

# Armeo®Power

## 1. Background information

After an injury, functional recovery takes place; on one hand, due to spontaneous recovery, on the other, therapy induced. However, the original level of function can usually not be re-achieved. The goal of the most efficient therapy solution is to bring back basic function faster, and to achieve a better long-term outcome. Scientific evidence shows that the key factors to successful recovery are:

- Functional training
- Active participation
- Self-initiated movements
- Training intensity: repetitions x effort
- Motivation
- Feedback

The **ArmeoPower** is the world's first commercially available robotic arm exoskeleton and has been specifically designed for arm and hand therapy at an early stage of rehabilitation. With its Assist-as-needed arm support the ArmeoPower provides highly repetitive training even for severely affected patients. The advantages of the ArmeoPower therapy are:

- Early rehabilitation with highly repetitive training for severely affected patients
- Improved therapy efficiency and patient care
- Arm Weight Support in an extensive 3D workspace
- Augmented Performance Feedback with motivating exercises to train activities of daily living (ADLs)
- Assist-as-needed support provided by the robotic arm exoskeleton that automatically adapts to the patients' capabilities.
- Assessment Tools for an objective analysis and documentation of the patient's progress

## 2. What is the Armeo®Power?

The ArmeoPower has been specifically designed for patients with severe movement impairment who have no voluntary activation of their arm muscles yet. The ArmeoPower is based on the ARMin technology developed at ETH Zurich and University Hospital Balgrist under the supervision of Prof. R. Riener.



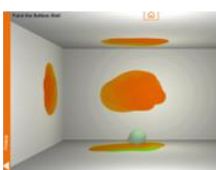
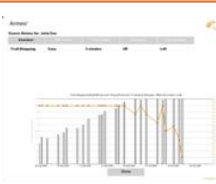
The ArmeoPower is a rehabilitative exercise device intended for patients who have lost function or have restricted function in their upper extremities caused by central nervous or peripheral neurogenic, spinal, muscular or bone-related disorders. The ArmeoPower supports specific exercises for increasing the strength of muscles and the range of motion of joints in order to improve motor function. Furthermore, the ArmeoPower assists clinicians in evaluating these functions.

Taking into account the contraindications and every patient's individual profile, indications for the use of the ArmeoPower include:

- Stroke
- Multiple sclerosis (MS)
- Cerebral palsy (CP)
- Recovery from neurosurgical interventions

- Spinal cord injuries (SCI)
- Traumatic brain injury (TBI)
- Muscle diseases
- Parkinson's disease and other movement disorders
- Upper limb ataxia
- Neuropathies (e.g. Guillain-Barré syndrome)

### 3. What does the Armeo®Power consist of?

<b>Arm Movement</b>		<ul style="list-style-type: none"> <li>- Exoskeleton</li> <li>- Safety zone &amp; ROM</li> </ul>
<b>Individual Settings</b>		<ul style="list-style-type: none"> <li>- Arm Weight Support</li> <li>- 3D Workspace</li> <li>- Robotic support</li> <li>- Exercises</li> </ul>
<b>Patient's Performance</b>		<ul style="list-style-type: none"> <li>- Augmented Performance Feedback</li> <li>- Active movements/ passive movements</li> </ul>
<b>Assessments</b>		<ul style="list-style-type: none"> <li>- A-ROM</li> <li>- A-MOVE</li> <li>- A-GOAL</li> <li>- A-FORCE</li> </ul>
<b>Patient's Data</b>		<ul style="list-style-type: none"> <li>- Scores</li> <li>- Reporting Tools</li> </ul>

The ArmeoPower consists of an exoskeleton (with 3 joints and 6 degrees of freedom), which is linked to a software on a screen. You can adjust the exoskeleton and several software parameters individually to your patients' needs and according to the therapeutic goal of the patient.

The exoskeleton will “guide” or “control” the **Arm movement**, that means, the movement that we want the patient to do. For safety reasons you have create some safety zones in the beginning.

Several **individual settings** can be adjusted or selected, like the arm weight support which supports the movement of the patient against gravity during the movement, the 3D workspace or several exercises according to the patient’s ability.

Moreover, the ArmeoPower (exoskeleton) has sensors which measure the **patient’s performance**. Patient performance and feedback are shown on the screen within Augmented Performance Feedback exercises. The software contains an extensive library of game-like movement exercises supported by a virtual-reality training environment that is both motivating and informative, clearly displaying the functional task along with immediate performance feedback.

Besides functional exercises, the system also provides **Assessments** designed to assess the motor ability and coordination of patients. Built-in sensors record the active arm movement at each joint during all therapy sessions and the performance data is stored in the computer, where it can be used to assess and document the patient’s progress, to determine the next appropriate challenge and to promote the optimum therapy and best possible outcomes.

All these details (**Training Data**) will be saved in the reporting tool, which you can export.

## 4. How are we going to use the Armeo®Power in a training session?

**1** Prepare Patient and Armeo

- 1.1 Personal Data in Software
- 1.2 Adjustment Exoskeleton
- 1.3 Safety Zone

First we will need to **Prepare the Patient and the ArmeoPower**, making the movement axis of the device match that of the patient and thus, ensure good arm movement. **Personal data** like user name and impaired arm will be put into the software. For ArmeoPower, also the height and weight of the patient is required in order to calculate the mass of the arm. The anatomical joints should match the mechanical joints. Therefore, **adjusting the exoskeleton** should be done in following order: shoulder – elbow – wrist. Select the **safety zone** as close as possible to the body. The safety zones prevent a collision of the device with the patient.

**2** Session Setup

- 2.1 Arm Weight Support
- 2.2 Define 3D Workspace (A-ROM, A-MOVE)
- 2.3 Create Therapy Plan

Additionally, **arm weight support** will be selected and put into the software. The arm weight support should be sufficient enough for the patient to be able to perform specific tasks without compensatory movements while allowing many repetitions and yet kept to a minimum to ensure a challenging training session.

**3** Training

- 3.1 Mobilization
- 3.2 Exercises
- 3.3 Assessments (optional)

Then we will prepare the session (**Session setup**). This session setup procedure will be done a systematic way, step by step, to make it time efficient and to avoid missing a step. To **define the 3D workspace**, you have to conduct the initial assessments A-ROM (1D workspace) and A-MOVE (2D, 3D workspace). For **A-ROM**: Select the minimum and maximum degrees of freedom in each joint or the ROM you want to exercise in later; consider, the patient can only perform within these defined ROM in the exercises. If you **create the therapy plan**, select appropriate **exercises** aligned with training goals or the patient's ability (1D/2D/3D, included joints, movements) as well as appropriate exercise parameters (difficulty level, duration, visual detail). **Mobilization** and **Assessment** tools may also be included in the therapy plan.

**4** Bring the Patient out

Once all is ready, we will start **Training** according to the selected therapy plan, which can also include assessments along with exercises.

Once the training session is finished, we **Bring the patient out** of the ArmeoPower.