ÖSSUR®

ACADEMY

Össur Touch Solutions: Introducing the i-Limb® Wrist

Rob Hodgson (Clinical Specialist)

Webinar: 12th December 2019

Introduction

- i-Limb range
- Overview of features and benefits
- Control Methods
  - App control
  - Muscle triggers
  - Gesture control
  - Proximity control
- Technical specifications

- Introducing the NEW i-Limb Wrist

ÖSSUR ACADEMY

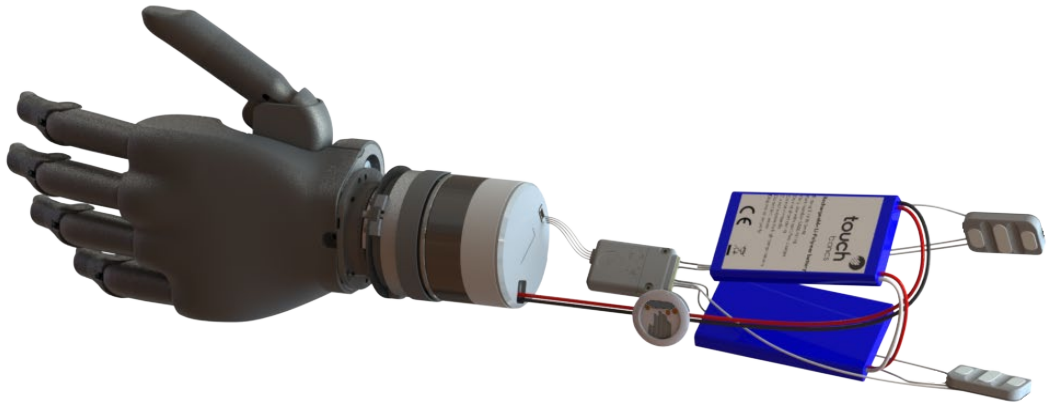
Overview of i-Limb range

- i-Limb Access
- i-Limb Ultra
- i-Limb Quantum

NEW: i-Limb Wrist

Introduction to i-Limb Wrist

- **i-Limb Wrist** is a powered wrist rotator
- Two main features:
  - Simultaneous Rotation upon grip selection (when fitted in conjunction with the **i-Limb Quantum)**
  - Direct Rotation
- Controlled via 2 **digital electrodes** detecting specific muscle actions from the users residual limb



Basic i-Limb Hand Functions

- Significant advances in multi-articulating myoelectric prosthetic hand technology
  - Individually articulating digits
  - Stall ability
  - Compliant grip
  - Thumb rotation: powered (auto) and manual
  - Proportional control
  - Vari-grip or pulsing
  - Autograsp

Hand Operation

ÖSSUR ACADEMY

Basic Functions

Open & Close all 5 fingers around objects

Automated Grips

- Precision Pinch
- Index Point
- Tripod Grip
- Lateral Grip

And more…

User Profile for i-Limb hands

- Any level of upper limb absence proximal to the wrist:
  - Wrist disarticulation
  - Trans-radial
  - Elbow disarticulation
  - Trans-humeral
  - Shoulder disarticulation

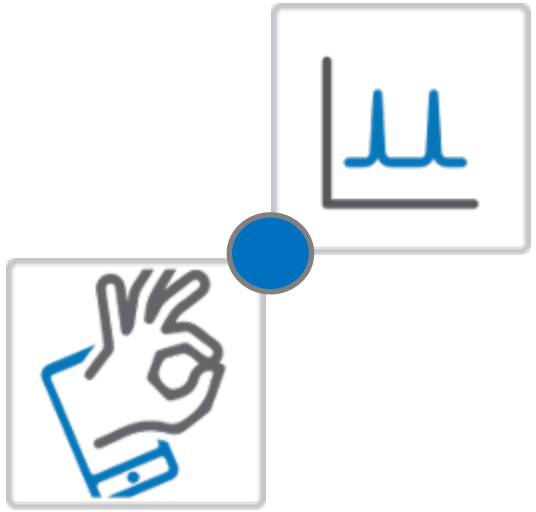
- **Low to moderate usage**
- Clients should:
  - Be motivated
  - Have realistic expectations

Optimum outcomes are achieved when Prosthetist and Therapist work closely together

i-Limb Range

i-Limb Access

- Manual thumb rotation
- 12 grip features
- Auto-grasp
- Pulsing
- App control: quick grips
- Muscle control: triggers



i-Limb Ultra

All features of i-Limb Access plus…

- Powered rotating thumb with manual override
- 18 grip features
- Vari-grip

i-Limb Quantum

All features of i-Limb Ultra plus…

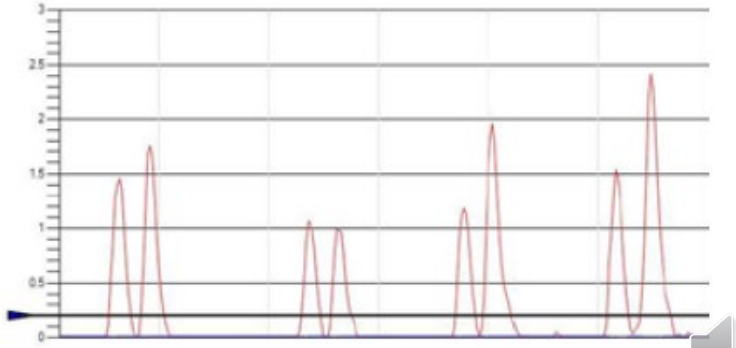
- Gesture control: access 4 grips with single muscle action
- Proximity control: grip chips
- 24 grip features
- 12 custom my grips

Accessing Multiple Automated Grips:
App Control

- App control: quick grips
- Use **Biosim**® (CPO) or **My i-Limb**® (patient) app to connect to hand via Bluetooth
  - iPad
  - iPhone
  - iPod
  - Apple Watch
- Tap icon to choose desired grip
- Useful for infrequently used grips

Accessing Multiple Automated Grips:
Muscle Control

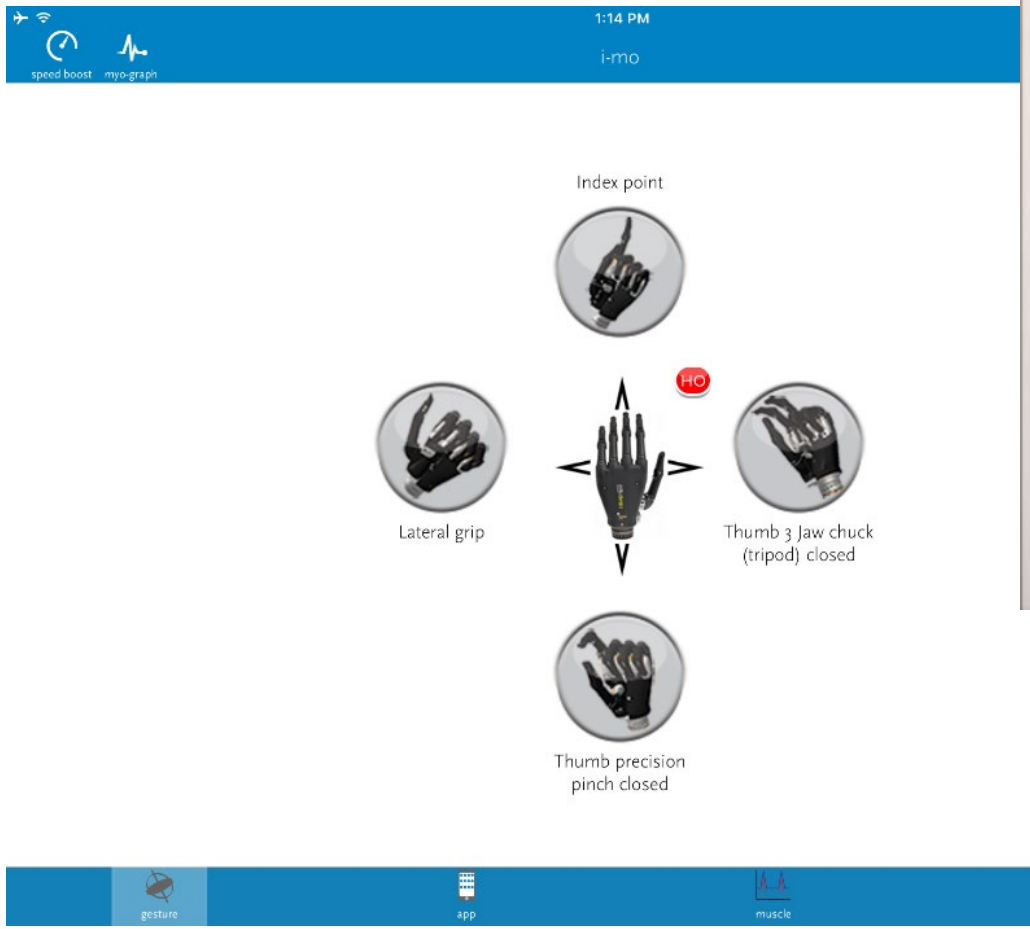
- Muscle control: triggers
- Use EMG muscle trigger signals to choose desired grips
  - Hold open
  - Co-contraction
  - Double (open) impulse
  - Triple (open) impulse
- Each trigger is pre-programmed with one grip by the user
- Favorites can be created for groups of commonly used triggers, such as for cooking, office, gym, etc.
- Require more time to learn and more effort to control hand



Accessing Multiple Automated Grips:
Gesture Control

- Gesture control: i-mo intelligent motion
- With multiple automated grips available, the user must learn to access his desired grips consistently
- App, Muscle, and Proximity Control require the user to learn more advanced techniques with their muscles or use additional accessories
- Gesture control uses simple gestures (forward, backward, left, right) to choose desired grips
- Each direction is pre-programmed with one grip by the user
- No need for additional muscle learning nor accessories

Example of changing grips: Gesture Control



Accessing Multiple Automated Grips:
Proximity Control - Grip Chips

- Proximity control: grip chips
- Bluetooth device that allows i-Limb to enter grips when nearby the chip (15cm)
- Each grip chip is pre-programmed with one grip or favourite group of grips by the user (Biosim or My i-Limb app)
- Activated by proximity or double tapping

Grip Chips

Technical Details: Titanium Digits

- Titanium material increases the maximum carry load at the proximal segment by 50%
- Improves the protection of the motor from impact forces
- Adds only 28 grams of weight to the i-Limb® hand
- Available for i-Limb® Quantum, Ultra, and Access hands and for i-Limb® hand sizes small, medium, and large

Small Medium Large

i-limb® hand interactive training

ÖSSUR ACADEMY

Stage 1:
Opening & Closing

Picking up objects

Stalling digits

Positioning the thumb

Varying the grip force

Stage 2:
Accessing Multiple Grips

gesture control

app control

Stage 3:
Advanced options

muscle control: triggers

proximity control: grip chips

Stage 1	Stage 2	Stage 3
Training	Training progression	Advanced training
Stage 1	Stage 2	Stage 3
i-Limb Wrist	i-Limb Wrist	i-Limb Wrist

- Introduction
- Setup
- Grips
- i-Limb Wrist
- Product range
- Resources

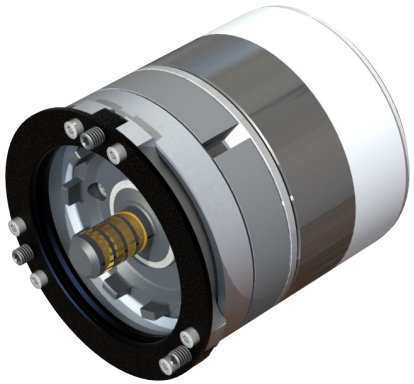
https://www.ossur.com.au/prosthetic-solutions/touch-solutions/support-services/training-module

i-Limb Wrist

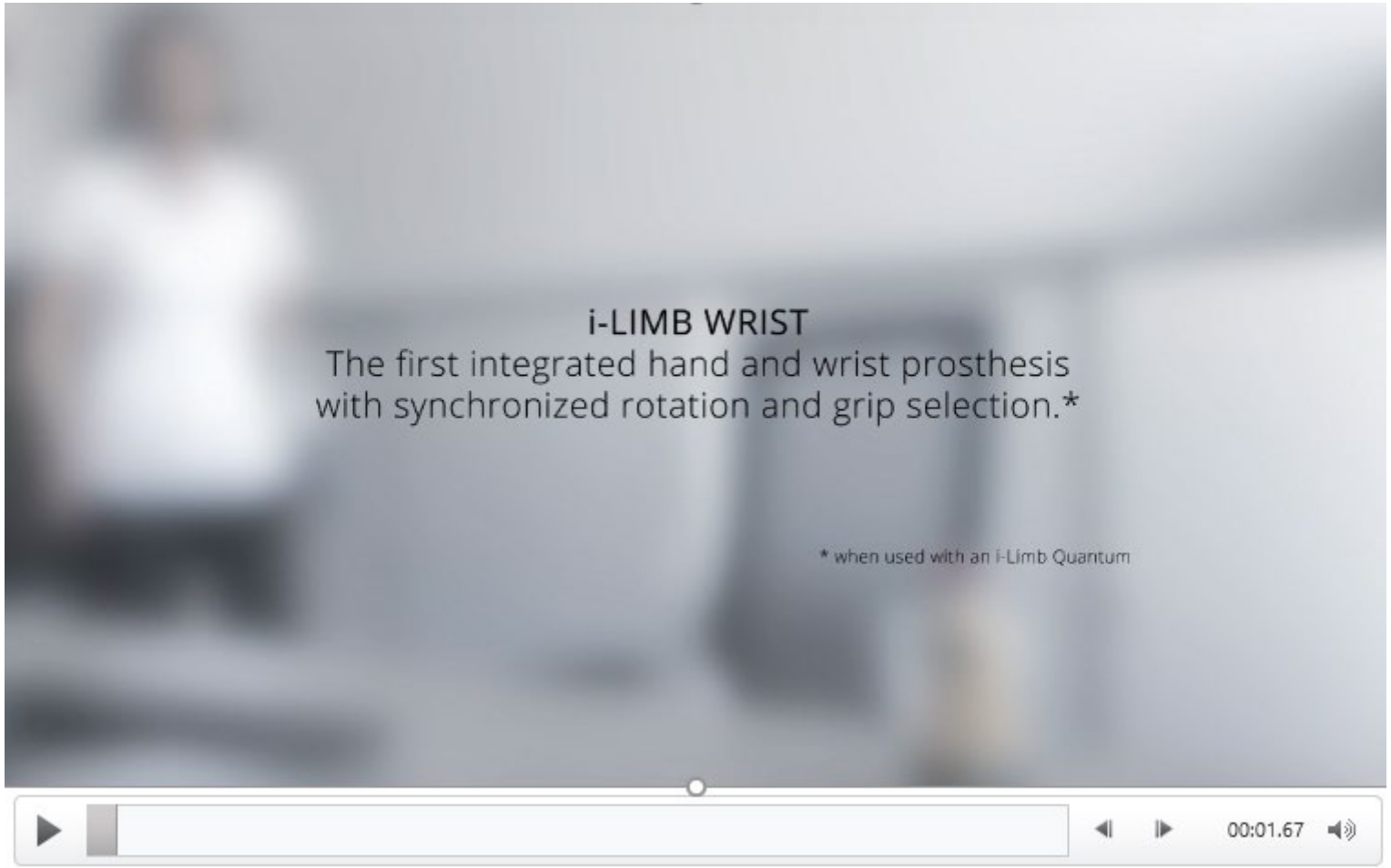
- Introduction
- User Profile
- Control Methods
  - Simultaneous Rotation
  - Direct Rotation
- Control Options
  - Smart Control
  - High/Low
  - Co-Contraction
- Features and Benefits
- Setup with Biosim
- Technical Details

Introduction: i-Limb Wrist

- **i-Limb Wrist** is a powered wrist rotator
- Controlled via 2 digital electrodes detecting specific muscle actions from the user's residual limb
- Two main features:
  - Simultaneous Rotation upon grip selection (only with **i-Limb Quantum**)
  - Direct Rotation
- Direct Rotation control methods:
  - Smart Control
  - High / Low
  - Co-contraction



Introduction to i-Limb Wrist



User Profile

Indications:

- Transradial-level absence
- Two viable control sites
- New and existing myoelectric users

Contraindications:

- Users unable to use two viable control sites
- More proximal level of absence
- Long transradial without room for a wrist (56mm)

Introduction to i-Limb Wrist: Control

Simultaneous rotation

- i-Limb Quantum

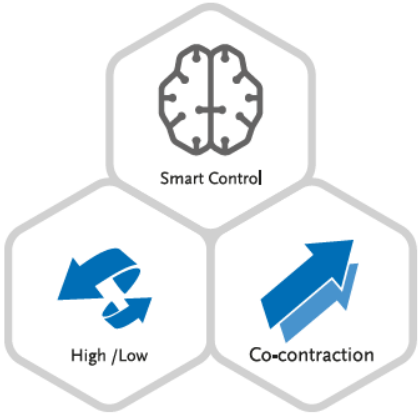
Direct rotation

- i-Limb Access
- i-Limb Ultra
- i-Limb Quantum

Control Methods

- Simultaneous rotation with grip selection
  - Grip is entered using any **i-Limb Quantum** control option (gesture, app, muscle, proximity)
  - Wrist automatically and simultaneously rotates to the optimum position for that grip

- Direct rotation from users muscle actions
  - **Smart Control** identifies intuitive muscle actions from the user during initial set up process with Biosim app
    - Allowing calibration of the prosthesis to the inidividual user
  - **Alternative direct rotation control methods**:
    - High/Low and Co-contraction offer availability of conventional control methods to also be used for the i-Limb Wrist



Simultaneous Rotation

All methods of control

APP

MUSCLE

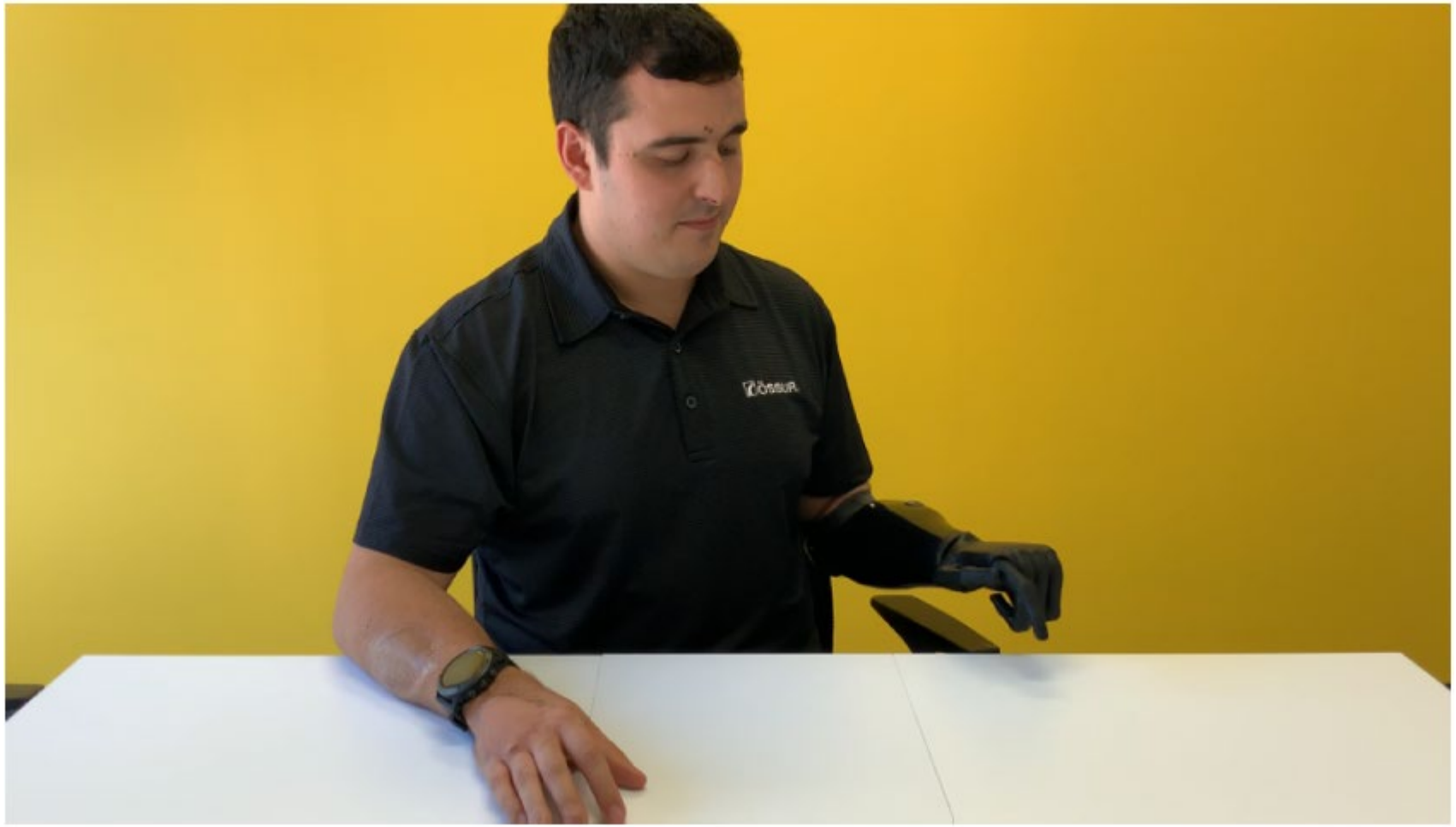
GESTURE

PROXIMITY

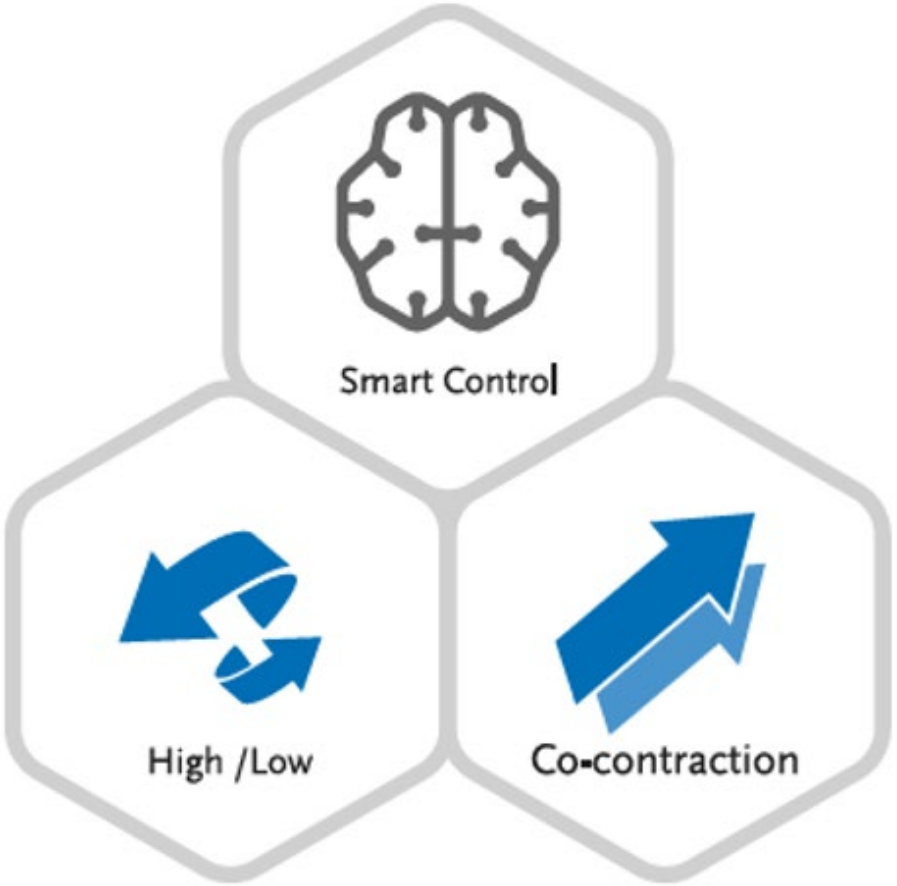
Pre-defined positions

Grip	Wrist rotation
Pinch	45°
Tripod	45°
Thumb park quick	Palm facing inwards
Lateral	Palm facing inwards
Index point	Palm facing downwards
Open palm	Palm facing upwards
Handshake	Palm facing inwards
Grasp	Palm facing downwards
Trigger grips	Palm facing inwards
Cylindrical	Palm facing inwards
Natural hand	No rotation set
My Grips	Full configurable

Simultaneous Rotation

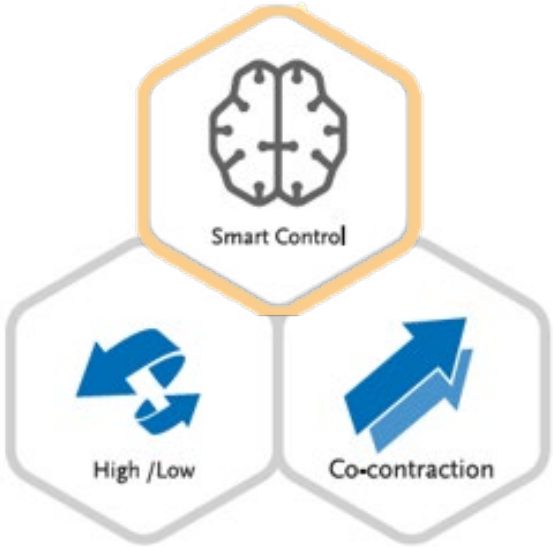


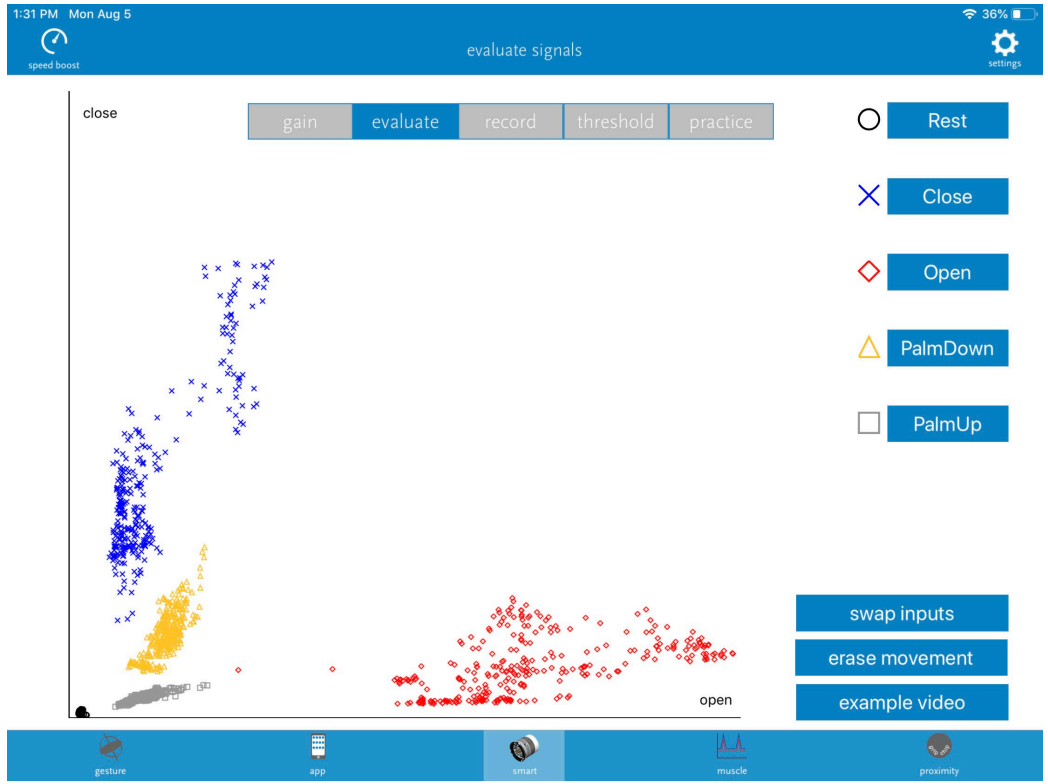
Direct Rotation: 3 Methods of Control



Control strategy is selected based on the users needs, capabilities and preference

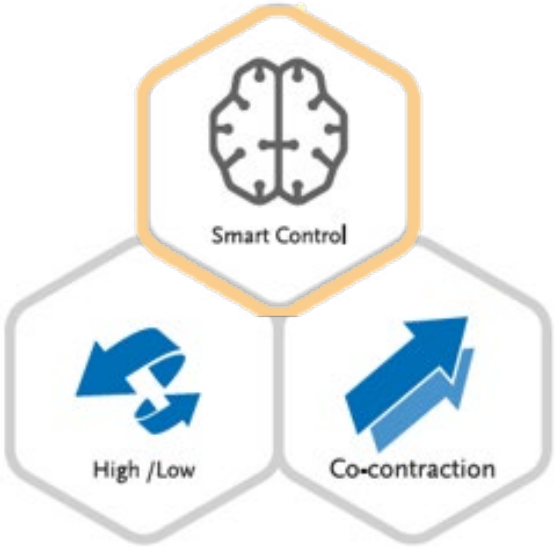
Direct Rotation: Smart Control

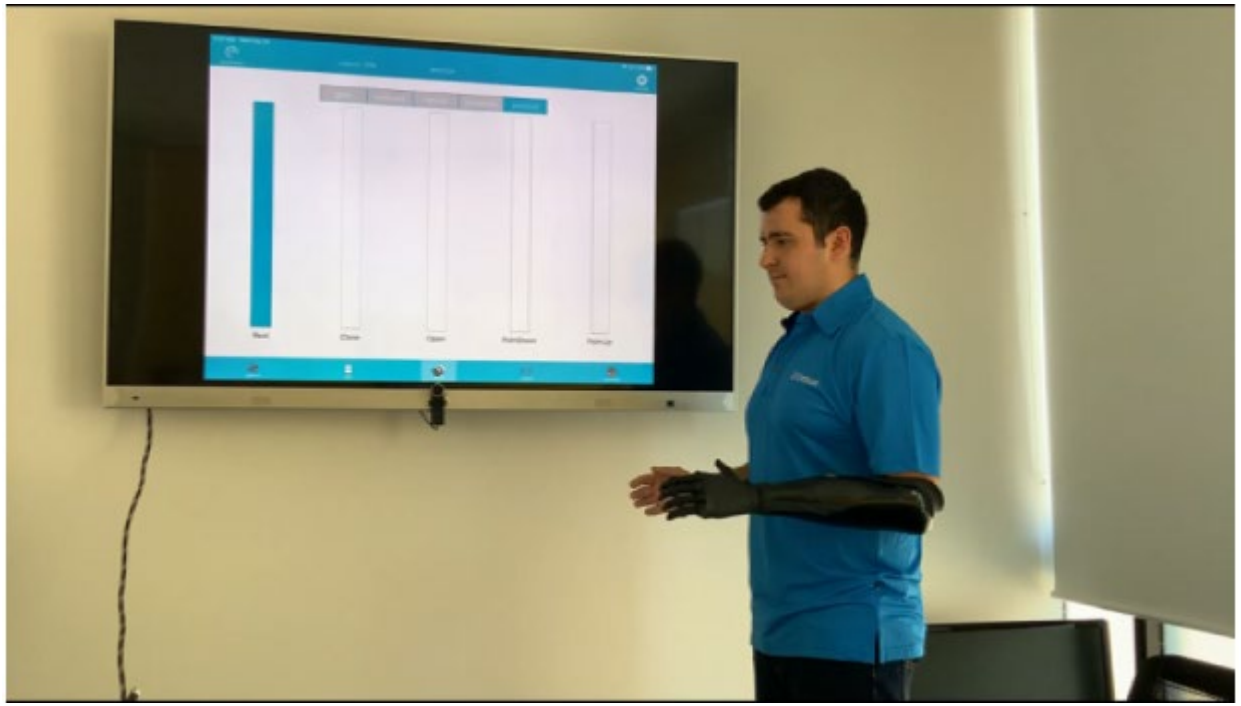




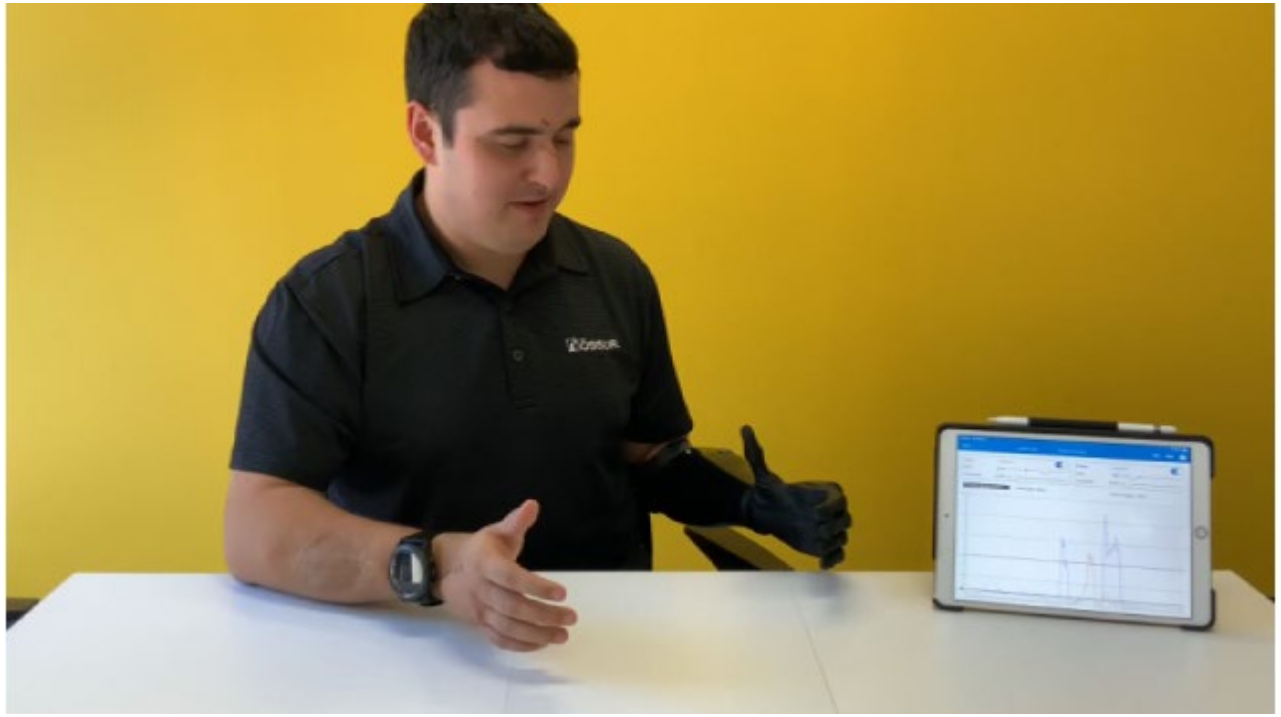
- Identifies muscle actions during initial setup
- Calibration of rest, close, open, palm up, palm down
- Pattern recognition with only 2 electrodes

Smart Control: Example



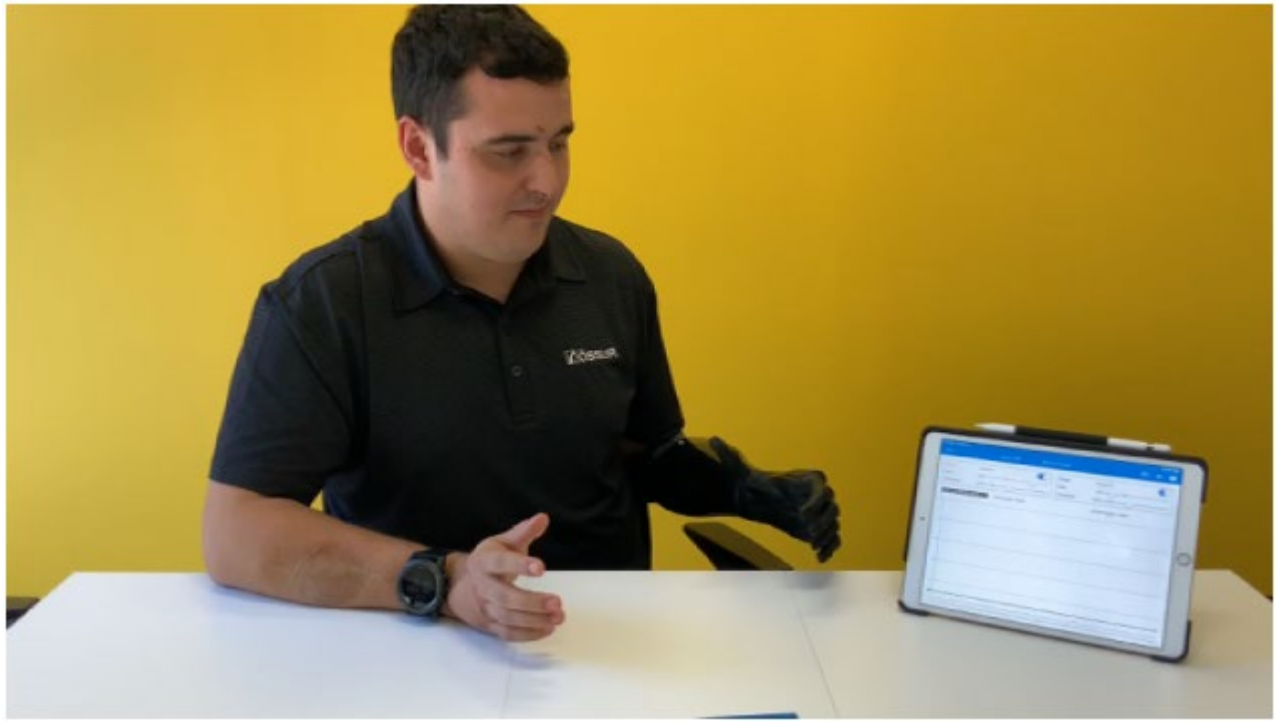


High/Low



- High (fast and strong) rising signal operates the wrist
- Low (slow and gentle) rising signal operates the hand

Co-Contraction



- Fast rising signal of both muscles at the same time switches control between the hand and wrist

Features & Benefits: Simultaneous Wrist Rotation

ÖSSUR ACADEMY

Technical Features

Simultaneous wrist rotation upon grip selection (i-Limb Quantum)

→

Functional Benefits

Avoids need to position hand and wrist components individually

→

Benefits for the end user

Faster grip change

Sound side hand free to use

→

Medical Necessity

Activity

Horizontal position

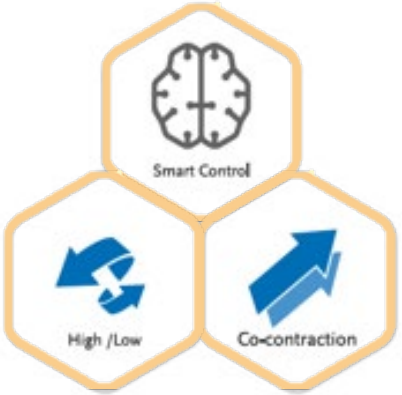
Grip Activation

Wrist Rotation to Pre-Defined Position

Grip	Wrist rotation
Pinch	45°
Tripod	45°
Thumb park quick	Palm facing inwards
Lateral	Palm facing inwards
Index point	Palm facing downwards
Open palm	Palm facing upwards
Handshake	Palm facing inwards
Grasp	Palm facing downwards
Trigger grips	Palm facing inwards
Cylindrical	Palm facing inwards
Natural hand	No rotation set
My Grips	Full configurable

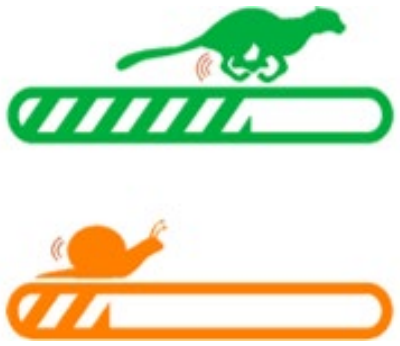
Features & Benefits: Direct Wrist Rotation

Technical Features	Functional Benefits	Benefits for the end user	Medical Necessity
Smart Control for direct wrist rotation	Pattern recognition based on individual user's muscle action	Control tailored to individuals capabilities	Activity
OR			
Hi/Low control for direct wrist rotation	Automatic signal recognition for either wrist or hand signals	Hand/wrist control without switching	Activity
OR			
Co-contraction for direct wrist rotation	Conventional distinction between wrist or hand signals	Acquired control strategies can still be used (no re-learning)	Activity



Features & Benefits: Speed Boost

Technical Features	Functional Benefits	Benefits for the end user	Medical Necessity
Speed Boost	Configurable rotation speed	Rotation speed matching the individual user's need	Activity

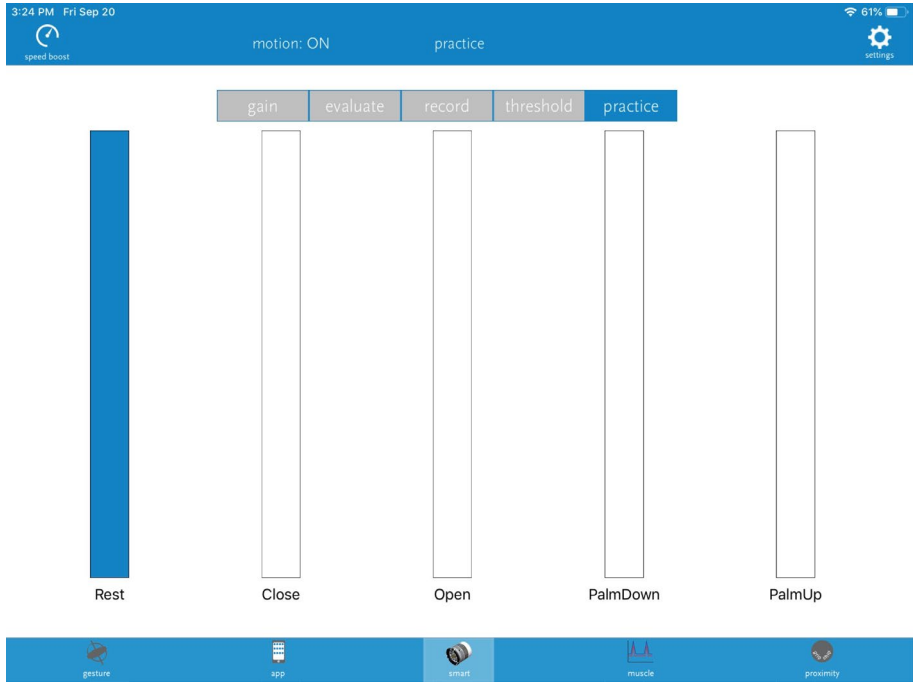


Biosim / My i-Limb

Biosim: with clinician, user can practise and fine tune setup before using prosthesis

My i-Limb: addition of practise mode, for user to practise Smart Control away from clinic

Smart Control



i-Limb Wrist setup via Biosim

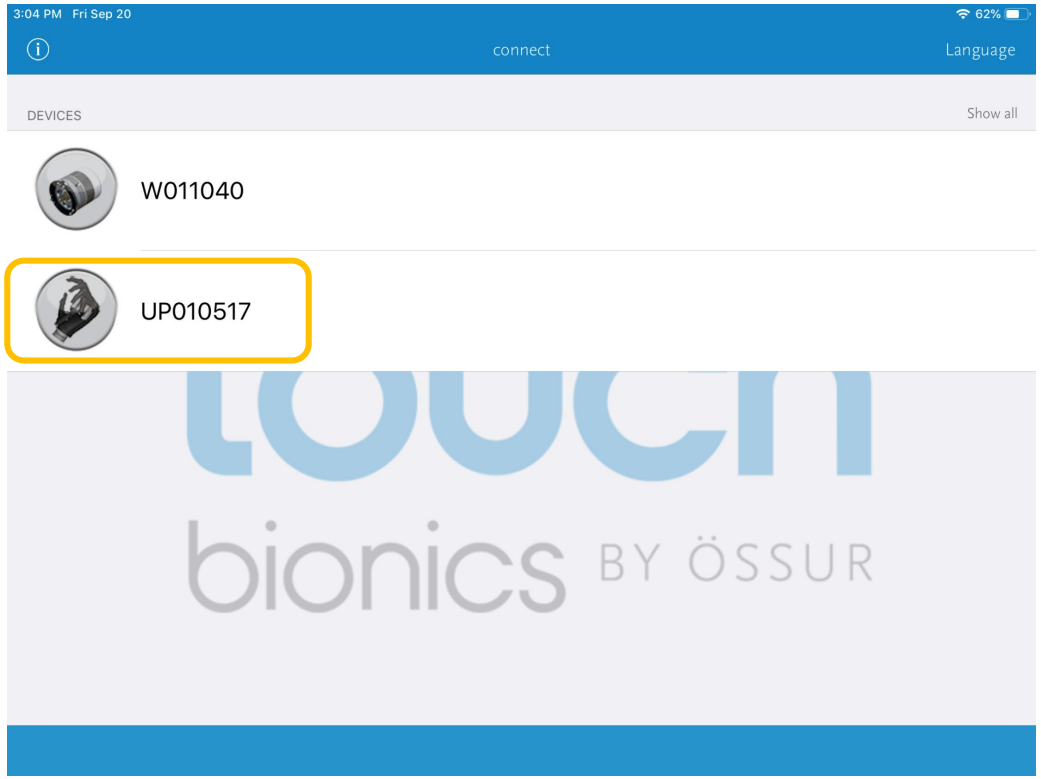
Smart Control: Setup Overview

- Set up of the **i-Limb Wrist** and **i-Limb Quantum** hand via **Biosim** on iPad.
- **Digital electrodes** are positioned on the residual limb in the optimum position identified through myo-testing
- User activates muscle actions which feel most intuitive to them for the open/close/palm up/palm down movements.
- A recording process is followed in **Biosim** app with the user repeating each of these actions and also the rest action.
- A successful recording is automatically applied to the **i-Limb Wrist** and **i-Limb Quantum** hand

Smart Control Setup: Connecting

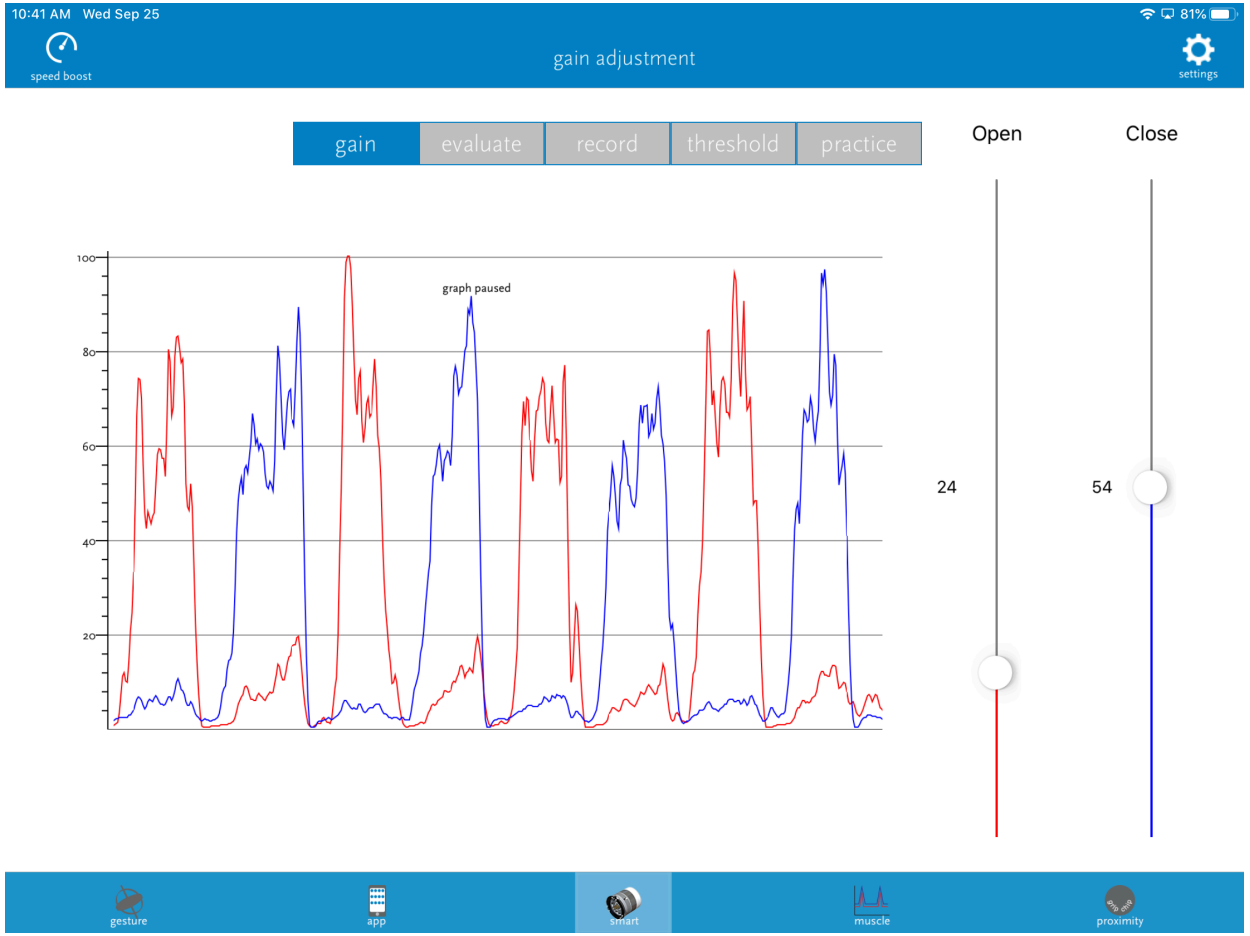
- Connecting with i-Limb Quantum

- Connecting with i-Limb Ultra or Access

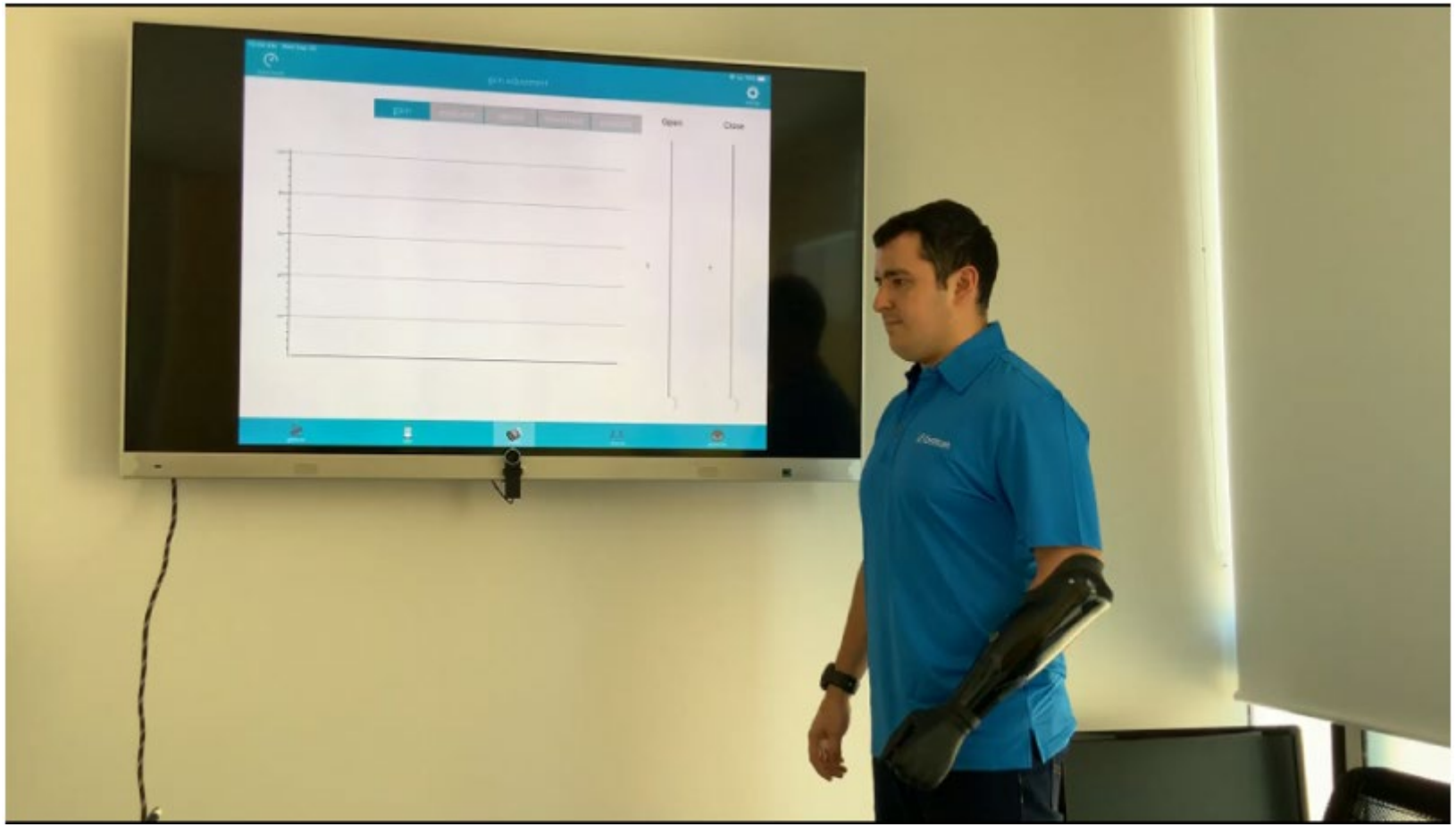


Smart Control Setup: Gain Adjustment

- Myo-testing with myograph using digital electrodes
- Expect different signals due to these electrodes being digital – more interference in graph
- Alter gains so that user can reach 70-80 on graph
  - This allows more signal for palm up/palm down as these movements are weaker

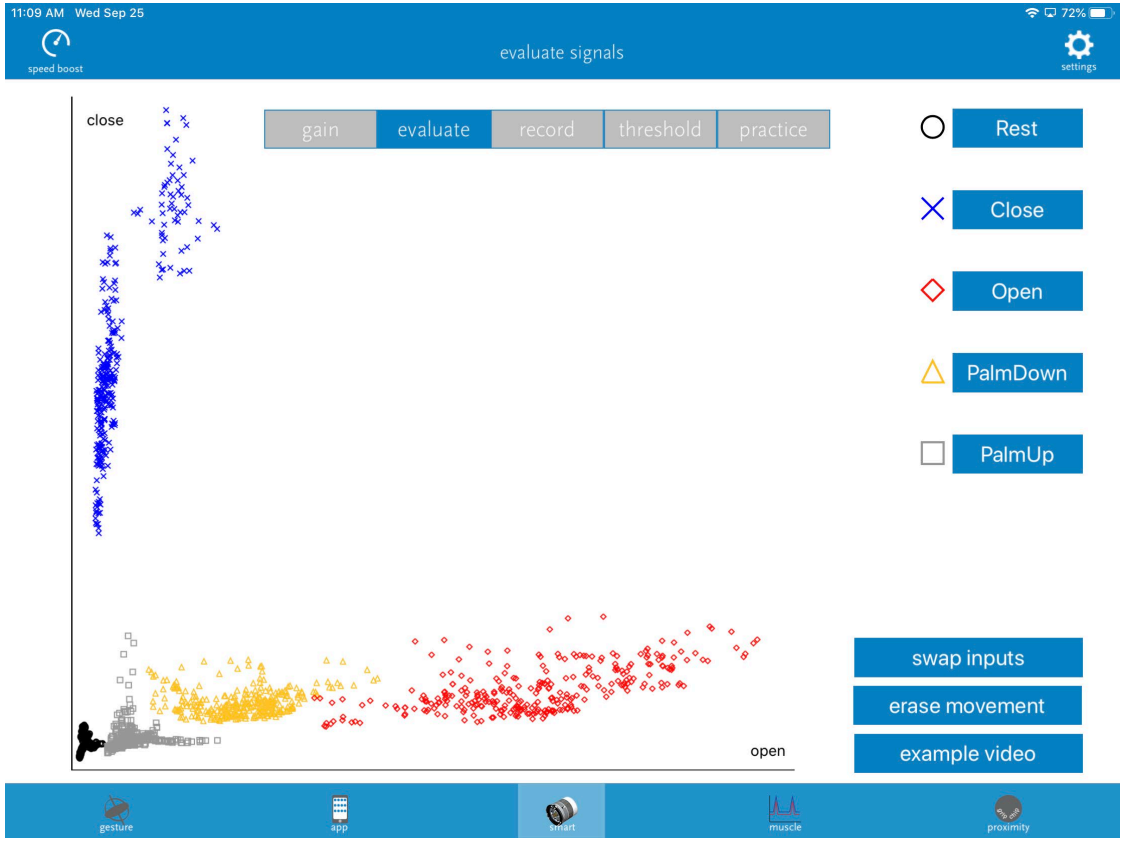


Smart Control Setup: Gain Adjustment

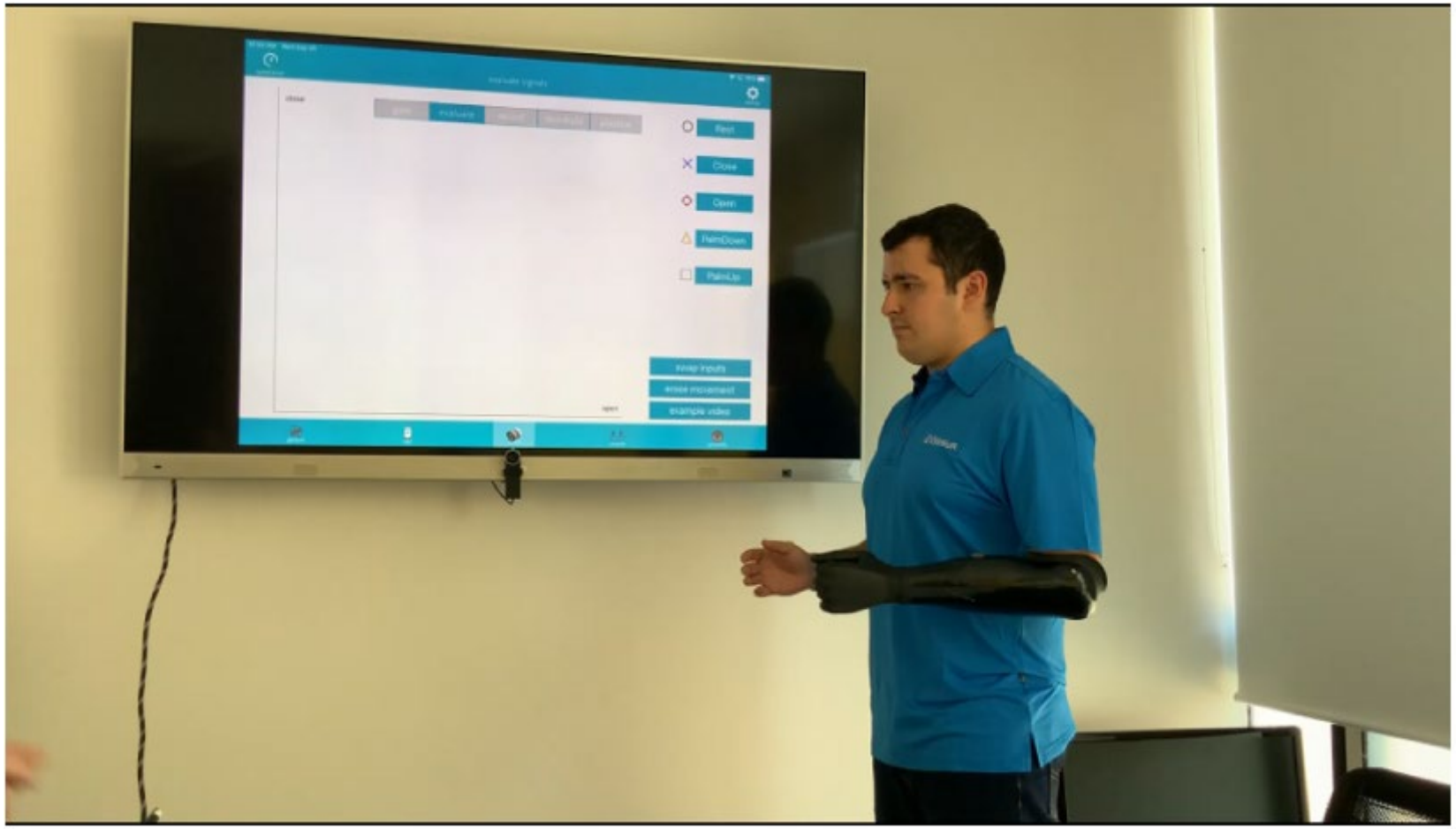


Smart Control Setup: Evaluate

- Spend time practising movements with the user
- Ensure separation of signals before proceeding to the recording process
- Erase all recordings before progressing to next stage

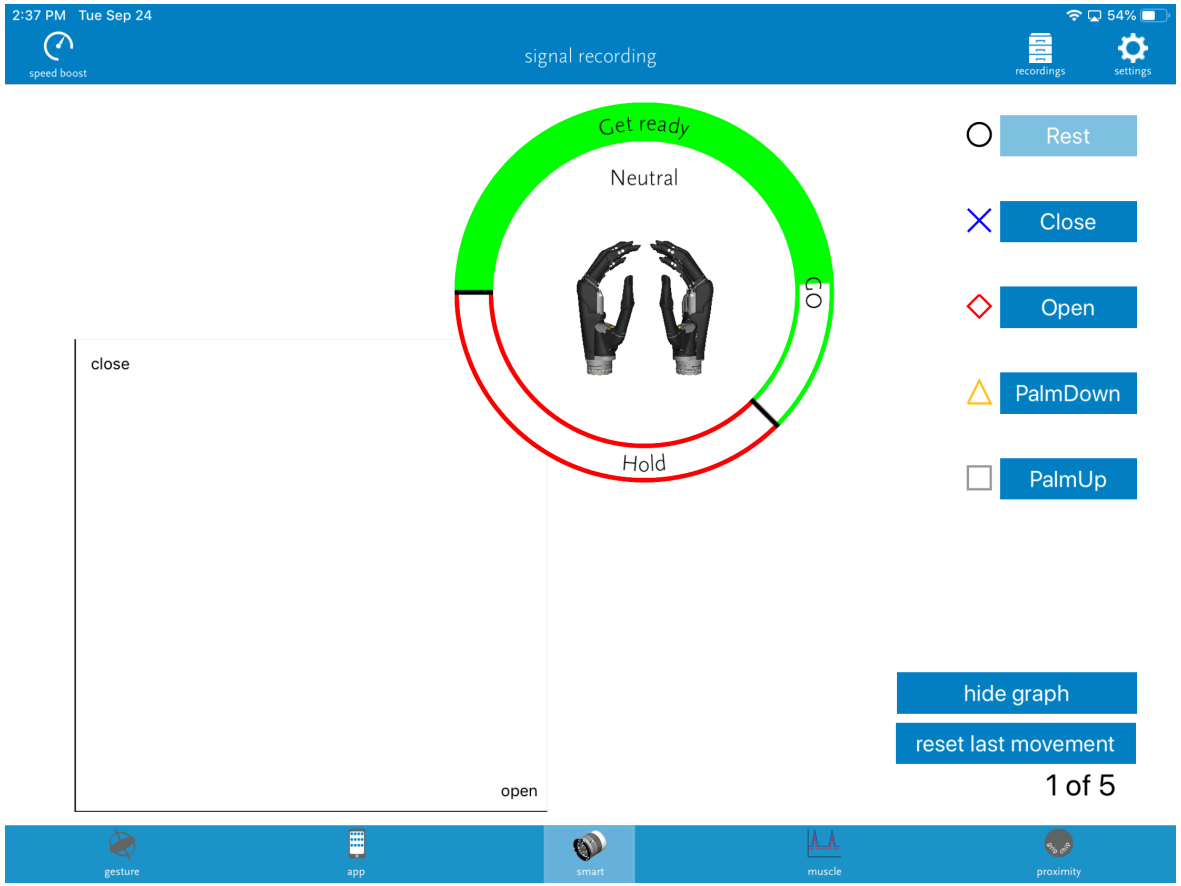


Smart Control Setup: Evaluate

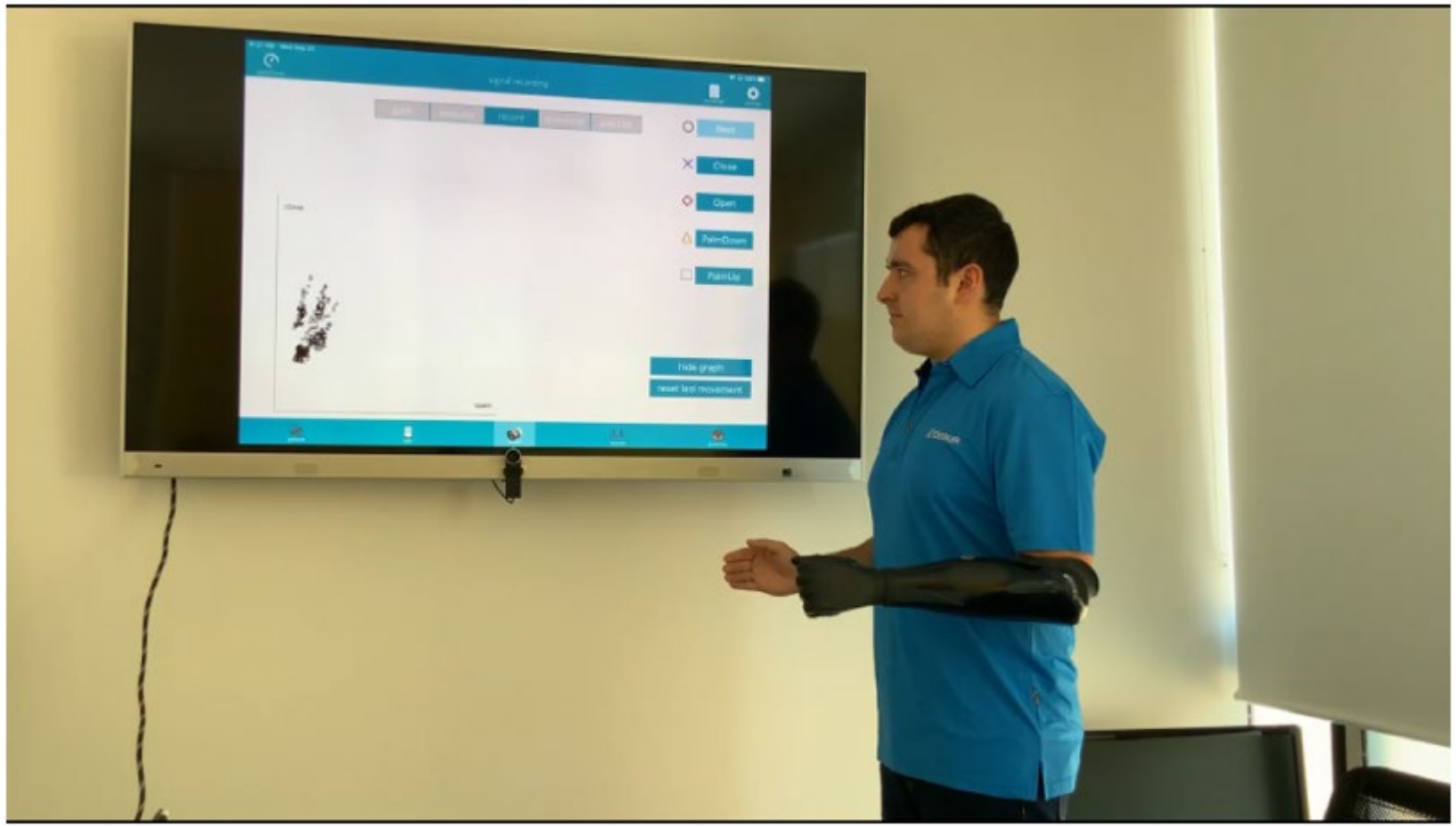


Smart Control Setup: Record

- Record each movement individually
- Having the graph on display can help prompt the user
- Follow the prompts during the recording process
- Last recorded movement can be erased to ensure optimum signals are obtained



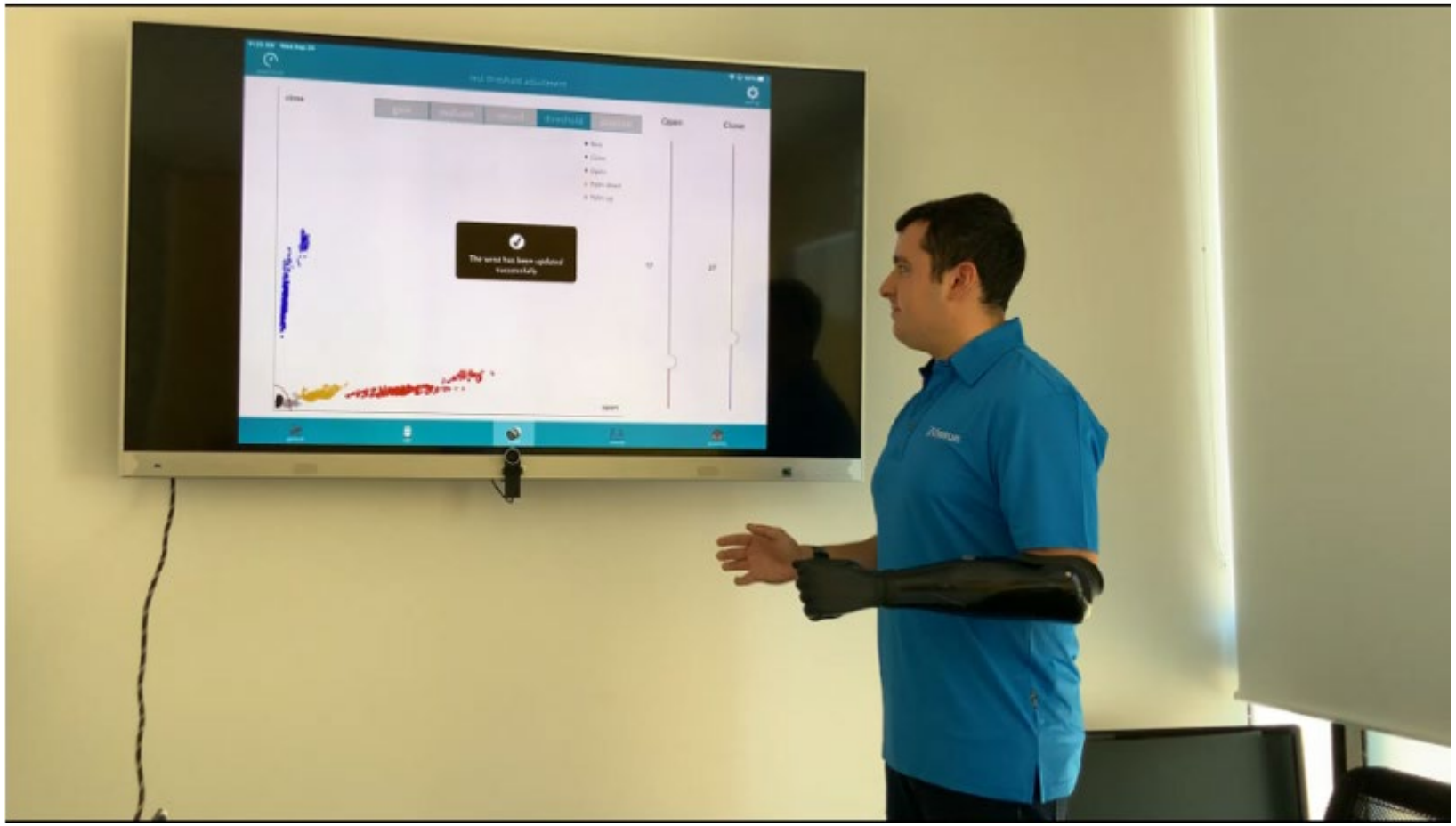
Smart Control Setup: Record



Smart Control Setup: Rest Threshold

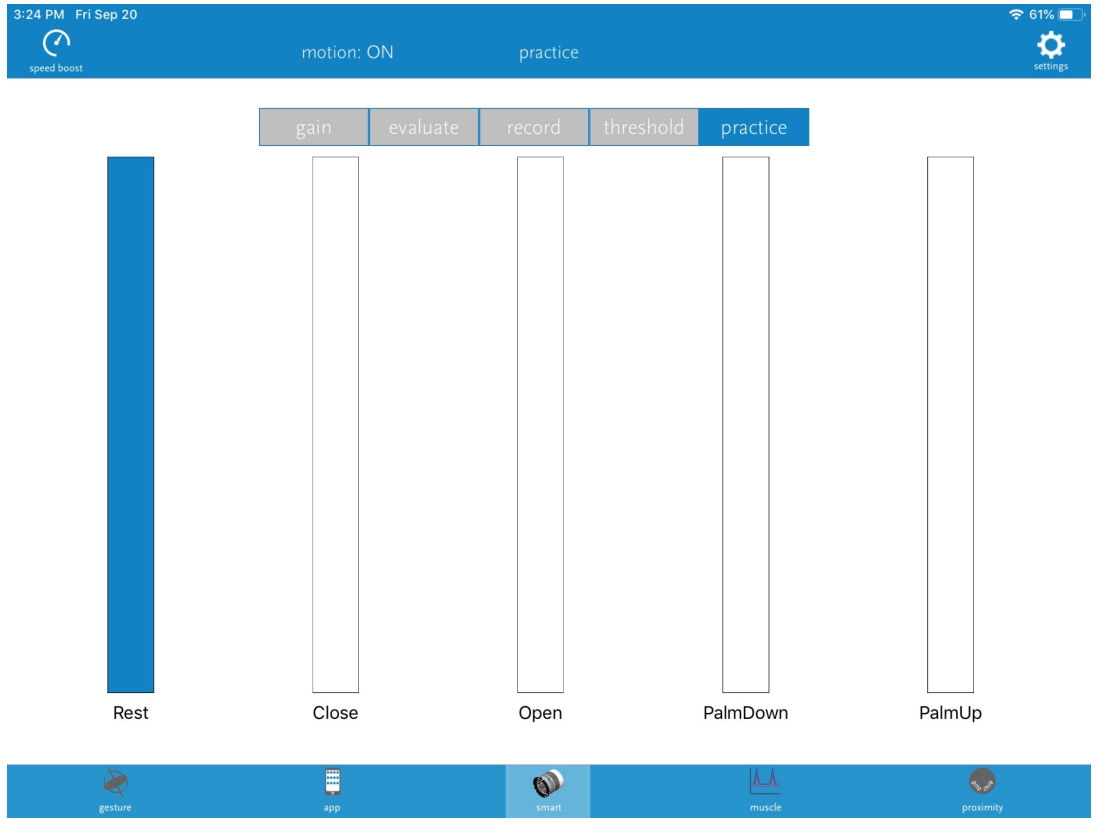
- Capture Rest signal using arc
  - This helps wrist separate functional movement
- Change arc size by using open and close sliders
  - Capture all of rest (black)
  - Turns all additional captured movements into rest (closest to rest)
  - Eliminates palm up/palm down movements when weight is added to limb e.g. shopping bag

Smart Control Setup: Rest Threshold Adjustment

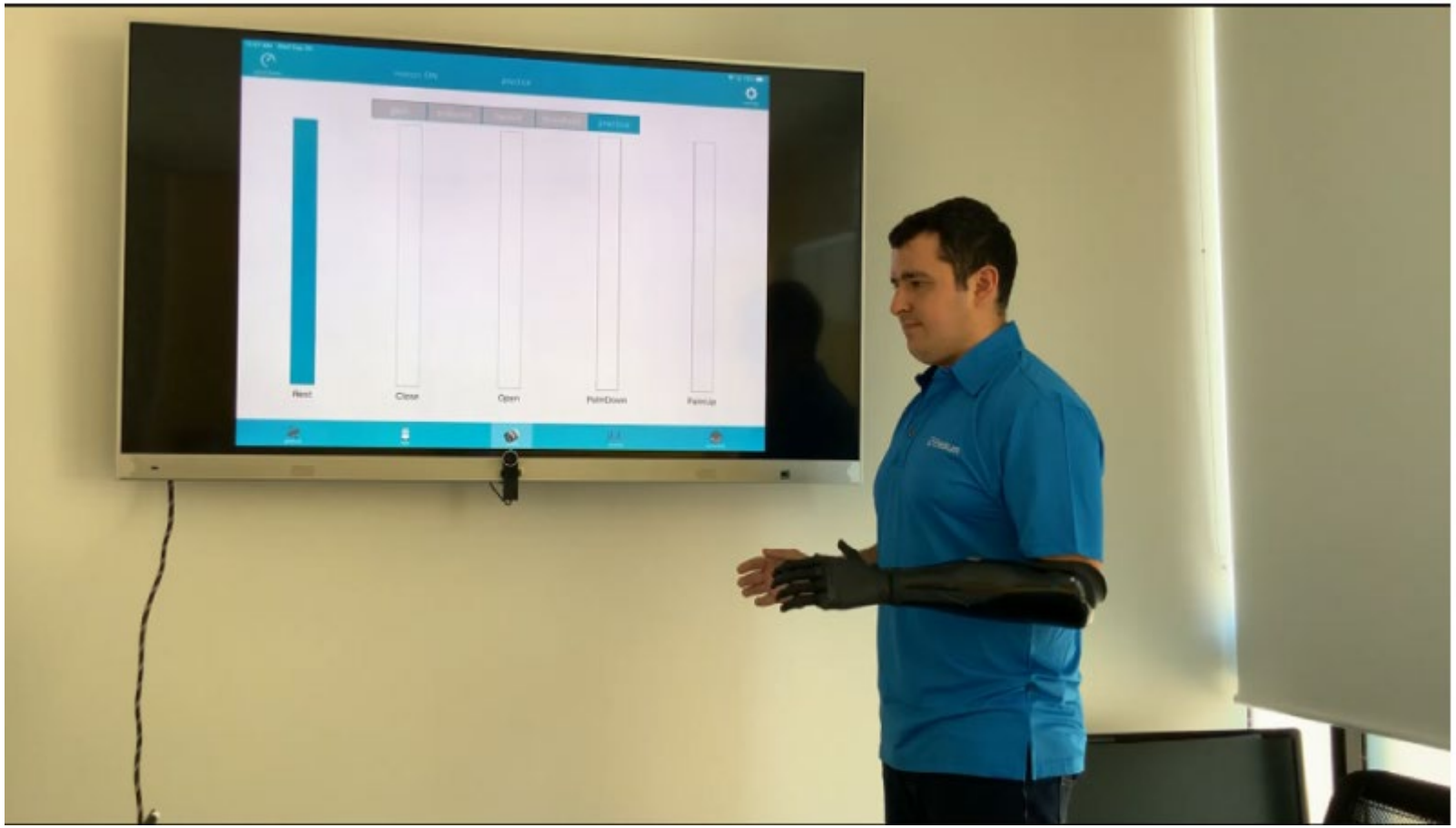


Smart Control Setup: Practise

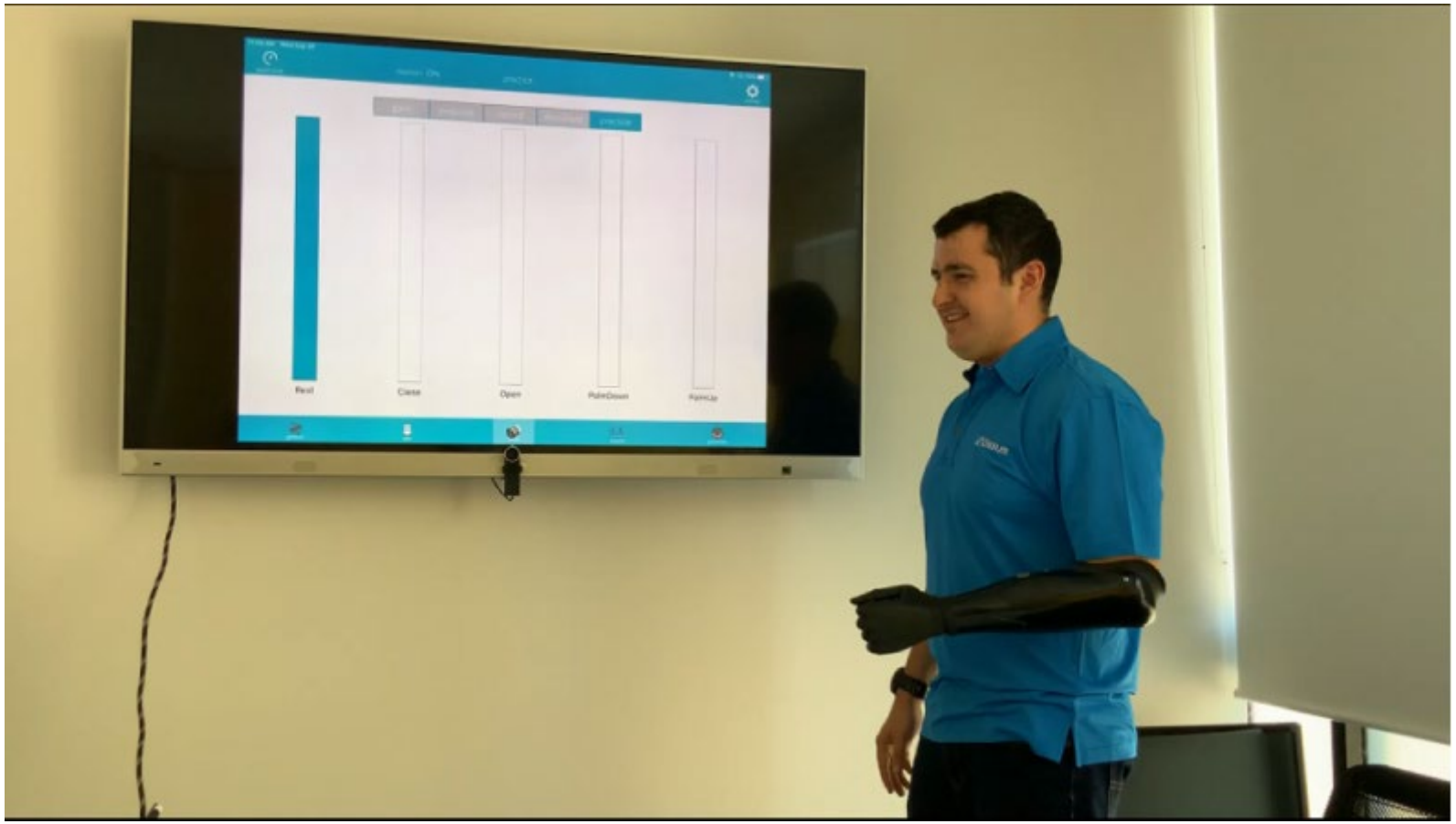
- Each bar represents a movement and will light up to identify which movement is being performed by the user
- Provides a visual feedback to demonstrate what user is doing
- Practise signal separation in various body positions (arms wide, above head, forwards and down)
- Practise purposeful rest in-between movements



Smart Control Setup: Practise



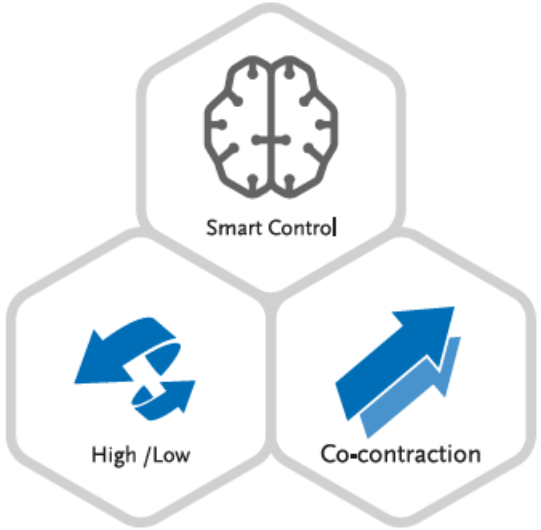
Smart Control Setup: Practise Control



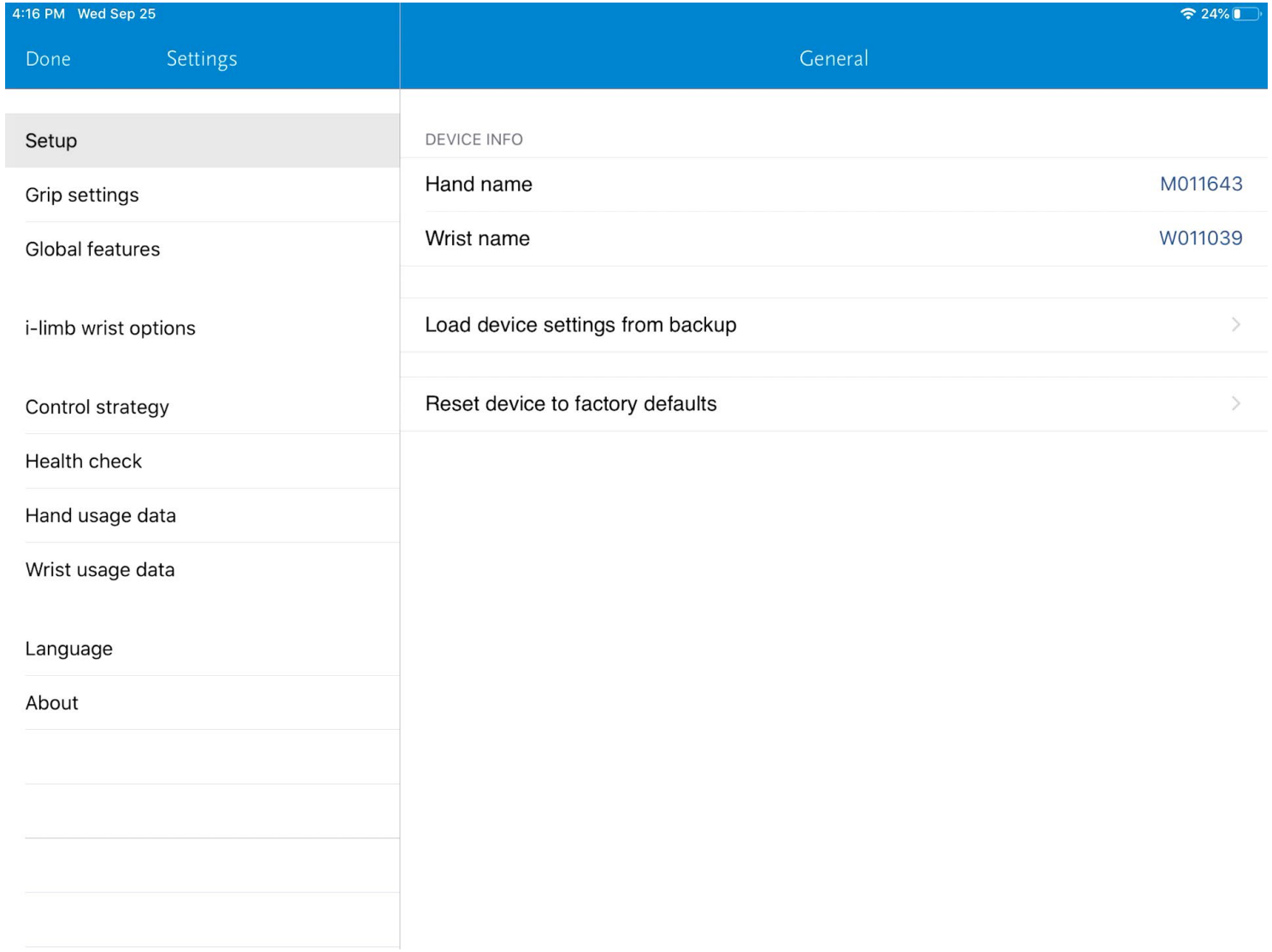
Setup: High / Low and Co-contraction

If the user is unable to utilise Smart Control initially, there are alternative control methods available:

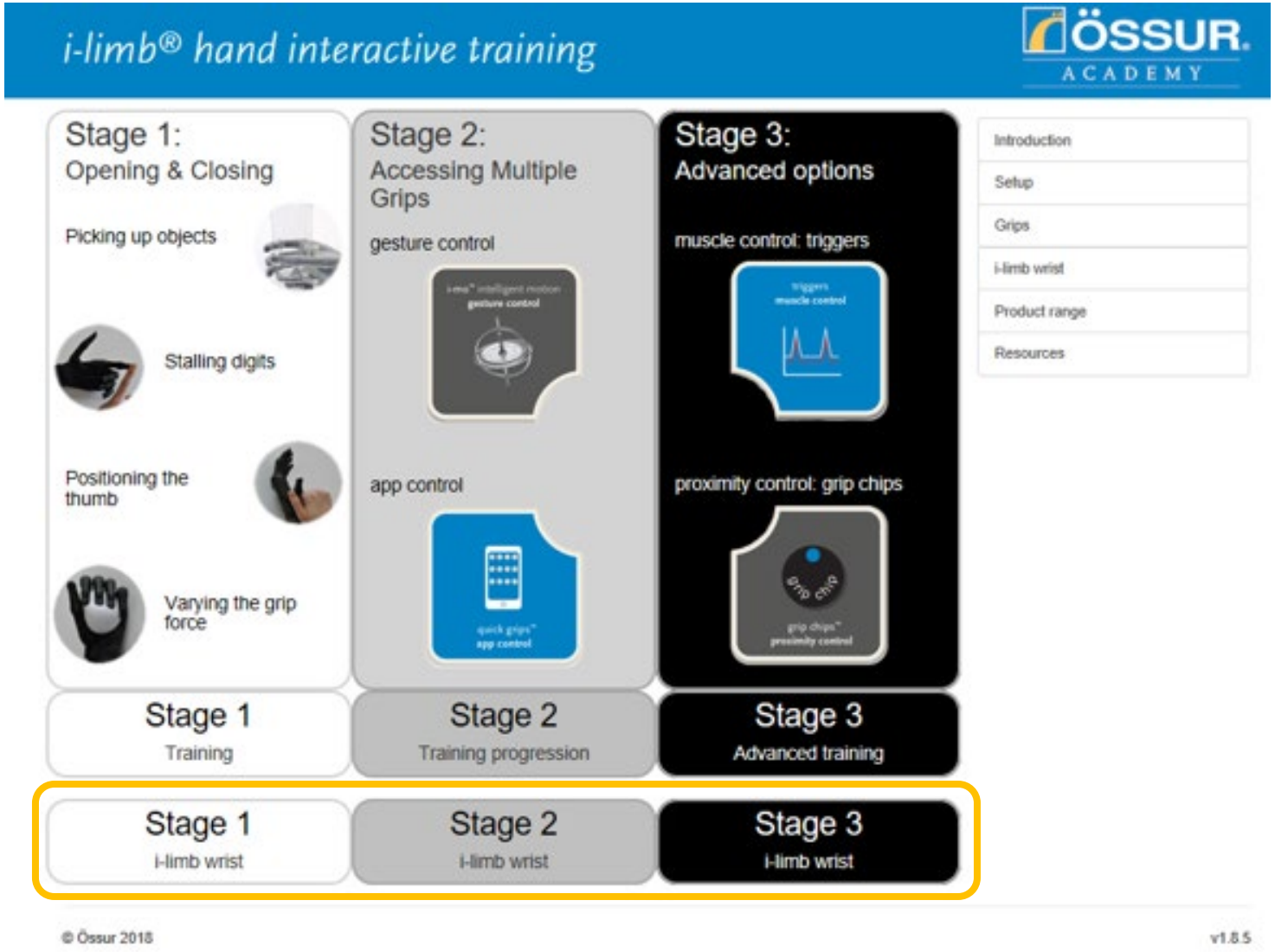
- **High / Low**
  - A slow (low) rising signal operates the hand
  - A fast (high) rising signal operates the wrist:
    - A fast (high) rising **OPEN = Palm up**
    - A fast (high) rising **CLOSE = Palm down**
- **Co-contraction**
  - A fast-rising contraction of both muscles at the same time switches control between hand and wrist
  - If using co-contraction to switch between hand and wrist control, then co-contraction will not be available for accessing grips (either for gesture control or a muscle trigger)



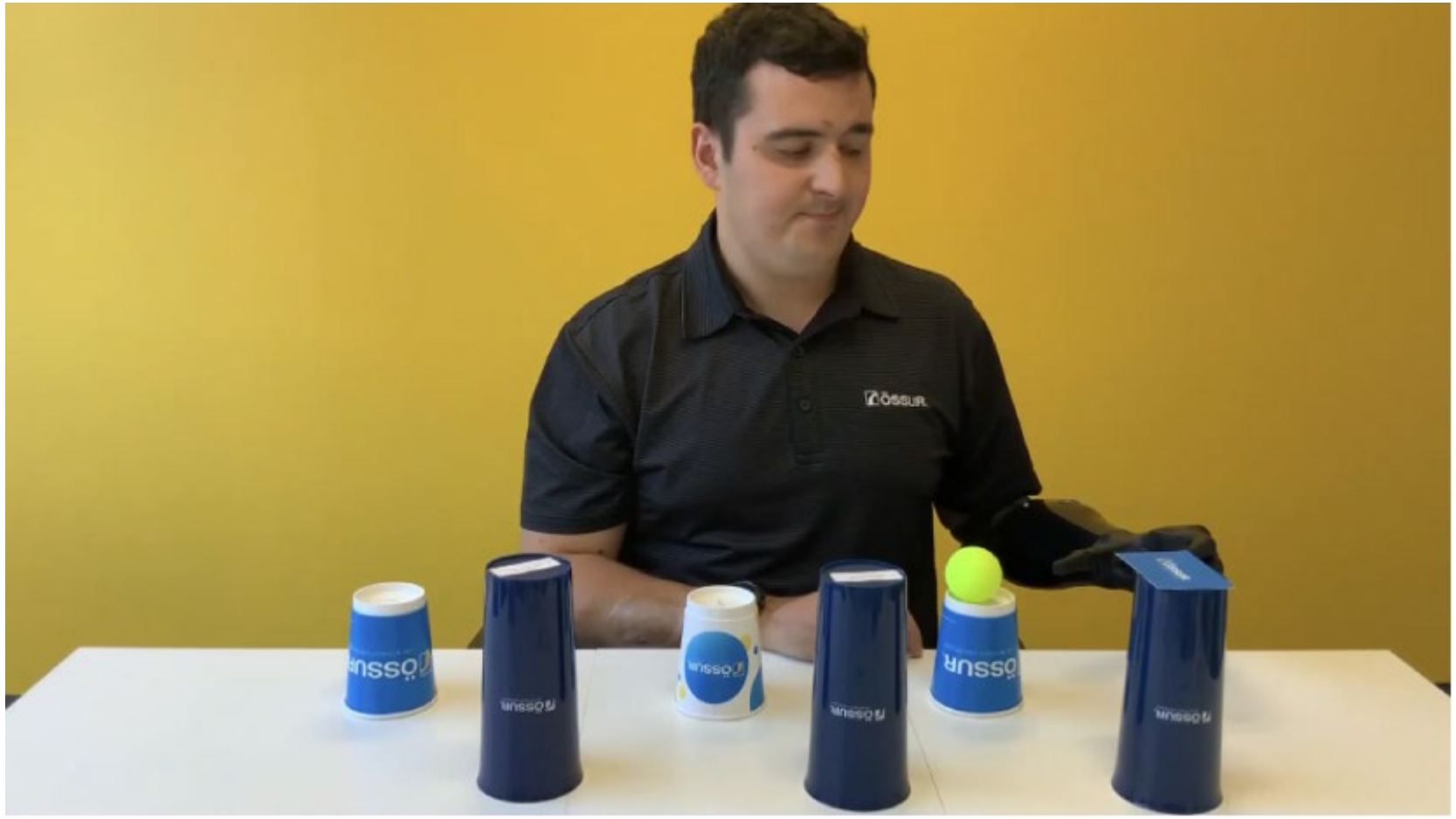
Setup: High / Low and Co-contraction



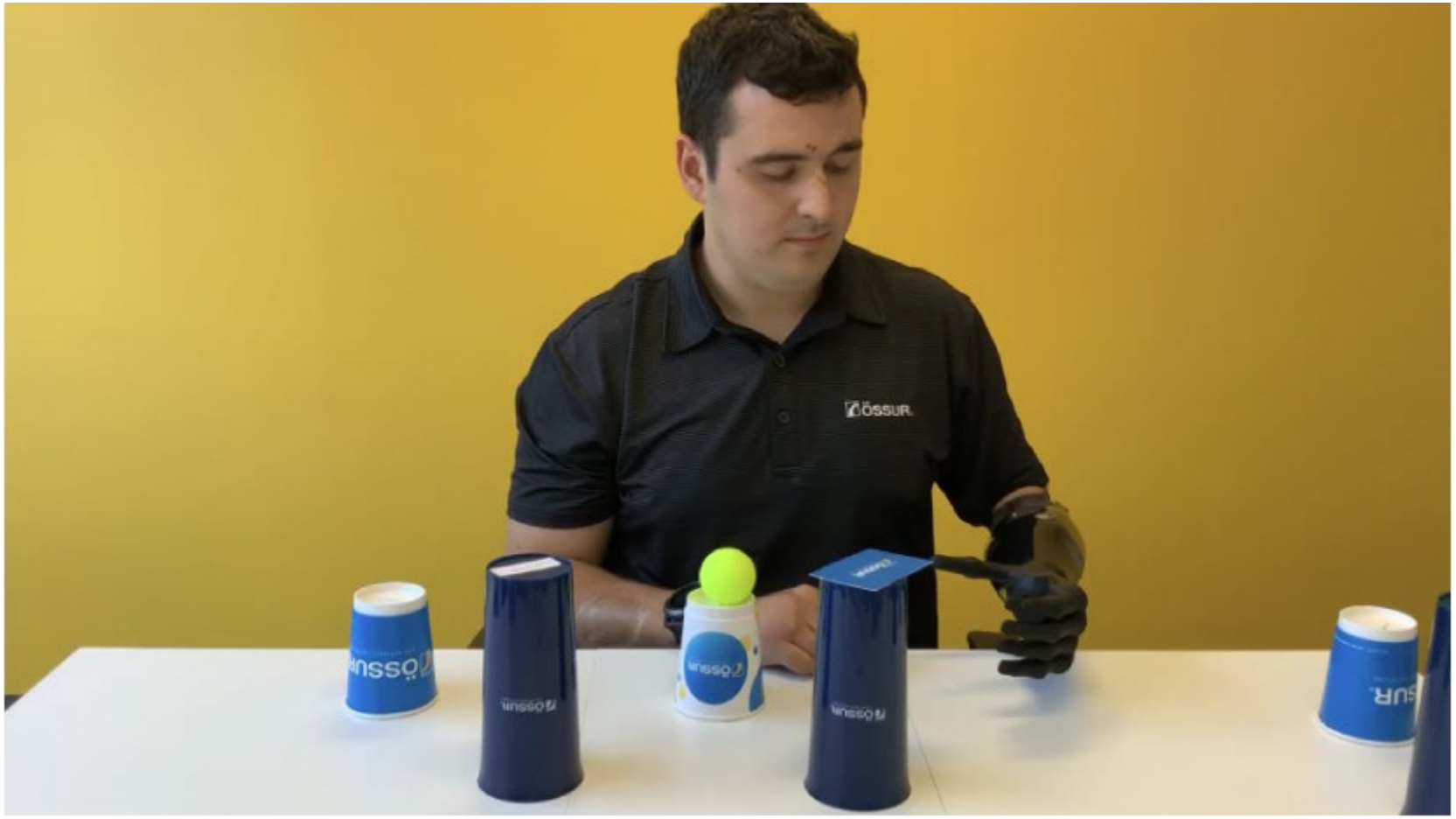
Staged Training Approach



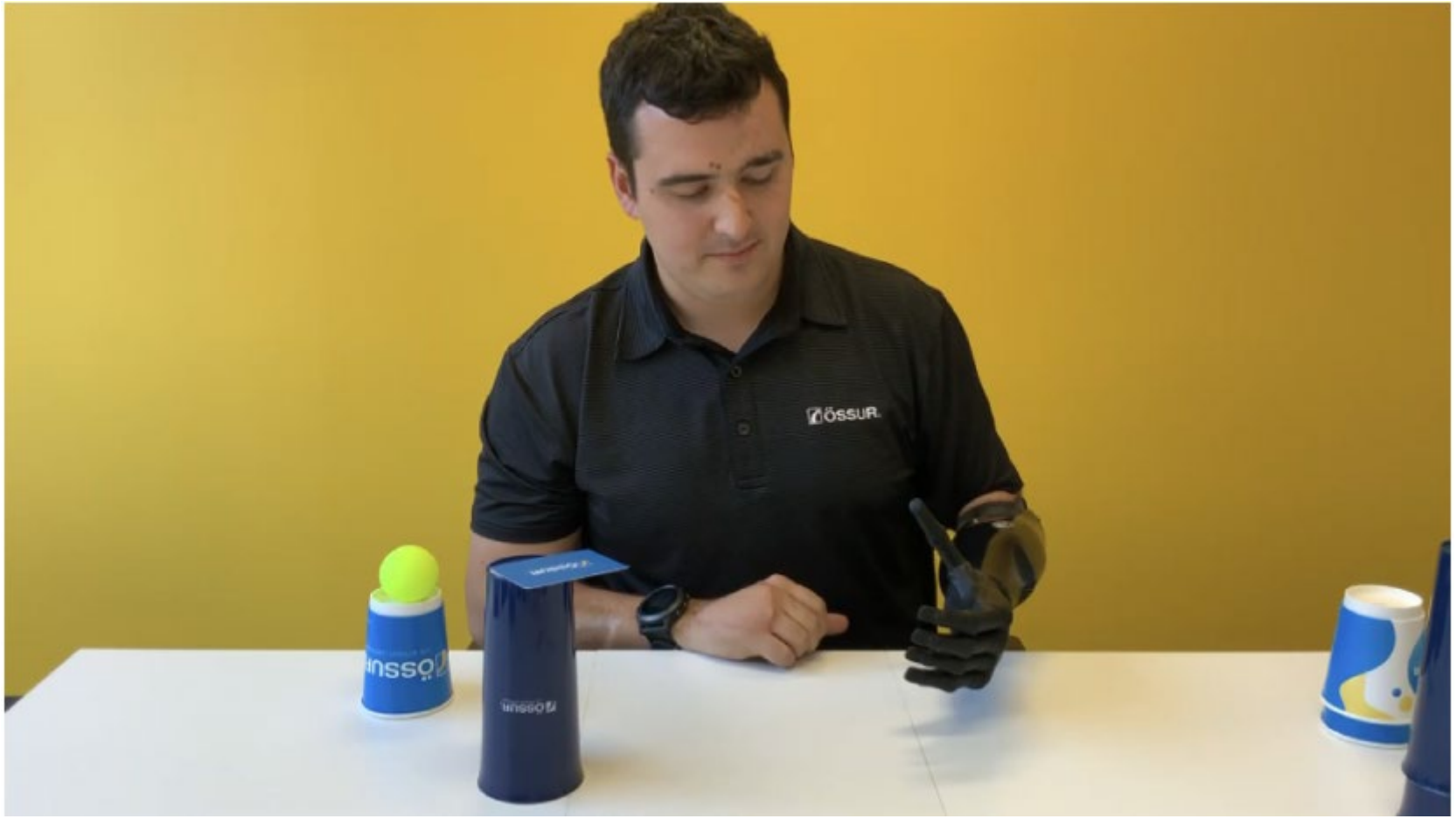
Stage 1 Training



Stage 2 Training



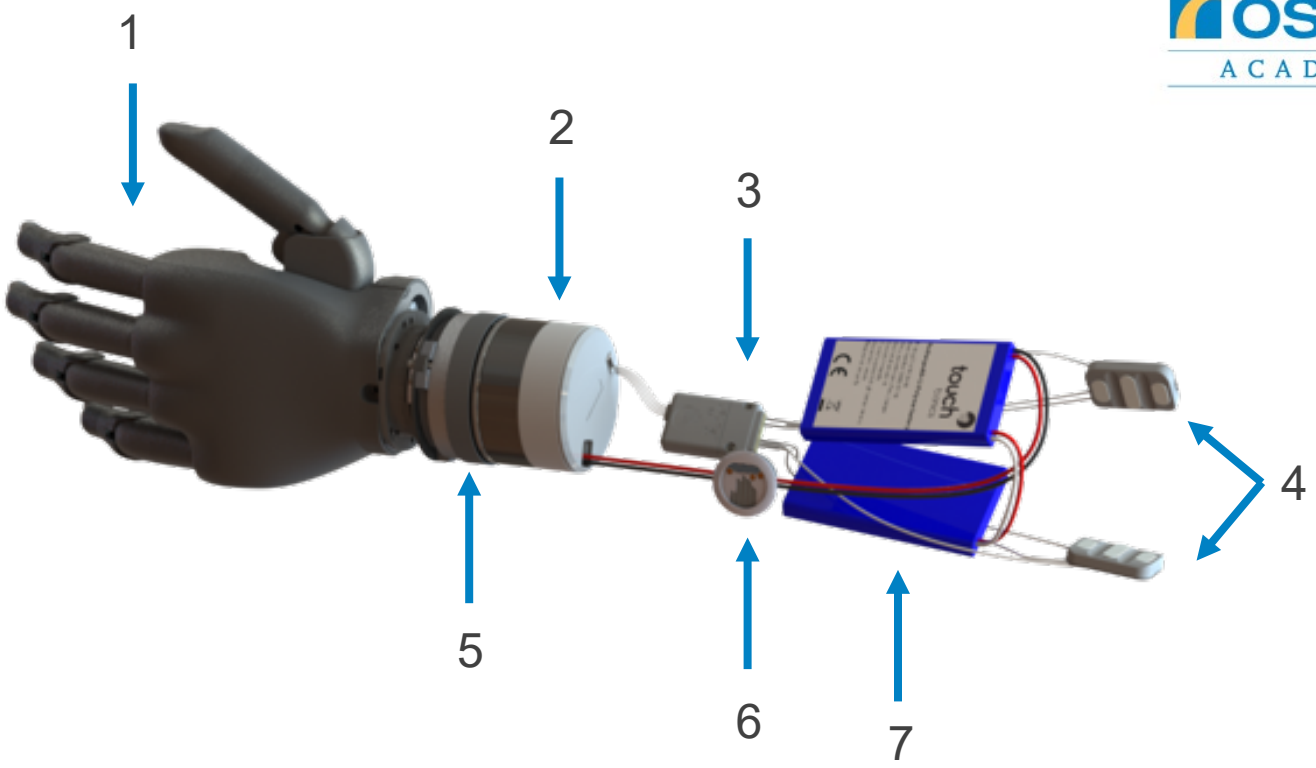
Stage 3 Training



Technical Specifications

System Components

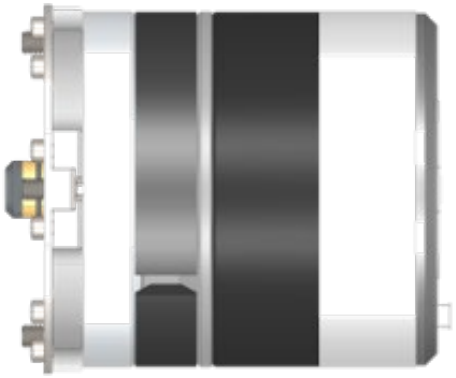
1. i-Limb (Quantum) hand
2. i-Limb Wrist
3. Digital electrode unit
4. Compact electrode contacts
5. Expansion ring
6. Magnetic charge port
7. Battery



Wrist Technical Specifications

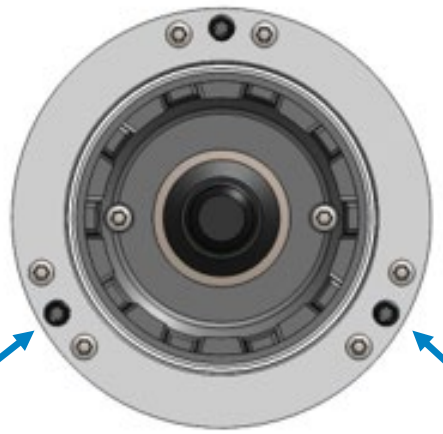
56mm

160g



Expansion ring

Torque: 1Nm



Torque: 1Nm

Torque: 1Nm

Electrode connection

Battery connection

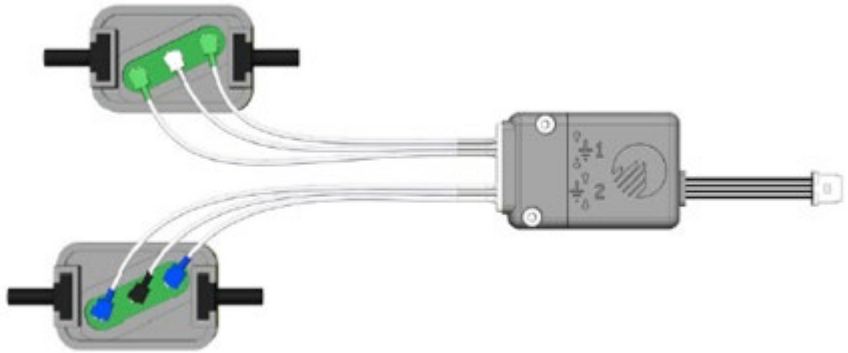
Digital Electrodes

- New digital electrodes control wrist and hand
- Compact and remote available
- More information gathered for wrist and hand to communicate
- Microprocessor within electrode for quick EMG signal processing

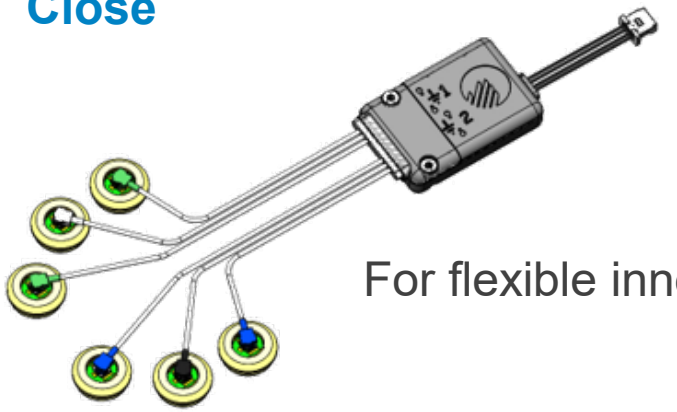
Green with white ground = **Open**

Blue with black ground = **Close**

Open



Close

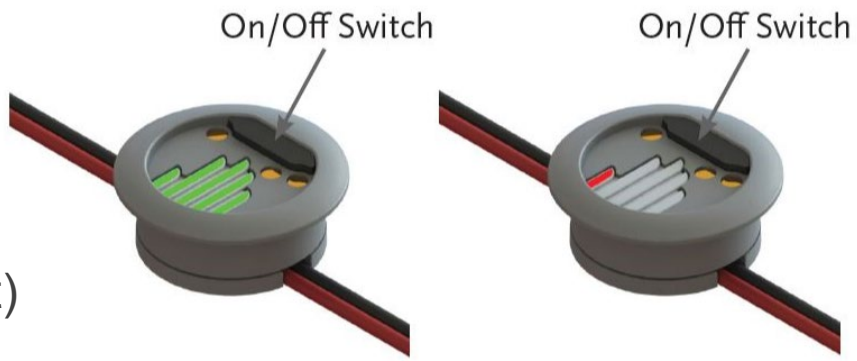


For flexible inner sockets

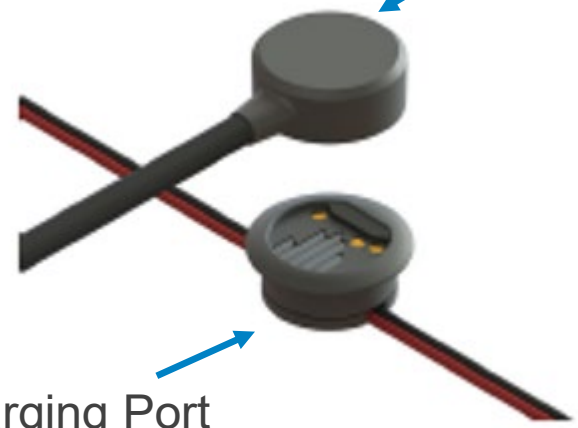
Note: digital electrodes must be plugged in prior to powering on the prosthesis.

Magnetic Charging Port

- Magnetic charging connection
- Powered through on/off switch on face
- Battery level monitored through LED lights (20% per light)
- Power reserve for emergency release (fail safe)



Off | Low battery | Fully charged



Car charger also available

i-Limb Compatibility

- **i-Limb Quantum** hands built since February 2018 are compatible with the **i-Limb Wrist**.
  - Device serial M9618 and above

- **i-Limb Quantum** hands built since November 2016 can be upgraded to be made compatible.
  - From device serial number M7695 for S/M/L hands and M7653 for XS hands

WE IMPROVE PEOPLE'S MOBILITY

ÖSSUR®