2.2. Connect Tablet PC to the charging port on the top of exoskeleton, turn exoskeleton on. The charging process will be shown on the display.

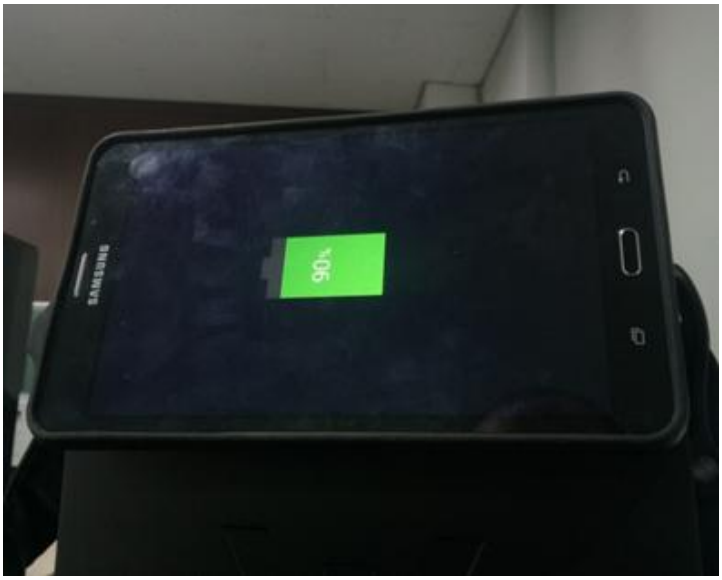


Figure 91

9.2.3. Tablet PC can be charged if exoskeleton is turned on or connected to the charger.

Note: it is forbidden to use any other charger except the one that comes with the device.

9.3. Charging ExoCrutch

9.3.1. Connect the charger to the port on the front side of the device.

Figure 92

9.3.2. Plug the charger into the outlet. Light will turn red on the front side of the device – ExoCrutch is now charging.

Figure 93

9.3.3. When charging is finished light will turn green so you can unplug the charger.

10. Trouble Shooting

10.1. When charging

Symptom	Checklist	Solution method
Battery charging error	Check that the charger is connected to the charging terminal correctly.	Connect the charger correctly to the charging terminal.
	Check if the charging light is turn on.	If the indicator is not turned on, contact your dealer.
	Please check the battery state of charge.	If the battery is not charged, please charge the battery. If it doesn't work even though it's charged, please contact the place of purchase.
Smart Crutch Battery Charging error	Please make sure the charger is connected correctly to the charger.	Connect the charger correctly to the charging terminal.
	Please make sure the charge indicator is on.	If the indicator is not on, contact the place of purchase.
	Please check the battery state of charge.	If the battery is not charged, please charge the battery. If it doesn't work even though it's charged, please contact the place of purchase.

10.2. When connecting

Symptom	Checklist	Solution method
When communication with the body does not connect.	Turn on the main body and beep when the boot is complete. Please check if the beeper sounds normal.	When the beeper sounds, please exit and re-run the application on your tablet PC.
	Please check whether the pilot, assistant, and device selection settings of the application have been carried out as normal.	Please exit the application and run it again from the beginning in order.
If you suddenly lose your connection	Please make sure the application on your tablet PC is being updated.	Applications installed on the tablet PC may be temporarily disconnected during the update process. Run the application again after updating normally.
	Make sure that the smart crutches are not too far from the main body.	If the main unit and the smart crutches are separated by more than the specified distance, the connection may be lost. Use within specified distance.

10.3. In operating

Symptom	Checklist	Solution method
If a beep sounds after setting your posture	If the postures are not fully engaged, a beep may sound. Please check if the posture is set properly.	Please set the posture again from the beginning.
If noise occurs during operation	The motor may make a noise during operation.	The motor may make a noise during operation.
When motion is stopped due to stiffness during operation	If the pilot's body is subject to stiffness, the sensor may stop working. Please check the pilot's condition.	Press "Error Correction" and then press Posture to sit the pilot on the chair. Please check the status of your pilot.
When the power is turned off during operation	Please check the battery state of charge on the main body.	Assistants should support the pilot and sit in the chair. If it is not a battery problem, contact the place of purchase.

11. Maintenance

11.1. Maintenance

- Clean the equipment and the Crutch according to the specified cleaning method with the power off.
- During use, the user or responsible organization must perform regular check-up or maintenance activities. If the operation of the device is suspicious or the device does not operate normally during use, contact our customer service center for action.
- If you need to replace the corset and strap for fixing your body, you can buy it again through the manufacturer.
- Do not disassemble or disassemble the unit. All information about the repair and replacement of the equipment (circuit diagram, wiring diagram, parts replacement method, etc.) is provided to our A / S team and should be performed by the personnel designated by us.

11.2. Disposal of equipment

This equipment must be disposed of in accordance with the standard disposal procedures for products specified by us. For the safe disposal of the product, please contact our customer service center.

12. Appendix

12.1. Product quality assurance policy

- This product is manufactured by ExoAtlet Asia Co., Ltd. Compensation standards for product repairs and exchanges are subject to the "Consumer Injury Compensation Rules" of the regulatory authorities.
- ExoAtlet Asia Co., Ltd. warrants that the design, development, and manufacture of this device is in reasonable control.

[Manufacturer]: ExoAtlet Asia Co., Ltd.,
- Head office: 212, Janghang-ro 225beon-gil, Ilsandong-gu, Goyang-si, Gyeonggi-do, Korea
- Factory: 2F, Happyland Annex, 66, Digital-ro 31-gil, Guro-gu, Seoul, Korea
- Tel: +82-2-2051-1596, Fax: +82-2-2051-1594
- Homepage: http://www.exoatletasia.com

The company homepage of ExoAtlet Asia Co., Ltd. can be used effectively to notify the customer of complaints. Please contact ExoAtlet Asia Co., Ltd. if you experience any inconveniences while using our device or if you have any suggestions for product defects or improvement. We will try to reflect your opinions.

12.2. Instructions and manufacturer declarations

12.2.1. Electromagnetic emissions

<table>
<tr><td colspan="3">The ExoAtlet®Ⅱ is intended for use in the electromagnetic environment specified below. The customer or the user of the ExoAtlet®Ⅱ should assure that it is used in such an environment.</td></tr>
<tr><td>Emissions test</td><td>Compliance</td><td>Electromagnetic environment – guidance</td></tr>
<tr><td>RF emissions
CISPR 11</td><td>Group 1</td><td>The ExoAtlet®Ⅱ uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.</td></tr>
<tr><td>RF emissions
CISPR 11</td><td>Class B</td><td rowspan="3">The ExoAtlet®Ⅱ is suitable for use in all establishments other than domestic, and may be used in domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes, provided the following warning is heeded:
Warning: This equipment/system is intended for use by professionals only. This equipment/ system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the ExoAtlet®Ⅱ or shielding the location.</td></tr>
<tr><td>Harmonic emissions
IEC 61000-3-2</td><td>N/A</td></tr>
<tr><td>Voltage fluctuations/
flicker emissions
IEC 61000-3-3</td><td>N/A</td></tr>
<tr><td colspan="3">Note. The use of cables and components other than those specified for this system is not recommended. Using cables or components that do not meet the system specifications may affect emission quality.</td></tr>
</table>

12.2.2. Electromagnetic IMMUNITY

The ExoAtlet®Ⅱ is intended for use in the electromagnetic environment specified below. The customer or the user of the ExoAtlet®Ⅱ should assure that it is used in such an environment.			
IMMUNITY test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) EN 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst EN 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge EN 61000-4-5	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11	<5 % UT (>95 % dip in UT) for 0,5 cycle 40 % UT (60 % dip in UT) for 5 cycles 70 % UT (30 % dip in UT) for 25 cycles <5 % UT (>95 % dip in UT) for 5 s	<5 % UT (>95 % dip in UT) for 0,5 cycle 40 % UT (60 % dip in UT) for 5 cycles 70 % UT (30 % dip in UT) for 25 cycles <5 % UT (>95 % dip in UT) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of the ExoAtlet®Ⅱ requires continued operation during power mains interruptions, it is recommended that the ExoAtlet®Ⅱ be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: UT is the a.c. mains voltage prior to application of the test level. The use of cables and components other than those specified for the current system is not recommended. Using cables or components other than those specified for the current system may affect the immunity.			

12.2.3. Electromagnetic IMMUNITY – Non-LIFE-SUPPORTING equipment or system

The ExoAtlet®Ⅱ is intended for use in the electromagnetic environment specified below. The customer or the user of the ExoAtlet®Ⅱ should assure that it is used in such an environment.

IMMUNITY test	IEC 60601 TEST LEVEL	Compliance level	Electromagnetic environment – guidance
Conducted RF EN 61000-4-6 Radiated RF EN 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2,5 GHz	3 Vrms 3 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the [ME EQUIPMENT or ME SYSTEM], including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.17\sqrt{P}$ $d = 1.17\sqrt{P}$ 80 MHz to 800 MHz $d = 2.33\sqrt{P}$ 80 MHz to 800 MHz where P is the maximum output power rating of the transmitter in watts(W) according to the transmitter manufacturer and d is the recommended separation distance in metres(m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, a should be less than the compliance level in each frequency range. b Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the ExoAtlet®Ⅱ is used exceeds the applicable RF compliance level above, the ExoAtlet®Ⅱ should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the ExoAtlet®Ⅱ.
b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

12.2.4. Recommended separation distance between this system and mobile RF communication devices - Non-LIFE-SUPPORTING equipment or system

Recommended separation distances between portable and mobile RF communications equipment and the ExoAtlet®Ⅱ

The ExoAtlet®Ⅱ is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the ExoAtlet®Ⅱ can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the ExoAtlet®Ⅱ as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz $d = 1.17\sqrt{P}$	80 MHz to 800 MHz $d = 1.17\sqrt{P}$	800 MHz to 2,5 GHz $d = 2.33\sqrt{P}$
0.01	0.117	0.117	0.233
0.1	0.370	0.370	0.736
1	1.17	1.17	2.33
10	3.70	3.70	7.36
100	11.7	11.7	23.3

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

FCC Information to User

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 of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is con-nected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution

Modifications not expressly approved by the party responsible for compliance could void the user’ s authority to operate the equipment.

FCC Compliance Information : 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.