

# HARMONIC — BIONICS —

## HARMONY SHR™

Harmony SHR is a bilateral, upper-extremity exoskeleton dynamically designed to provide unique value in three areas of practice: neuroscience and movement science research, movement disorder assessment, and rehabilitation.

Harmony's multi-plane movements and bilateral design open up new research possibilities, while using precise motion and effort sensing to achieve objective assessment.

All of the system's data capabilities enable researchers and caregivers to optimize the treatment process for patients suffering from movement disorders by measuring functionality at baseline and throughout the recovery process. Harmony's different modes of therapy also help address patients throughout the care continuum, from highly-impaired patients with no motor function to progressing patients in a post-acute setting or an outpatient rehabilitation facility.



### RESEARCH

Harmony's unique design and capabilities break down barriers and limitations set by existing tools used in neuroscience and movement science research today.



### ASSESSMENT

With over 80 sensors recording measurements at 2,000 times per second, Harmony SHR is designed to provide objective assessment of a patient's capabilities. The system can precisely measure functionality including range of motion, force generation, and number of repetitions completed.



### REHABILITATION

By enabling early intervention, functional repetition, and intent-based therapy, Harmony SHR may improve the efficiency and effectiveness of upper-body rehabilitation.



# RESEARCH APPLICATIONS

Take your research to the next level with advanced instrumentation that breaks down barriers and limitations set by existing tools.

With an anatomically matched shoulder design, Harmony SHR more closely represents natural movements, and its actuation and control allow for differentially adjusting assistance at each joint. Harmony's multi-plane movements and bilateral design open up new research possibilities, while using precise motion and effort sensing to achieve objective assessment.

## HARMONY SHR APPLICATIONS IN RESEARCH

- Advancing fundamental neuroscience and movement science research
- Exploring novel robotic therapy methods for neuro-recovery in spinal cord injury (SCI), traumatic brain injury (TBI), and stroke cases
- Accelerating research in human-robot interaction, e.g. brain-machine interfaces (BMI), tele-manipulation, virtual and augmented reality (VR/AR), etc.

## WHAT SETS HARMONY APART FROM OTHER ROBOTIC SYSTEMS BEING USED IN RESEARCH TODAY?

### 1 Multi-Planar Design

Moving in multiple planes, Harmony's anatomically matched design maintains the **scapulohumeral rhythm** of the shoulder for a large, natural range of motion.

### 2 Bilateral Structure

Harmony's unique bilateral design enables mirror image movement allowing a precise comparative assessment of upper-extremity function.

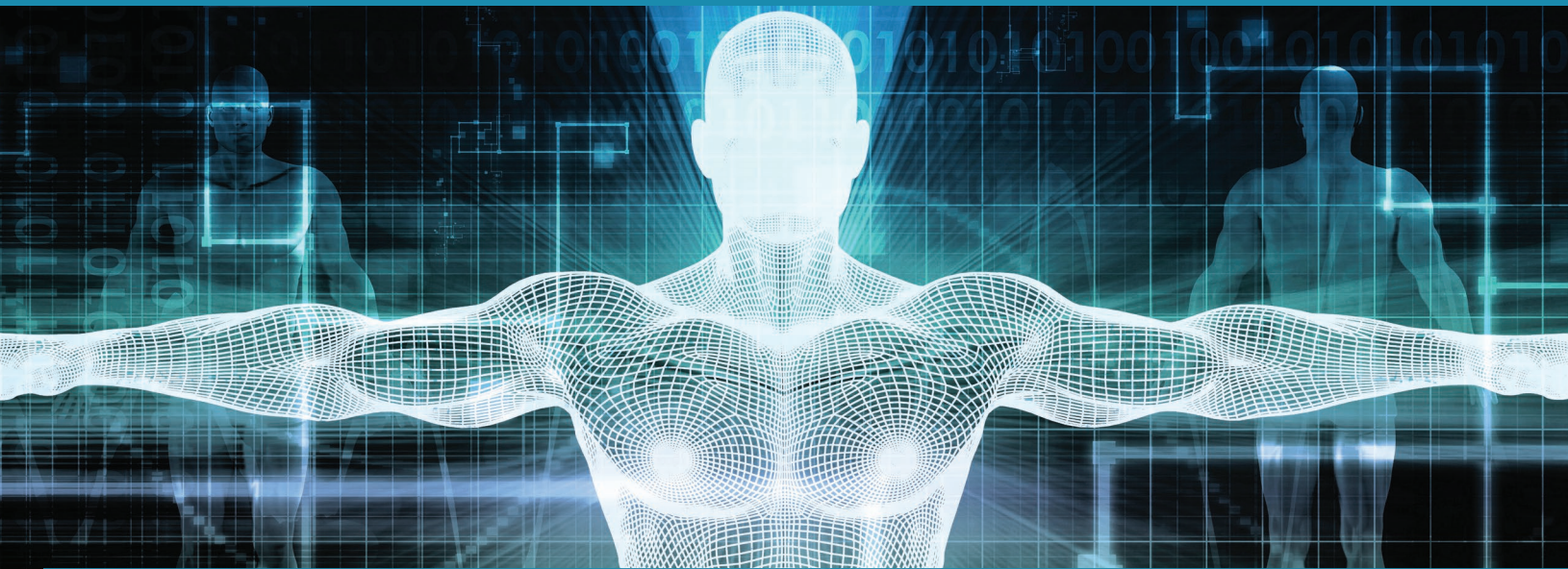
### 3 Customizability

Harmony allows for a wide range of size adjustments to perfectly match user needs. Position and torque control modes enable researchers to apply subject-specific assistance within a predetermined range.

### 4 Measurable, Objective, Exportable Data

High-speed and high-resolution sensors allow for accurate assessment of the participant's abilities measuring both motion (kinematics) and effort (force generation). This data can be integrated in BMI, tele-manipulation and augmented reality/virtual reality research.





# ASSESSMENT CAPABILITIES

## BRINGING PRECISION MEDICINE TO REHABILITATION

There are a number of common assessment or functional outcome measurement tools used today by therapists that rely on subjective analysis. Harmony SHR is designed to provide **objective assessment** of a patient's capabilities with over 80 sensors recording measurements at 2,000 times per second. This immense amount of data allows Harmony SHR to precisely measure a patient's functionality, including range of motion, force generation, and number of repetitions.



## INSTANTLY MEASURE MOTION AND EFFORT AT ANY GIVEN TIME

For those that experience neurological injury, orthopedic injury, or chronic conditions that impair movement, Harmony can act as a diagnostic tool to record a patient's ability at baseline and throughout the recovery process. This dynamic ability to create snapshots of an individual's kinematics combined with force generation will greatly enable researchers and caregivers to optimize the treatment process.

## TRANSPARENCY AND PRECISION IN A PATIENT'S PROGRESS AND RECOVERY

Traditional assessment methods are unable to detect smaller changes in motor function which, in the early stages of recovery, could be the catalyst that keeps both the caregiver and patient committed and engaged in the therapeutic plan.

# REHABILITATION APPLICATIONS

## INTELLIGENT TECHNOLOGY DESIGNED TO MOVE WITH YOU, SO YOU CAN MOVE BETTER ON YOUR OWN.

Harmony, as an upper-extremity exercise device, may assist in the treatment of upper-body movement impairments, including:

- **Neurological injury** (stroke, spinal cord injury, incomplete cervical, traumatic brain injury, brachial plexus injury)
- **Neuromuscular disease/disorder** (multiple sclerosis, Guillain-Barré syndrome, Lou Gehrig's disease)
- **Musculoskeletal disease** (Duchenne muscular dystrophy)
- **Musculoskeletal rehabilitation post-procedure** (shoulder arthroplasty, rotator cuff tear)

## EARLY INTERVENTION



Harmony SHR's anatomically matched design mimics the **scapulohumeral rhythm** of the shoulder to give the patient a large, natural range of motion during therapy. Patients suffering from upper-extremity dysfunction may also experience partial dislocation (or subluxation) of the shoulder, making it difficult and possibly dangerous to begin early intervention. With Harmony SHR, any dislocation is addressed prior to therapy and proper scapulohumeral rhythm is maintained throughout the session. In addition, the system's Weight Support mode allows for bilateral upper-extremity exercise with minimal gravitational resistance to help prevent pain and possible shoulder damage.

## FUNCTIONAL REPETITION



Repetition in rehabilitation is a key factor in reestablishing damaged neural pathways. With Preprogrammed Exercises, Harmony SHR facilitates functional recovery by simulating everyday, multiplanar movements with automated repetition.

## INTENT-BASED THERAPY



When treating a patient suffering from arm immobility or weakness, incorporating the healthy neural pathways of the non-affected side of the body into therapy has been shown to improve functional recovery. Harmony SHR's Bilateral Sync Therapy mode enables mirror image movement by recording and replicating the healthy arm motion onto the stroke-affected side in real time for patient-driven therapy. This promotes intent-based movements that may assist in reactivating neuroplasticity.