Otto Bock®

QUALITY FOR LIFE

Axon-Bus® Prosthetic System with Michelangelo® Hand

Information for Practioners

Axon-Bus® System

Seizing Opportunities

Few parts of the human body are as important and complex as our hands. Only the perfect interplay of nerves, tendons, a total of 27 bones, 39 muscles and 36 joints allow us to handle everyday tasks.

This complexity makes the re-creation of its many functions a great technological and medical challenge.

Based on this background, the Axon-Bus® System in combination with the Michelangelo® Hand represents a milestone in product development for upper limb prosthetics. With innovative communication possibilities, the self-contained Axon-Bus® System offers many advantages while the Michelangelo® Hand with its degrees of freedom restores numerous hand functions for the user.

A product development milestone

The Axon-Bus® System is a new system for transradial fittings. **Axon** stands for **A**daptive e**x**change **o**f **n**europlacement data. The Axon-Bus® itself is a new development from Otto Bock for the field of exoprosthetics. It was derived from safety-related bus systems in the aviation and motor vehicle industries and is a true innovation from our Research and Development department.

One of the benefits of its optimised, self-contained data transmission system is that individual components communicate with each other perfectly, eliminating losses in terms of data transmission, speed and functionality. Compared to conventional systems, the Axon-Bus® System achieves a significant reduction in sensitivity to outside interference, which results in clear advantages for the user, both in safety and reliability.

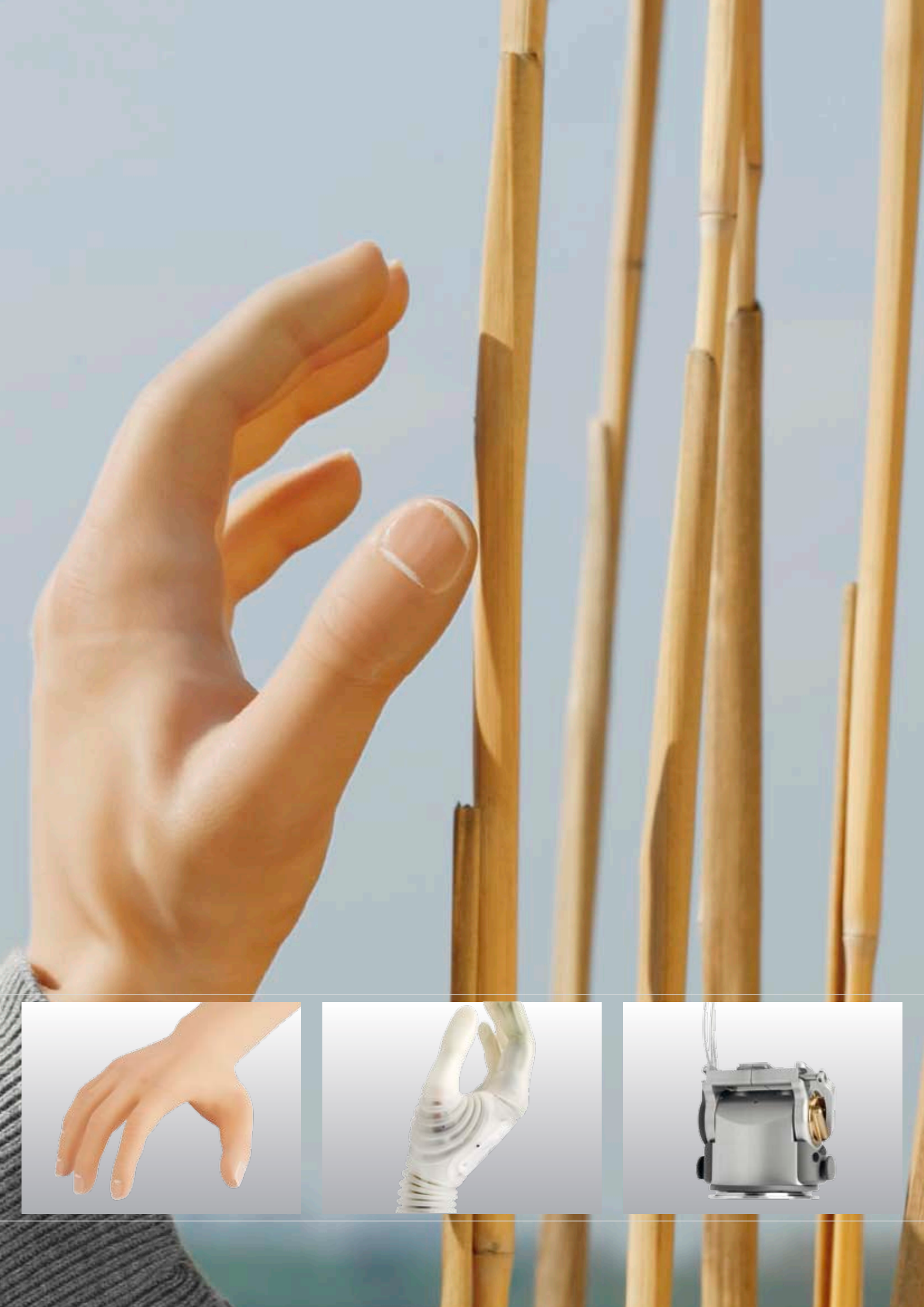
In combination with the Michelangelo® Hand, which offers the user enhanced hand functionality, the Axon-Bus® System provides more degrees of freedom than ever before.

The modular prosthesis system can be expanded with additional components in the future. The adaptation of the Dynamic-Arm® and ErgoArm®, additional hand sizes, electric rotation and flexion for the wrist joint, new electrodes and a new Greifer or hook as well as additional features are all in progress. These components will be harmonised to work perfectly with the Axon-Bus® System.

The current Axon-Bus® System is suitable for **transradial fittings** only.

It consists of the following components:

- Michelangelo® Hand
- AxonWrist
- AxonEnergy Integral
- AxonCharge Integral
- AxonSoft
- AxonMaster
- AxonSkin Natural/Visual



8E500 Michelangelo® Hand – The Heart of the System

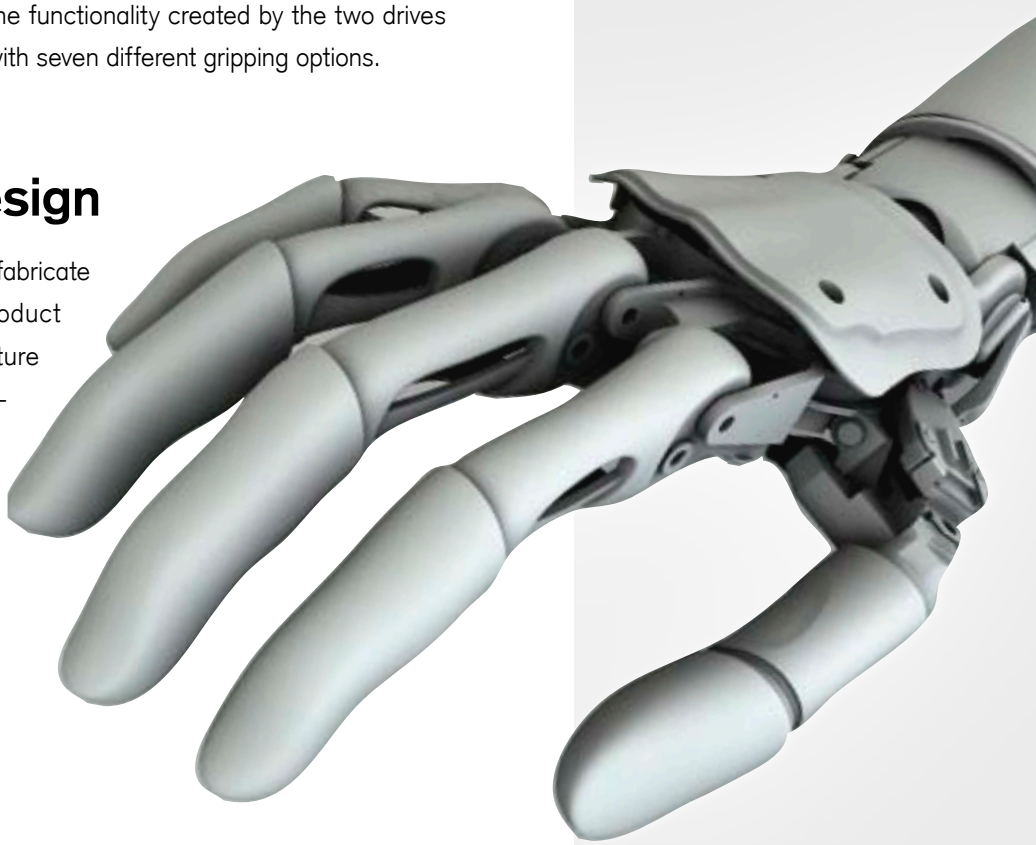
The **8E500 Michelangelo® Hand** is the heart of the new prosthetic system. Complex gripping kinematics, natural movement and appearance as well as low weight support the user during everyday activities.
The Michelangelo® Hand is a part of a new prosthesis generation and designed for transradial fittings.

Unique Functionality

Thanks to four movable fingers and a thumb that can be independently positioned, the Michelangelo® Hand offers innovative, never-before-seen gripping kinematics. In order to achieve a more natural movement pattern, the hand is equipped with two drive units. The main drive is responsible for gripping movements and gripping strength, and actively drives the index finger and middle finger, while the ring finger and little finger 'follow' the main fingers passively. The thumb drive allows the thumb to be electronically positioned in one additional axis of movement. Taken together, the functionality created by the two drives offers the user incredibly versatility, with seven different gripping options.

Extraordinary Design

The soft and hard materials used to fabricate the fingers constitute another product highlight. With details based on nature as a model, they make a major contribution towards the acceptance of the Michelangelo® Hand.



8E500 Michelangelo® Hand

Easy to Use

The Michelangelo® Hand is easy for the user to operate. It is turned on and off by pressing the charging receptacle of the AxonEnergy Integral on the outside of the socket. The finger grip can also be externally loosened by means of the mechanical switch if required.

Settings

Adjustments to the Michelangelo® Hand can only be performed through Bluetooth® data transfer using the AxonSoft software. In order to do so, a Bluetooth® wireless connection has to be established between the Axon Master and the PC.

Power Supply

The power supply for the Michelangelo® Hand is provided by the AxonEnergy Integral integrated into the socket. Intelligent battery management alerts you when the battery capacity decreases - the hand becomes slower and the gripping strength is reduced. Only when the battery capacity gets very low is the hand turned off in order to protect the battery against harmful deep discharge.

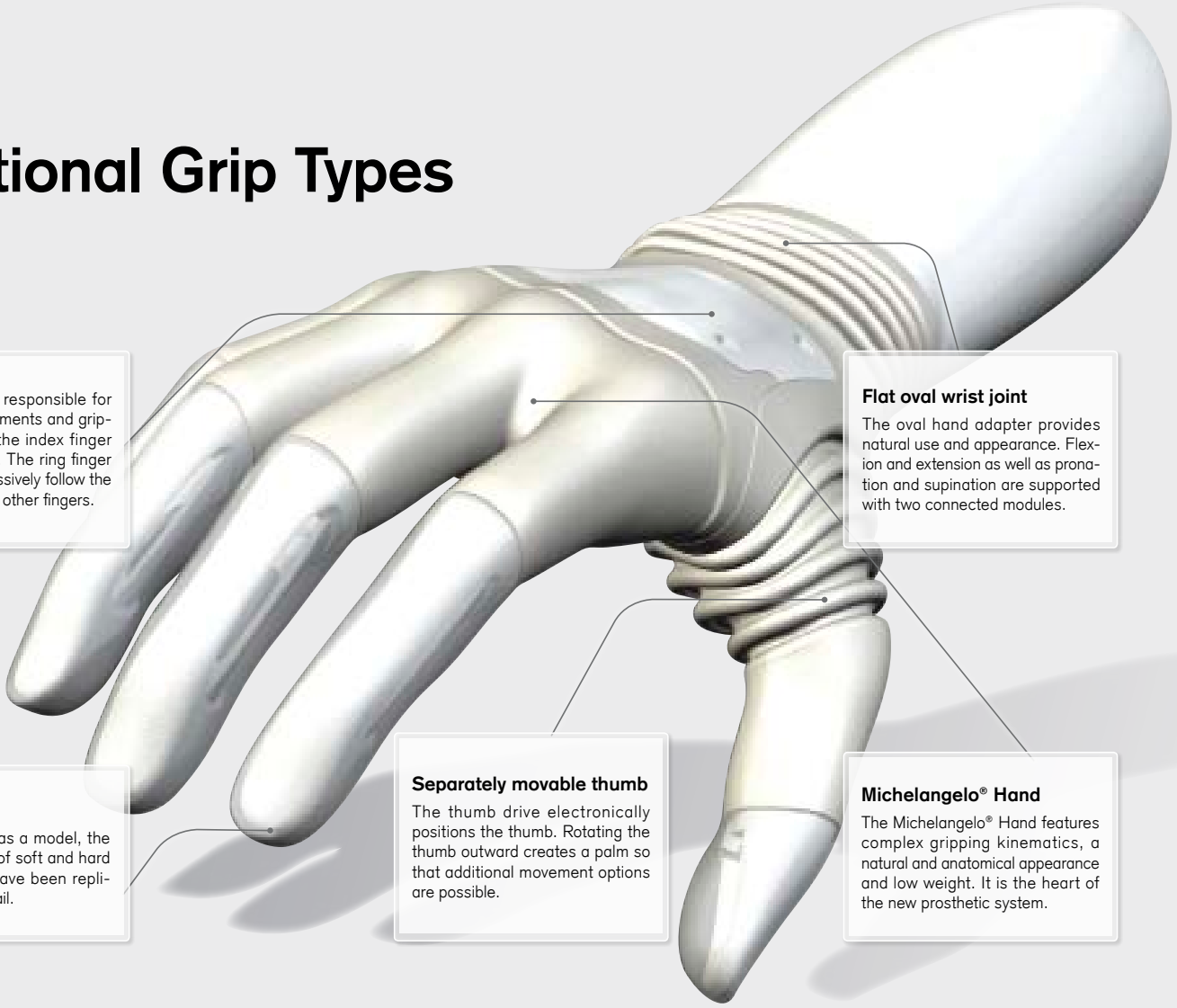
Ordering Information

Article number:	8E500
Size:	M (= 7 ¾)

Technical Data:

Operating temperature:	0° C to +60° C (+32° F to +140° F)	Speed:	Approx. 325 mm/s
Weight:	Approx. 410 g (without prosthesis glove)	Gripping strength, opposition mode:	Approx. 100 N
Operating voltage:	11.1 V	Gripping strength, lateral mode:	Approx. 70 N
Opening width:	Approx. 120 mm	Gripping strength, neutral mode:	Approx. 15 N

Functional Grip Types



Main Drive
The main drive is responsible for the gripping movements and gripping strength of the index finger and middle finger. The ring finger and little finger passively follow the movements of the other fingers.

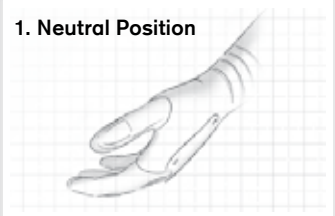
Flat oval wrist joint
The oval hand adapter provides natural use and appearance. Flexion and extension as well as pronation and supination are supported with two connected modules.

Soft fingertips
Based on nature as a model, the fingers are made of soft and hard materials. They have been replicated in great detail.

Separately movable thumb
The thumb drive electronically positions the thumb. Rotating the thumb outward creates a palm so that additional movement options are possible.

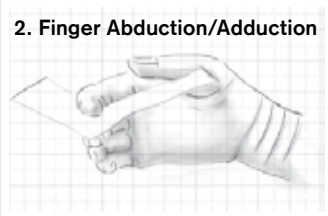
Michelangelo® Hand
The Michelangelo® Hand features complex gripping kinematics, a natural and anatomical appearance and low weight. It is the heart of the new prosthetic system.

1. Neutral Position



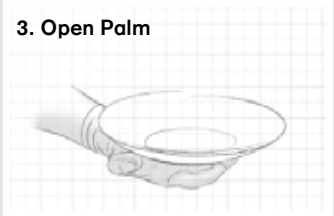
Natural, physiological appearance at rest.

2. Finger Abduction/Adduction



Spreading the fingers allows several flat, thin objects to be held between the fingertips. ➞ Closed thumb position

3. Open Palm

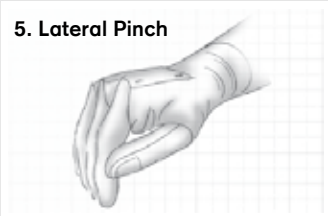


In the open palm position, the thumb is at an **extended** palmar location to achieve a flat hand position. ➞ Completely open thumb position

4. Lateral Power Grip

The thumb moves laterally to the index finger so that objects of moderate size are gripped sideways. ➞ Open thumb position

5. Lateral Pinch

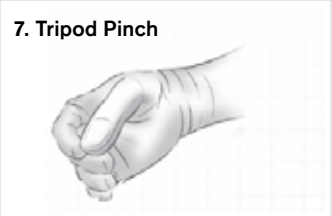


The thumb moves laterally to the index fingers so that flat items are gripped from the side. ➞ Closed thumb position

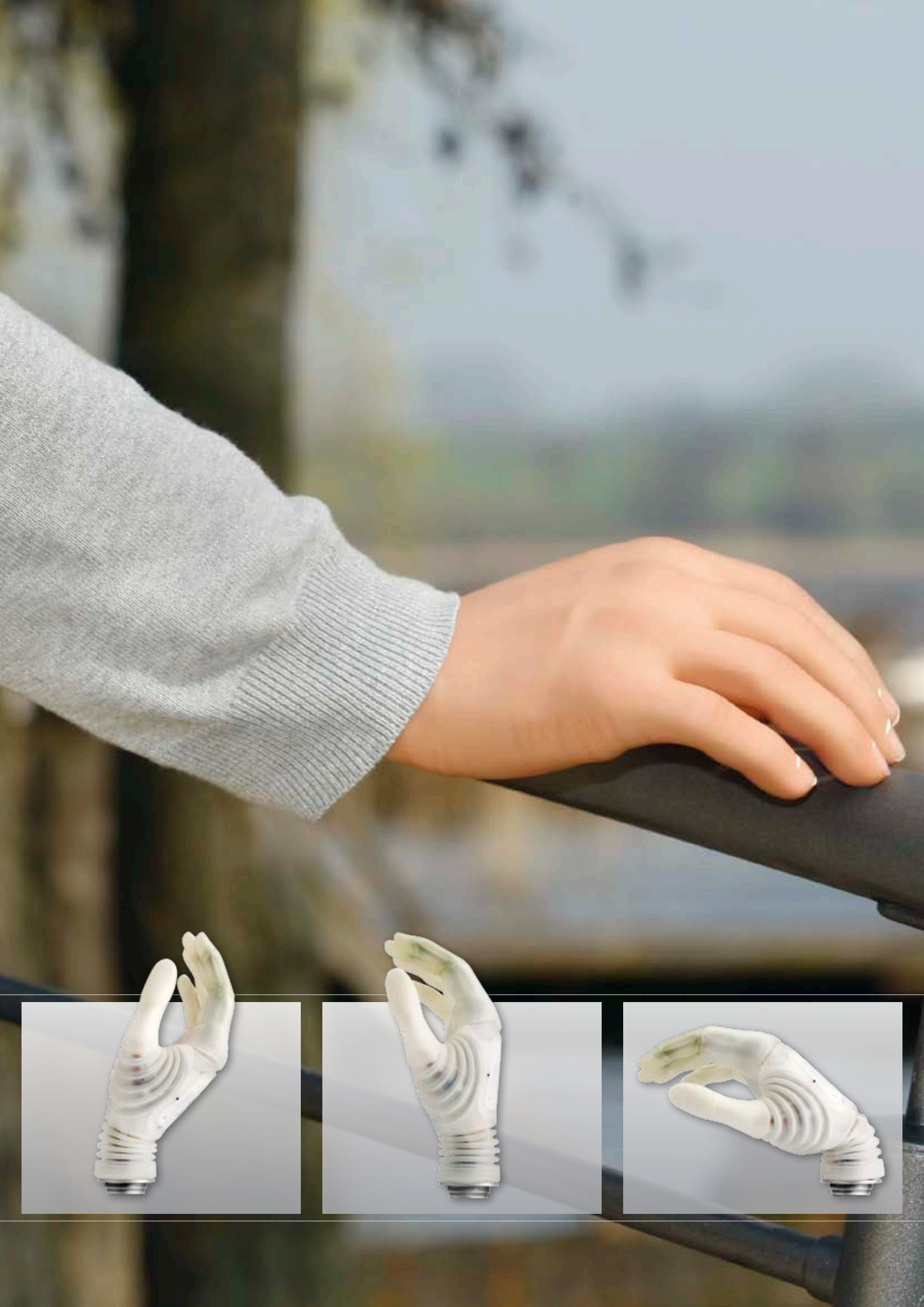
6. Opposition Power Grip

The opening width allows cylindrical objects with a large diameter to be held. ➞ Half open thumb position

7. Tripod Pinch



The thumb, middle finger and index finger form a three-point support to hold small objects securely. ➞ Closed thumb position



10V500=2 AxonWrist

Description

The **10V500=2 AxonWrist** mechanical wrist joint offers never-before-seen degrees of freedom for the Michelangelo® Hand. The wrist joint itself consists of two modules that support flexion and extension as well as pronation and supination. These functions support the user during everyday activities.

The multi-axial movement pattern helps avoid unnatural compensatory movements and thereby promotes a healthy, natural body posture. An oval hand adapter, which appears more natural than round wrist joints, is another innovation.

Numerous Functions

The Michelangelo® Hand is easy to disengage from the AxonWrist by pushing both unlock buttons. When only one unlock button is pushed, the gripping prosthesis cannot be removed for safety reasons.

Pronation and supination are passive. From the neutral position, the module can be rotated 180° to the inside and 180° to the outside. It engages at 24 positions with increments of 15°. Thanks to the new release mechanism, over-rotation or accidental disconnection is not possible.

Another module permits individual, passive flexion and extension. Starting at the neutral position, the joint can be flexed by approximately 70° in 5 ratchet positions; extension is 45° with 3 ratchet positions. Depending on the application, the wrist joint can be used in a flexible or a rigid mode.

1. Flexible Mode

Flexible mode copies the natural movement pattern of a relaxed wrist joint. Flexibility closely approximates the physical movement characteristics of the hand and wrist. To select flexible mode, the lever has to be pushed to the stop until it engages. This allows the joint to be moved without engaging at the ratchet positions.

2. Rigid Mode

Various everyday conditions require individually adjustable flexion and extension of the gripping prosthesis in rigid mode. When the unlock button is only pushed lightly and not to the stop, the AxonWrist can be moved to the desired position. When the unlock button is released, the wrist joint engages at the next available position.

Technical Data:

Rotation:	360° in 24 ratchet positions
Flexion:	75° in 5 ratchet positions
Extension:	45° in 3 ratchet positions
Weight:	Approx. 180 g

757B500 AxonEnergy Integral

Description

The **757B500 AxonEnergy Integral** is an integrated energy supply system consisting of a ❶ charging receptacle, ❷ battery and the ❸ Axon-Bus® cable. The components are permanently connected to each other.

Charging Receptacle

The charging receptacle with integrated button, LED and beeper has several functions:

- Contacts for battery charging
- The LED indicates the current battery capacity. To determine the battery capacity, push the charging receptacle button for less than 1 second. The LED is illuminated and indicates the current battery capacity according to the colour.
- Button to turn the prosthesis component on and off. Push the button for approximately 1 second. Two short beeps are heard and the LED is briefly illuminated when the system powers up.
- Button to activate the Bluetooth® function
- Switch to open the prosthesis in an emergency
- Beeper for providing feedback on operating states

Battery

The battery consists of 3 Li-Ion cells. The integrated electronics protect the device against short circuits, overvoltage, undervoltage and charging outside the allowable temperature range. In order to charge the battery, connect the charging plug to the charging receptacle and allow it to snap into place. A short beep sounds, the prosthesis is turned off and the charging process starts automatically.

Axon Cable

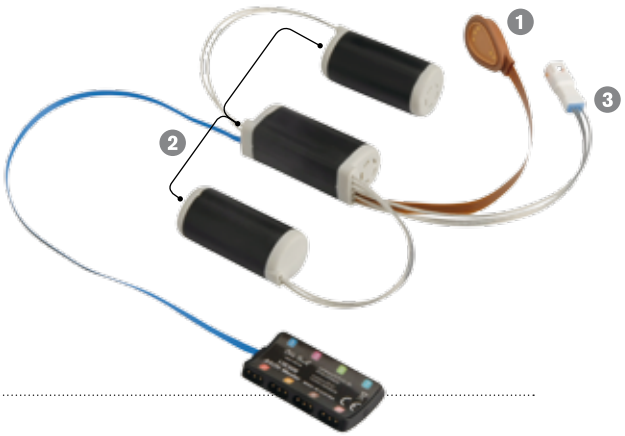
The Axon cable with the three-pin receptacle is used to exchange data and connects the respective prosthesis components to the battery.

Bluetooth®-function

When the prosthesis is turned off and the charging receptacle button is pushed for more than 4 seconds, the prosthesis Bluetooth®-function is activated. The LED flashes blue.

Technical Data:

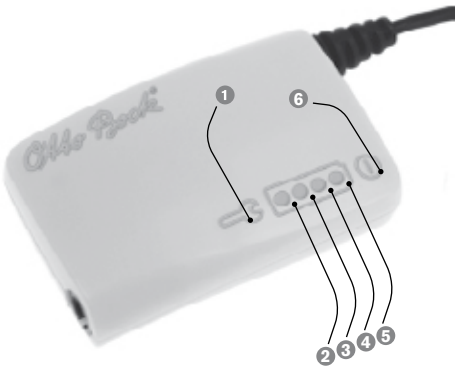
Capacity:	Approx. 1,500 mAh
Output voltage:	11.1 V
Charging time:	Approx. 3.5 h
Operating temperature:	0° C to + 60° C (+32° F to +140° F)
Weight:	Approx. 140 g



757L500 AxonCharge Integral

Description

The **757L500 AxonCharge Integral** charges the Axon Energy Integral integrated into the socket. For charging, the charging plug must be connected to the charging receptacle with the help of an integrated magnet. The special contour of the receptacle and plug ensures the two components are aligned quickly and easily. LEDs indicate the readiness of the charger and the current battery capacity.



LED Functions

- **LED 1 is not illuminated:** There are no errors and service is not required.
- **LED 1 flashes red:** There is an overall system error (battery, prosthesis components etc.). Please contact Otto Bock Myo-Service.
- **LED 1 is illuminated in yellow:** The gripping prosthesis should be sent to Otto Bock Myo-Service for maintenance service.
- **LED 6 flashes red:** The charger is defective. Please send the product to Otto Bock Myo-Service.

	LED 2	LED 3	LED 4	LED 5
Battery empty				
Battery 25% charged	●			
Battery 50% charged	●	●		
Battery 75% charged	●	●	●	
Battery 100% charged	●	●	●	●

● LED illuminated ● LED flashes

560X500 AxonSoft

Description

In order to establish individual patient settings for the prosthesis components, the myo-signal must be evaluated. This is done using the **560X500 AxonSoft** adjustment software, which is integrated into the Otto Bock Data Station. Communication between the prosthesis components and the PC takes place via a Bluetooth® interface.

Key functions of the setup software

- Evaluation of muscle signals and optimum electrode adjustment
- Configuration of the prosthesis parameters based on patient indications
- Documentation of all recorded patient data with printouts, e.g. for reimbursement parties

The integrated online help system offers practical assistance while working with the software and contains a lot of additional, useful information.

Data transfer between the Michelangelo® Hand and the PC

Adjustments to the Michelangelo® Hand can only be performed through Bluetooth® data transfer and the setup software. In order to make adjustments, connect the 60X5 BionicLink PC and establish a wireless connection between the AxonMaster and the PC.

13E500 AxonMaster

Description

The **13E500 AxonMaster** is the central control unit of the Axon-Bus® system. It receives control signals generated by the user and transmits them to the respective prosthesis components via the Axon-Bus®. This allows the user to control and switch between the prosthesis components. The AxonMaster also administers all data communication over the Axon-Bus® system.

Power supply

The supply of power to the AxonMaster and prosthesis components is provided centrally by the AxonEnergy Integral via the Axon-Bus®.

Setting up the prosthesis components

Adjustments to the prosthesis components can be performed through Bluetooth® data transfer and the Axon Soft software. The Bluetooth® module is integrated into the AxonMaster. 7 standard programmes that can be individually adapted are available in the AxonMaster.

- Programme 1: **MultiGrip**
- Programme 2: **DMC**
- Programme 3: **DMC LowInput**
- Programme 4: **AutoControl LowInput**
- Programme 5: **Digital**
- Programme 6: **VarioControl**
- Programme 7: **DoubleChannel**

Technical Data:

Operating voltage:	11.1 V
Operating temperature:	0° C to +60° C (+32° F to +140° F)
Bluetooth® range:	Approx. 5 m
Weight:	Approx. 15 g

AxonSkin Natural/Visual

PVC gloves in six different colour variations were developed for the Axon-Bus® System. In addition to a physiological appearance, the new gloves feature excellent durability.

New lamella in the hand cups also facilitate the mobility of the multi-axial wrist joint and the thumb, which can be electronically positioned. In addition to various skin-coloured versions, there will also be a translucent prosthesis glove to underscore the appealing futuristic design of the Michelangelo® Hand.

Article number

- 8S500=* Translucent Prosthesis Glove
- 8S501=* Skin-Coloured Prosthesis Glove for men
- 8S502=* Skin-Coloured Prosthesis Glove for women

Colour Selection

646M47 Colour Pattern Set N

Advantages at a Glance

Design

The Michelangelo® Hand features an extraordinary physiological design with various hard and soft structures that model bones, joints, muscles and tendons. The new oval wrist adapter also offers a much more natural appearance.

- Highly Natural Appearance

Technology

The integrated wrist joint permits flexion, extension and rotation. New grip positions are possible thanks to electronic thumb positioning.

- Active thumb positioning with two movement axes
- Wrist joint with flexion, extension and rotation
- More degrees of freedom

Innovation

As a system provider, Otto Bock is offering a completely new prosthesis system that assures fast and secure data transmission thanks to digital data transfer technology. The prosthesis system can also be expanded. This is achieved by the intelligent Axon-Bus® System.

- Optimised, harmonised system
- Very high gripping strength and speed
- Expandable thanks to the modular structure

Please contact us if you have any further questions or would like to have more information.

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