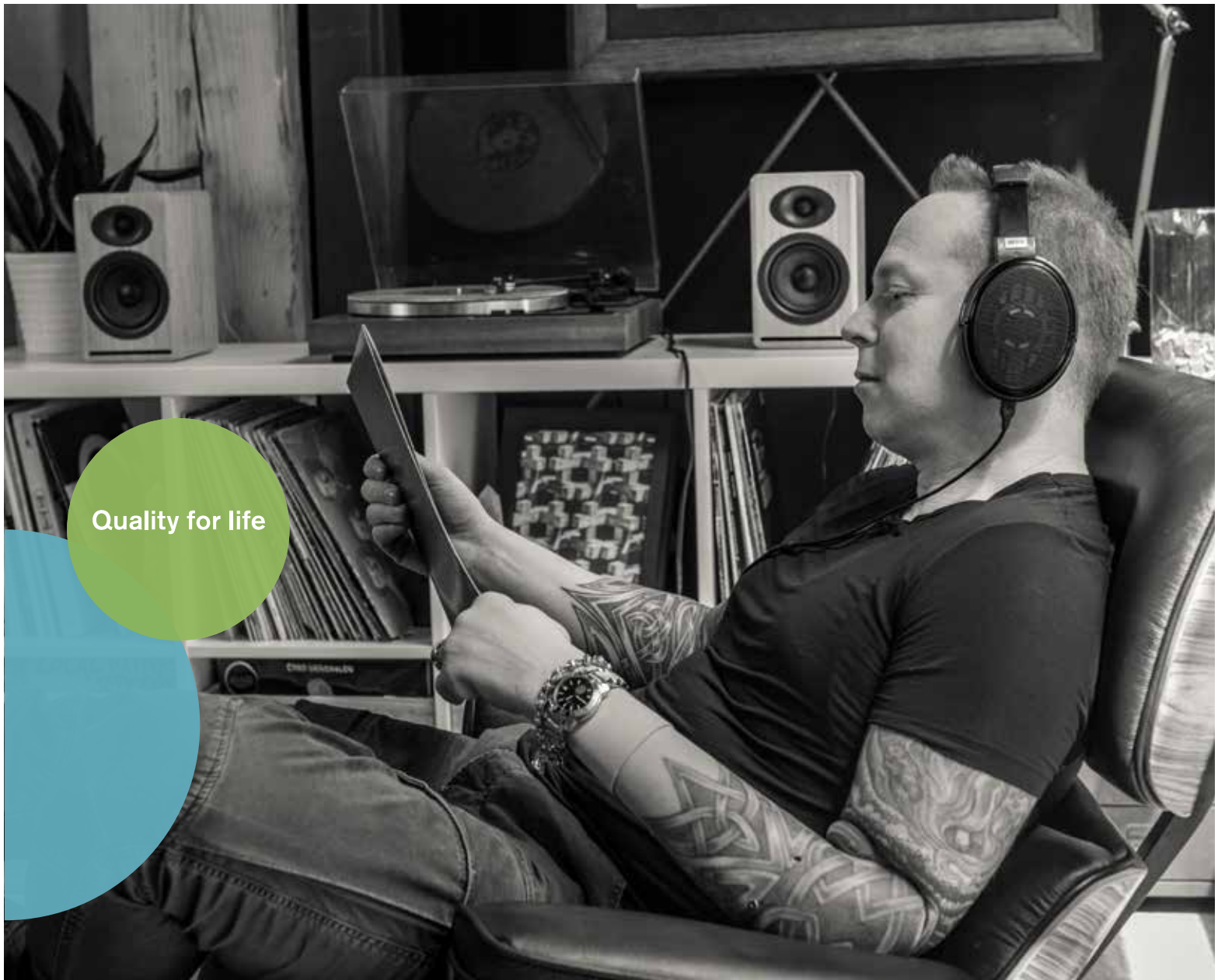


**ottobock.**

# Michelangelo

Embrace the everyday.



Quality for life

Few parts of the human body are as important and complex as the hand. Only the perfect interplay of nerves, tendons, a total of 27 bones, 39 muscles and 36 joints allows people to handle their everyday tasks.

With the Michelangelo Hand and Axon-Bus system, Ottobock has realized the most advanced technical implementation of this functionality ever: as the heart of the prosthesis system, it offers unrivaled benefits for the user. Electric rotation with the AxonRotation significantly increases this freedom of movement. This is our understanding of innovation – technology that meets the needs of people.



## Using advanced technology to help you reach your potential

### **This is our technology**

We know the challenges users face on a daily basis – and how we can help them with the latest technologies. Axon stands for Adaptive eXchange Of Neuroplacement data. The Axon-Bus system, developed by Ottobock for the field of exoprosthetics, was derived from safety-related systems in the aviation and automobile industries – a true innovation in terms of the process and the results.

The advantage is that it constitutes a self-contained data transmission system with perfectly harmonized components. The individual components “communicate” with each other so smoothly that losses in terms of data transmission, speed and functionality are eliminated. For users, this means a clear safety advantage and greater reliability: they benefit from considerably reduced sensitivity to external interference in comparison with conventional systems.

### **True added value for users**

Combined with the Michelangelo Hand and the AxonRotation electric wrist unit, the Axon-Bus system offers more degrees of freedom than ever before – users benefit from enhanced hand functionality and the ability to actively rotate the hand to the inside and outside. The modular prosthesis system is suitable for transradial as well as transhumeral fittings. These components will be harmonized with the Axon-Bus system.

The current Axon-Bus system comprises the following components:

- Michelangelo Hand with AxonWrist
- AxonRotation (active rotation), AxonRotation adapter (passive rotation)
- AxonEnergy Integral
- AxonCharge Integral
- AxonSoft
- AxonMaster
- AxonSkin Natural (men)
- AxonSkin Natural (women)
- AxonSkin Visual
- AxonSkin Black
- AxonArm Ergo



# The Michelangelo Hand: Intelligently simple

## Easy for the user to operate

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 socket surface.

## Easy for you to adjust

Adjustments to the Michelangelo Hand are made using the AxonSoft software and Bluetooth® data transfer. In order to do so, a Bluetooth® wireless connection has to be established between the AxonMaster and the PC.

## Well supplied

The power supply for the Michelangelo Hand is provided by the AxonEnergy Integral integrated into the socket. When the battery capacity is lowered, integrated battery management automatically informs the user. In this case, the hand gets perceptibly slower and exerts less gripping force. When there is very little battery capacity remaining, the prosthetic hand switches off to protect the battery against harmful deep discharge.



### Michelangelo Hand

The Michelangelo Hand features complex gripping kinematics, a natural, anatomical appearance and low weight.

### Main drive

The main drive of the Michelangelo Hand is responsible for the gripping movements and gripping force. Actively driven elements are the thumb, index finger and middle finger while the ring finger and little finger passively follow the other fingers.

### Release buttons on both sides

By simultaneously pressing the release buttons, the user can remove the Michelangelo Hand from the socket.

### Flat oval wrist unit

The oval hand adapter looks very natural. Flexion and extension (bending and stretching) are based on the relaxed wrist (flexible mode).

### Soft fingertips

The fingers of the Michelangelo Hand are based on a natural hand down to the details. For a natural effect, they are made from a combination of softer and harder materials.

### Separately movable thumb

The thumb drive permits electronic positioning. Rotating the thumb outward creates a wide open palm, so that additional movement options are possible.

### Flexible wrist joint

With the lock button, the user can make adjustments to the wrist joint mode: flexible or rigid mode can be selected as desired.

### AxonRotation – active rotation

The Michelangelo Hand is combined with an active rotation. With the use of myosignals, the user can rotate the Michelangelo Hand to the inside (pronation) and outside (supination).

### Ordering Information

Michelangelo Hand	8E500=*
Michelangelo Hand Transcarpal	8E550=*
Size	M (= 7 ¾)

### Technical Data

Operating temperature	14° F to +140° F
Weight	520g with AxonWrist, without AxonSkin
Operating voltage	11.1V
Opening width	approx. 120mm
Speed	approx. 325mm/s
Gripping force in Opposition Mode	approx. 70N ~ 15.5 lbf
Gripping force in Lateral Mode	approx. 60N ~ 13.5 lbf
Gripping force in Neutral Mode	approx. 15N ~ 3.5 lbf

# New possibilities in gripping kinematics for unique functionality

Thanks to four movable fingers and a thumb that can be separately positioned using myoelectric signals, the Michelangelo Hand offers innovative, lifelike gripping kinematics.

Two drives create a natural hand movement pattern. The main drive is responsible for gripping movements and gripping force while the thumb drive allows the thumb to be

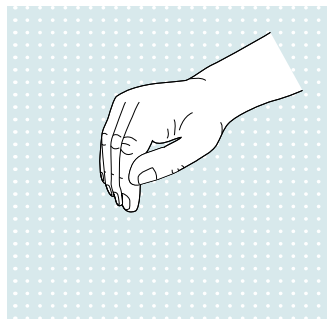
electronically positioned in an additional axis of movement. This results in seven different hand positions. Actively driven elements are the thumb, index finger and middle finger while the ring finger and little finger passively follow the movements of the other fingers.

## AxonRotation

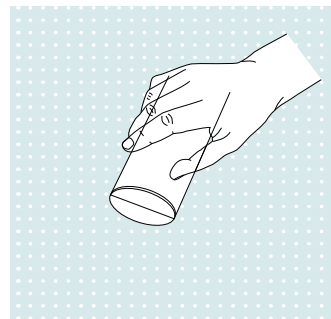


**AxonRotation**  
Permits active pronation and supination at a range of 160° respectively in all 7 gripping positions.

## Lateral Mode

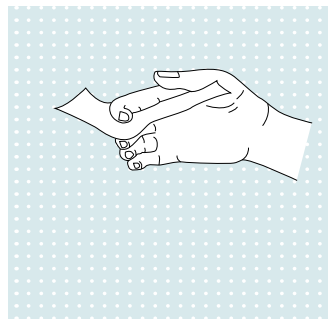


**Lateral Pinch**  
The thumb moves lateral to the index fingers so that the user can grip flat items from the side.



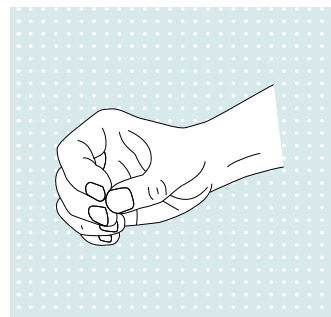
**Lateral Power Grip**  
Thumb moves sideways to index finger. This allows the user to grasp objects of medium size from the side.

## Lateral + Opposition Mode

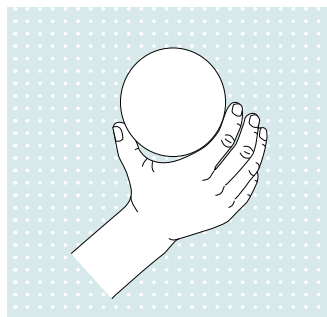


**Finger Abduction/Adduction**  
Finger adduction takes place when closing the hand. This allows the user to grasp a flat item between the fingers (< 2 mm). Abduction takes place automatically when opening the hand.

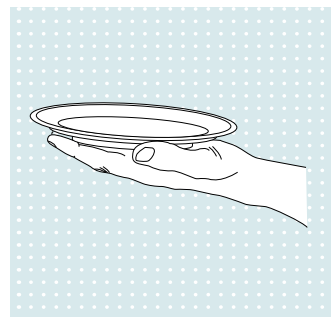
## Opposition Mode



**Tripod Pinch**  
The thumb, middle finger and index finger form a three-point support – so the user can hold small objects securely.

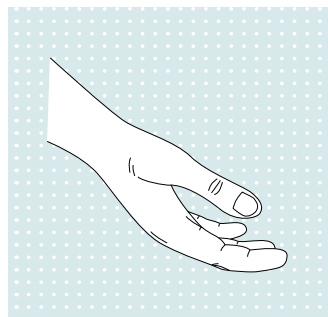


**Opposition Power Grip**  
The greater opening width allows the user to hold objects with a large diameter.



**Open Palm**  
In the open palm position, the thumb is at a far palmar location: the user achieves a flat hand position.

## Neutral Mode



**Neutral Position**  
Natural, physiological appearance in the rest position.

# Great freedom: AxonRotation



## 1 Active rotation of the Michelangelo Hand

The Michelangelo Hand in combination with active rotation allows the user proportional, smooth, and precise control according to the muscle signal. Proportional control is possible for all movements, rotation, and the gripping function of the Michelangelo Hand.

Rotation assists users in numerous bimanual (two-handed) activities in their everyday life. With the flexible wrist joint of the AxonWrist, the various grip types of the Michelangelo Hand, and the addition of the active AxonRotation, compensatory movement is greatly reduced.

## 2 Automatic neutral position

When the hand is not holding an object and the user relaxes the myosignal, the hand automatically returns to a relaxed, neutral position. Therefore, the user automatically knows the starting position of the hand. This reduces the concentration required while grasping and makes controlling the prosthesis more intuitive.

## Ordering Information

AxonWrist	integrated in the 8E500 Michelangelo Hand
AxonRotation	9S503

# AxonWrist



## 1 Flexible Modus

Flexible Mode simulates the natural movement characteristics of a relaxed wrist joint. This flexibility closely approximates the physical movement characteristics of the natural hand and wrist. To adjust flexible mode, the lock button is pressed until it engages. Now the joint can be moved freely without engaging at the fixed, ratchet positions.

## 2 Rigid Mode

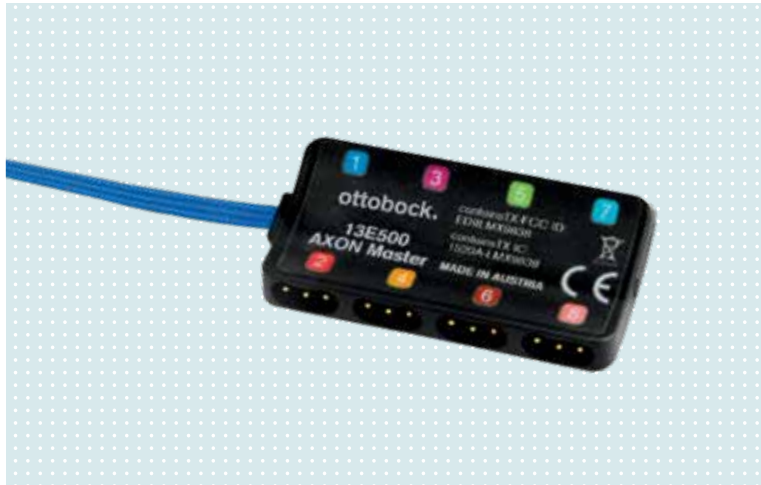
Various everyday situations faced by users require individually adjustable flexion and extension of the gripping prosthesis in Rigid Mode. When the unlock button is only pushed lightly, the AxonWrist can be moved to the desired position. When the unlock button is released, the wrist joint engages at the next available position.

## Technical Data

AxonRotation	
Pronation from the neutral position	160°
Supination from the neutral position	160°
Weight	140 g
AxonWrist	
Flexion	75° in 4 ratchet positions
Extension	45° in 3 ratchet positions



## Central control: The AxonMaster

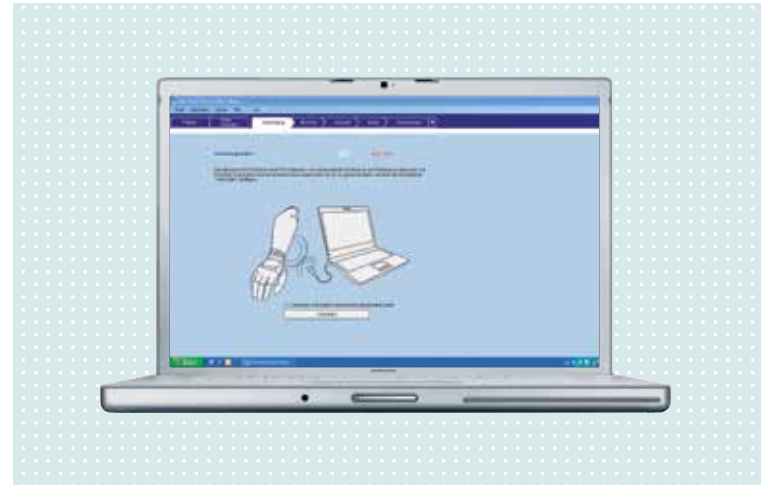


The AxonMaster as the central control unit of the Axon-Bus system is connected directly to the AxonEnergy Integral. It receives and processes control signals from the user and transmits them to the respective prosthesis components. This allows the user to control the hand movements and switch between the prosthesis components directly and reliably. The AxonMaster stores all control parameters of the prosthesis system. With an integrated Bluetooth module in the AxonMaster, the Axon-Bus prosthesis system can be programmed using the AxonSoft software and wireless Bluetooth data transfer. The user can move about the room freely while the system is being programmed.

Technical Data	
Operating voltage	11,1V
Operating temperature	32° F to + 140° F
Bluetooth® range	approx. 5 m
Weight	approx. 15 g

Ordering Information	
AxonSoft	560X500=*
BionicLink	60X5

## Individual adjustment: AxonSoft



In order to establish individual user settings for the prosthesis components, the myo-signal must be evaluated. This is done using the AxonSoft adjustment software, which is integrated into the Ottobock Data Station.

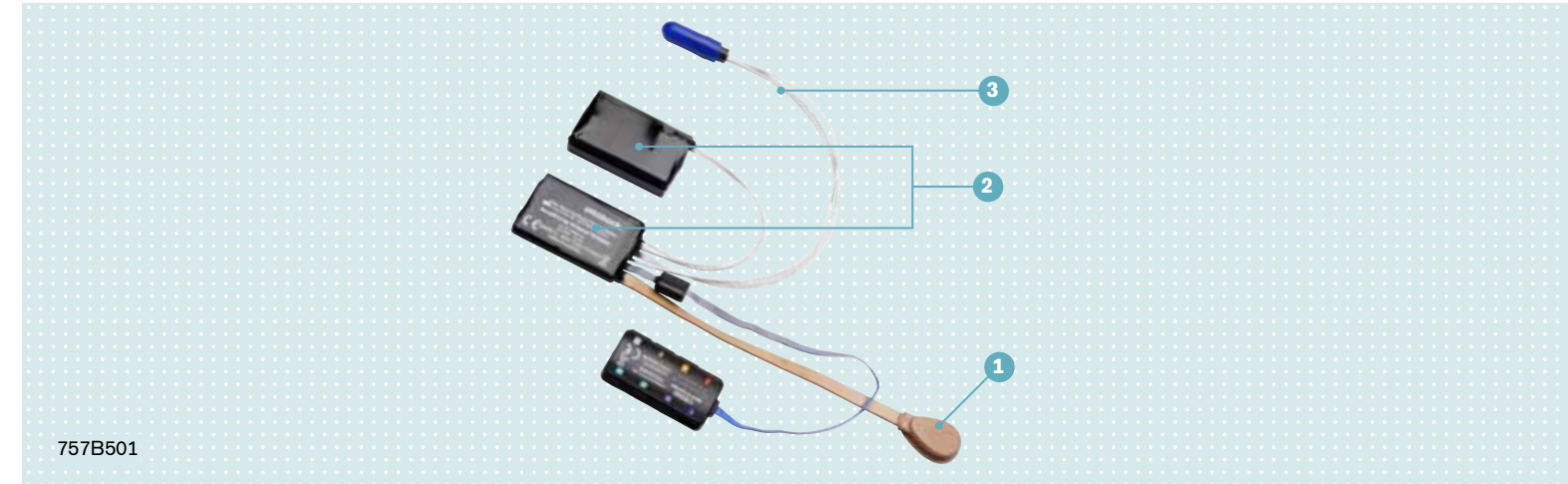
### Key functions of the adjustment software

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

### Data transfer between the AxonMaster and the PC

Michelangelo Hand settings are configured with the adjustment software via Bluetooth® data transfer. In order to do this, you connect the 60X5 BionicLink PC and establish a wireless connection between the AxonMaster and your PC.

## With full energy: AxonEnergy Integral



757B501

- 1 Charging receptacle
  - 2 Battery
  - 3 Axon-Bus cable
- (without 13E500 AxonMaster)

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

### Charging receptacle

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

- Contacts for **battery charging**
- LED display for **current battery charge level:** Press the charging receptacle button for less than 1 second; the LED display lights up and shows the current battery charge level by color
- **Turning on the prosthesis component:** Press the button for approx. 1 second; switching on is confirmed by two short audible signals (2× beep) and the LED display lights up briefly
- **Turning off:** Press the button again to switch the prosthesis off (1 ×beep)
- **Activating the Bluetooth® function:** First power down the prosthesis. Then push and hold the charging receptacle button for 4 seconds
- **Emergency prosthesis opening:** Push and hold the button for 3 seconds, until the hand opens and the prosthesis switches off
- Audible signals (beeps) provide feedback on operating states

### The battery

The battery consists of 3 Li-Ion cells. The integrated electronics protect against short circuits, overvoltage, undervoltage and charging outside the allowable temperature range. Use the AxonCharge Integral battery charger for charging.

### The Axon-Bus cable

The Axon-Bus cable is the interface to the gripping component. This connecting cable supplies the prosthesis components with energy on the one hand and transmits the control signals on the other hand.

Technical Data	757B501
Capacity	approx. 1.150 mAh
Output voltage	11.1V
Charging time	approx. 3.5 h
Operating temperature	32° F to 140° F
Weight	ca. 90 g

Ordering Information	
AxonEnergy Integral	757B501

# Easy and efficient charging: AxonCharge Integral



- 1 LED 1
- 2 LED 2
- 3 LED 3
- 4 LED 4
- 5 LED 5
- 6 LED 6
- 7 AxonCharge Mobile

The AxonCharge Integral charges the AxonEnergy Integral integrated in the socket. Makes charging a snap: the charging plug is connected to the charging receptacle with the help of an integrated magnet. The special contour of the receptacle and plug ensures that the two components are aligned quickly and easily. LEDs indicate the status of the charger and the current battery charge level.

In summary, using the AxonCharge Integral is straightforward and highly intuitive.

### The LED functions

- LED 1 is not illuminated: there are no problems and service is not required.
- LED 1 flashes red: there is a general system error (battery, prosthesis components etc.). Please contact Ottobock Myo-Service
- LED 1 is illuminated in yellow: the gripping component should be brought to Ottobock Myo-Service for maintenance service
- LED 6 flashes red: the charger is defective. Send the product in to the Ottobock Myo-Service

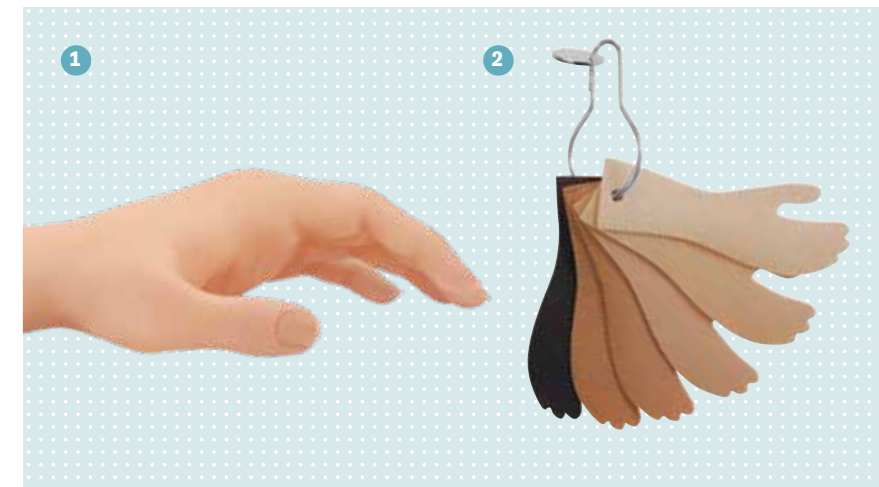
### Ordering Information

AxonCharge Integral	757L500
AxonCharge Mobile	4X500

	LED 2	LED 3	LED 4	LED 5
Empty	•	•	•	•
25 %	•	•	•	•
50 %	•	•	•	•
75 %	•	•	•	•
100 %	•	•	•	•

• LED illuminated • LED flashes

# Close-fitting: AxonSkin



- 1 Glove
- 2 Color pattern set
- 3 Applicator
- 4 Alignment rod
- 5 Donning sphere
- 6 Mounting adapter Transcarpal Hand

The Michelangelo Hand is worn with the AxonSkin prosthetic glove: for an attractive, natural appearance and to protect the prosthesis against environmental influences such as moisture, dirt and dust. Multi-layer PVC gloves in six different color versions and with a special surface treatment were developed for the Axon-Bus System. The portfolio has been expanded to include a silicone glove (7 color versions).

### As natural as possible

The various skin tones permit the closest possible matching of the glove to the skin color of the user. The coloring is handmade and simulates the structures of blood vessels and knuckles. The fingernails are naturally colored. What's more, conventional nail polish can be applied to the PVC gloves (remove only with acetone-free nail polish remover).

In addition to the natural appearance, the glove features the highest material quality, great durability and is easy to care for. Water and soap is generally sufficient for daily cleaning. Promptly using the glove cleaner (with matching pump sprayer) is recommended for extremely dirty PVC gloves (not for silicone!).



In addition to the skin color variations, a translucent glove is available to highlight the unusual design of the Michelangelo Hand. A black glove is offered as well.

For problem-free and correct application and removal of the prosthetic glove, please consult the brochure 646D646=DE.

### Ordering Information

AxonSkin Natural for men (skin color)	8S501=*
AxonSkin Natural for women (skin color)	8S502=*
AxonSkin Visual (translucent)	8S500=L/R-M0
AxonSkin Black (black)	8S500=L/R-M20
AxonSilicone for men (skin color)	8S511=*
AxonSilicone for women (skin color)	8S512=*
Glove Cleaner	640F12
Pump Sprayer	640F13
Applicator	711M64
Donning Sphere	711M114
Alignment Rod	711M1
Mounting adapter Transcarpal Hand	711M116
Color selection	646M47 color pattern set N

# Powerful, durable and rugged AxonHook



- 1 Polyurethane coating
- 2 Electrical emergency opening
- 3 Resistant against splashed water (IP33)

With the addition of the powerful AxonHook, Michelangelo users are free to choose. Compatible with the Michelangelo Hand, the AxonHook is designed to meet the performance needs of the most demanding users by increasing the number of functional work tasks available. The myoelectric hook expands the existing Michelangelo Hand fitting with a powerful and rugged secondary terminal device.

Users can easily switch between the Michelangelo Hand and the AxonHook, allowing individuals to choose the most appropriate terminal device for maximum versatility. Combined with the AxonRotation, the AxonHook is the perfect complement to the Michelangelo Hand to give the user unmatched power and precision.

### Features

- A safe grip: even with small objects, due to the polyurethane coating
- Robust steel Hook fingers for stability during all work and leisure activities
- High gripping force supports the user during demanding activities
- Good visibility when gripping objects due to slim design
- Reduces compensatory movements to a minimum through the functionality of the flexible wrist

### Technical Data

Gripping force (at the hook tips)	110 N ± 15 N 25 lbf +/- 3 lbf
Opening width	130 mm
Weight	400 g
Height (The same height as the Michelangelo Hand.)	180 mm

### Ordering information

AxonHook	8E600=R/L
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# For transhumeral fittings: AxonArm Ergo



The AxonArm Ergo is recommended for use in hybrid prostheses with the Axon-Bus system, where the Michelangelo Hand and AxonRotation are controlled by myosignals.

With the AxonArm Ergo, unlocking and locking is controlled by myoelectric signals using an electronic elbow joint lock.

The integrated AxonEnergy Integral provides energy to the prosthesis components. Since all cables are concealed inside the prosthesis, the risk of defects caused by broken cables is reduced and the appearance is enhanced.

The electrodes can be connected with the AxonMaster which is plugged into the elbow ball.

### Features

	AxonArm Ergo
Easy Plug (electronic through connection)	3 input signals
Automatic Forearm Balance (AFB)	✓
ratchetless lock	electronic lock
Upper arm rotation joint (humeral rotation feature)	✓
Adjustable friction	✓
Elbow ball made of skin-colored plastic	✓
Forearm can be shortened	✓

### Technical Data

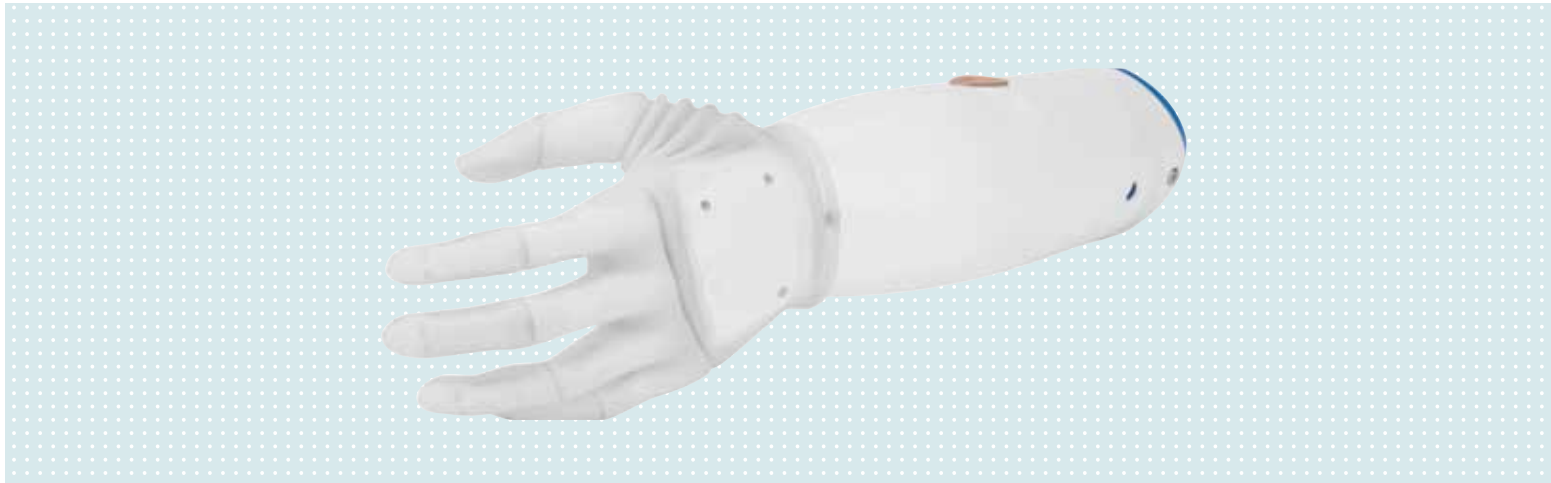
Weight (without battery)	approx. 750 g
Power Supply	757B501
Battery Charger	757L500

### Ordering Information

Designation	Article number	Upper arm connection Ø	for hand	for lamination ring Ø	Color
AxonArm Ergo	12K501=M	70 mm	8E500=L-M 8E500=R-M	10S500=M	Nr. 4
AxonArm Ergo	12K501=M	70 mm	8E500=L-M 8E500=R-M	10S500=M	Nr. 11
AxonArm Ergo	12K501=M	70 mm	8E500=L-M 8E500=R-M	10S500=M	Nr. 15



# Michelangelo Hand Transcarpal



The Michelangelo Hand Transcarpal makes it possible to fit users with long residual limbs and transcarpal-level amputations. As with the Michelangelo Hand, the compact drive unit is integrated into the palm of the hand, making its overall height without the AxonWrist approximately 50 mm shorter. The feed-through for the Axon signal cables was adjusted accordingly, and the hand shell was adapted as well. The new lamination ring allows the O&P professional to position the hand in a slightly flexed, ulnar deviation position. The design is based on the relaxed position of the physiologic hand and gives the transcarpal prosthesis a natural appearance.

### Scope of Delivery:

- 1 pc. 8E550=L/R-M Michelangelo Hand Transcarpal
- 1 pc. 10S550=M lamination ring. Includes the lamination dummies for the upper and lower side in addition to the lamination ring.
- 8 pc. 501S101=M4x12 countersunk head screws
- 8 pc. 501S84=M4x14 countersunk head screws
- 1 pc. cosmetic case for battery charger and power supply

### Technical data

Operating temperature	14 °F to +140 °F
Weight:	460 g (without glove)
460 g (without glove)	11,1V
Opening width	120 mm
Speed	approx. 325 mm/s
Gripping force in Opposition Mode	approx. 70 N ~ 15.5 lbf
Gripping force in Lateral Mode	approx. 60 N ~ 13.5 lbf
Gripping force in Neutral Mode	approx. 15 N ~ 3.5 lbf

### Ordering information

Michelangelo Hand Transcarpal	8E550=R/L
Size	M (= 7 ¾)
Weight	460 g (without glove)
System height:	160 mm (measured from middle finger, incl. lamination ring)
Lamination ring:	10S550

## Visible result: Combining technology and benefits

### The Innovation

As a system provider, Ottobock is offering a completely new prosthesis system that ensures fast and secure data transmission based on digital data transfer technology. The prosthesis system can also be expanded thanks to the intelligent Axon-Bus system.

- Optimized, harmonized system
- Very high grip force and speed
- Expandable thanks to the modular structure

### The Technology

The flexible wrist joint permits flexion, extension and rotation. Another innovative feature is the ability to separately position the thumb using muscle signals. This makes entirely new hand positions and a neutral, relaxed hand position possible.

- Active thumb positioning with two movement axes
- Wrist joint with flexion, extension and electric rotation – AxonRotation
- Significantly more degrees of freedom
- Individual choice of controls using the AxonSoft adjustment software

### The Design

The Michelangelo Hand features a very natural-looking design with hard and soft structures that replicate physiological bones, joints, muscles and tendons. The oval hand adapter also looks much more natural compared to conventional prostheses.

A fitting with the Michelangelo Hand offers new movement possibilities for the user. It makes many everyday situations easier to handle, so that the Michelangelo user can participate in life more actively and naturally – both at work and during leisure activities.



reddot design award  
winner 2011





