



# System 4

Dynamometer

Identify. Treat. Document.

ISO 13485:2016  
CERTIFIED



**BIODEX**  
A MIRION MEDICAL COMPANY

# A Better Path to Injury Recovery & Performance

Through science and innovation, we empower our customers to deliver a better patient experience at every turn, from enabling more effective training protocols to promoting faster injury recovery.

For decades, Biodex™ physical medicine devices have been relied on by top facilities around the world to aid in patient recovery and research. Our science-based technology and programs keep you on the cutting edge of rehabilitation exercise – and on top of patient care.





# The Biodex Team is Proud to be Part of Mirion Medical

In July 2022, Mirion Technologies announced the rebranding of its Medical segment as the Mirion Medical group, comprised of the organization's healthcare-focused Dosimetry Services, Sun Nuclear, CIRS, Biodex, and Capintec business units.

*"Given the expanding scope of our work and commercial reach, it is natural to bring our healthcare businesses together under a unified banner," notes Thomas Logan, CEO of Mirion Technologies and acting Mirion Medical President.*

The Biodex brand remains focused on Physical Medicine and Medical Imaging, providing science-based solutions for rehabilitation exercise and injury recovery, as well as advanced surgical and ultrasound tables to support a quality imaging experience for practitioners and patients.

*"Mirion Medical represents the science of better. We're committed to enhancing the delivery and ensuring the safety of healthcare treatments to truly better the human condition. For practitioners, our advanced technologies streamline workflows and reduce risk, while their patients benefit from a safer, more efficient healthcare experience," notes Mr. Logan.*

The Mirion Medical group will take on a family brand identity that carries across all business units in the group. The new logos will feature the Mirion "M", symbolizing the strength of this group as part of the Mirion Technologies family.



**MIRION**  
MEDICAL

For more than 30 years the System 4 continues to be the choice of the most distinguished clinics and research facilities worldwide.



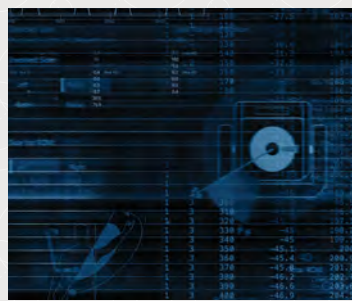
### Technology

Featuring six modes of operation, the System 4 offers pioneering breakthroughs in neuromuscular testing and rehabilitative technology.



### Phases of Rehabilitation

The System 4 allows for six phases of rehabilitation following the model of proving need, progress, and outcome.



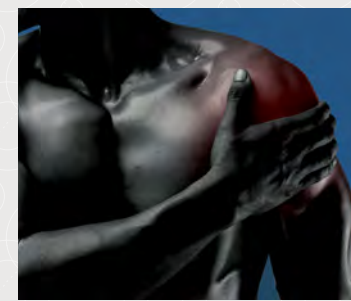
### Advantage BX™ Software

Streamlined, intuitive experience so users can capture and document every stage of the rehab process. Now features report for ACL Return to Play.



### Versatility

Expand your applications to provide consistent, accurate, objective data for sports/orthopedic medicine, pediatric, research and more.



### Adaptability

The potential uses for the System 4 go well beyond ACL rehab. The System 4 Dynamometer is used worldwide on a variety of joints and neuromuscular injuries.

# Distinguish Yourself

Elevate Your Patient Experience, Increase Referrals



# The Technology

Based on accepted science, backed by independent studies, supported by clinical protocols and normative data.

## Isokinetic Resistance Mode

Completely accommodating throughout the entire range of motion

- Resistance continuously matches effort, accommodating to variations in patient force output due to weakness, pain or fatigue at specific points in the individual's range of motion.
- By identifying the area that is weak, a targeted rehabilitation program can be designed. Targeting and concentrating on the impairment allows a faster, measurable recovery.
- The unique impact-free acceleration and deceleration eliminates joint trauma, allowing exercise and testing at more functional speeds.
- Applied torque response ensures limb velocity increases or decreases in proportion to the torque applied during acceleration and deceleration, enabling neuromuscular control measurements.
- Choose concentric and eccentric contractions to perform isolated plyometric exercises.
  - Concentric torque up to 500 ft-lb
  - Eccentric torque up to 400 ft-lb

## Isometric Mode

Effectively develop strength and decrease joint effusion

- Commonly used pre- and post-operatively or when pain associated when motion is a factor.
- Work the agonist, antagonist or both muscles at specified joint angles.

## Passive Motion Mode

Multi-function modality

- Unique control properties allow for early intervention throughout all phases of rehabilitation.
- Passive speeds can be set as low as 0.25 degrees per second and as fast as 300 degrees per second.

## Isotonic Mode

Restore function

- Allows velocity to vary while providing inertia-free constant force and concentric or eccentric muscular contractions.
- Higher performance - Isotonic force as low as 0.5 ft-lb = 6 inch pound; and as high as 400 ft-lb
- Selecting force provides protective pre-loading of the joint prior to movement.

## Reactive Eccentric Mode (Rhythmic Stabilization)

For submaximal neuromuscular re-education in early phases of rehabilitation

- Patient must produce and maintain a predetermined minimum force output to initiate movement, loading the muscles surrounding the joint, producing preload, thus stabilizing and protecting the joint.
- Eccentric torque up to 400 ft-lb.



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Learn how Biodex supports ACL rehab

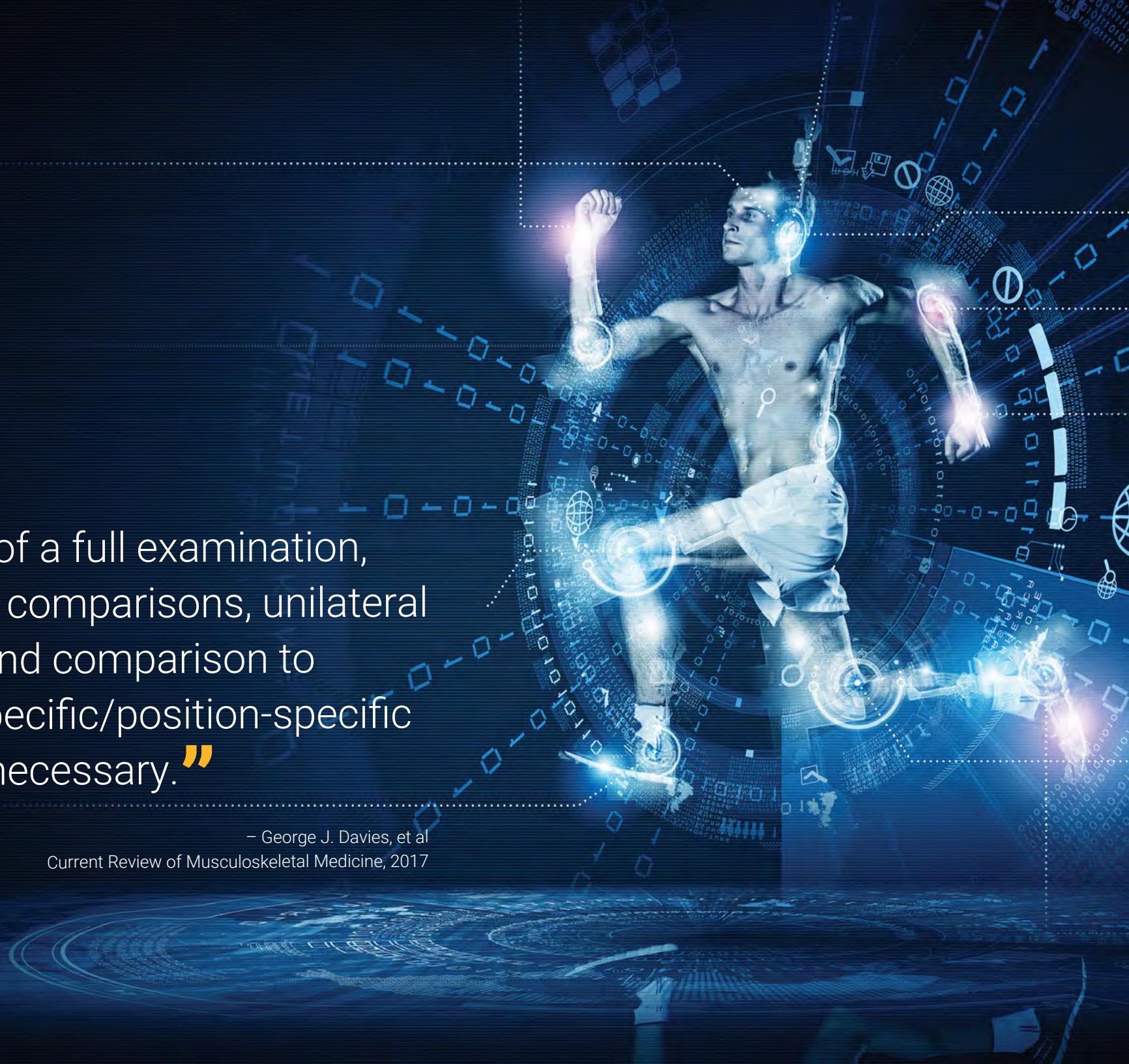
Simple decision rules can reduce reinjury risk by **84%** after ACL reconstruction.

(Grindem, H., et al. British Journal of Sports Medicine, 2016)

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“As part of a full examination, bilateral comparisons, unilateral ratios, and comparison to sport-specific/position-specific data is necessary.”

– George J. Davies, et al  
Current Review of Musculoskeletal Medicine, 2017





# Prove need, progress, and outcome

## Six phases of rehabilitation

### 1. Healing Constraints and Proving Need

In Passive Mode, gentle range of motion exercise can facilitate the healing process and restore normal range of motion necessary for function. Isometric mode allows safe, comfortable strengthening and testing at specified angles that are safe for both your pre- and post-operative patients.

### 2. Controlling Joint Effusion/Inflammation

Utilizing the Passive Mode with other modalities allows the structures around the joint to work as a pump to move blood, lymph and waste products out of the joint. System 4 has the capability to move the limb as slow as .25 degrees per second and with force capabilities as low as .5 ft-lb.

### 3. Restoring Range of Motion

Controlling the System 4 through the GUI interface in Passive Mode allows range of motion to be restored by gradually increasing range of motion on the fly in a specified direction, at appropriate speeds and safe torque levels.

### 4. Restoring Strength and Proving Progress

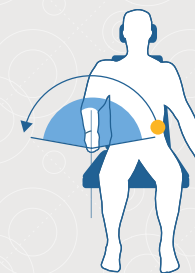
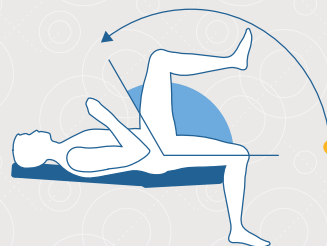
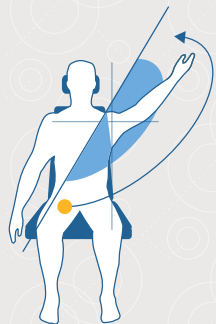
Isometric, active assistive, submaximal concentric, eccentric contractions are early strengthening techniques that are available to the System 4 user. More progressive maximal concentric, eccentric contractions are available in Isokinetic, Isotonic, Passive and Reactive Eccentric modes. These modes are also suitable for testing and delineating a documentable progression of muscular strength, endurance and joint position sense.

### 5. Restoring Function

Isokinetic concentric/concentric mode allows for safe exercise at speeds which approximate function. Impact and inertia-free Isotonic Mode allow muscles to contract exactly as they would perform during functional activities. Proprioception, muscular acceleration and deceleration are also activities that are addressed with the Biodex™ System 4.

### 6. Proving Outcome

All five modes can objectively assess isolated joint muscle strength and neuromuscular control.



# The Software

Simple. Logical. Intuitive.

Advantage BX™ Software makes it easy to capture and document every stage of the rehabilitation process with efficient functionality and intuitive navigation.

- Return-to-Play reports for ACL-R and Hamstring Injury
- Fresh, modern interface with intuitive navigation
  - Guides you step by step through protocol-based activities
  - Quick start and repeat activity options
  - Ability to store and pin frequently used activities
  - Create custom protocols on the fly
  - Fast access to training mode
- Linked protocols
  - Perform up to ten consecutive protocols using different torque modes
  - Save settings for individual linked protocols for easy repetition
- Curve analysis
- Closed chain operations
- Specialized built-in hamstring protocols
- Integrated analog/EMG output signal scaling
- Enhanced data management capabilities
  - Create multiple databases and switch between them to develop separate data sets for specific research purposes
  - Easily share test data and custom protocols between dynamometers running Advantage BX Software
  - Export both single and multiple test data with comprehensive metrics and raw data for use with third party tools
  - Import existing patient lists into Advantage BX Software
  - SQL database with easy access to patient data and reports

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Setting up a protocol based activity (knee)

Setting the range of motion (knee)

Performing a two-speed isokinetic protocol based activity on the knee

Activity results showing a unilateral knee test

Tracking progress with comprehensive reporting - print or save to PDF

Integrated data management

POSITION	POS (ANAT)	VELOCITY
Degrees	Degrees	DEG/SEC
182.7	-22	0.5
182.7	-22	0.5
182.8	-22	1.3
182.8	-22	1.5
180	-22	7.1

“Patients who did not meet the discharge criteria before returning to professional sport had four times greater risk of sustaining an ACL graft rupture...”

– Kyritsis, P. et al. British Journal of Sports Medicine, 2016

**Special Thanks to Our Panel for Return-to-Play**

- John Cavanaugh, PT, MEd, ATC, SCS
- George J. Davies, DPT, MED, PT, SCS, ATC, LAT, CSCS, PES, CSMS, FAPTA
- Timothy Heckmann, PT, ATC
- Mark Paterno, PT, PhD
- Bryan Riemann, PhD, ATC, FNATA
- Milo Sini, ATC, PTA, CSCS
- Tim Tyler MS, PT, ATC

## Return-to-Play Test Results, Simplified.

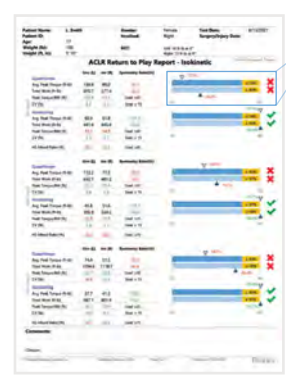
Designed to simplify communication with stakeholders, Biodex introduces the first return-to-play reports for ACL-R and hamstring injury. Built into Advantage BX software, the reports simplify muscle performance test results with clear pass/fail for each test throughout the athlete's recovery.

- Grounded in the latest research
- Results can be understood at a glance
- Clearly communicates test results with patients, third-party payers and employers
- Adds confidence to the return-to-play decision

### ACL Report

Uses evidence-based measures for limb strength symmetry and balanced hamstring to quadriceps ratios – major components of return-to-play criteria shown to reduce reinjury in athletes after ACL-R.

### ACL Return-to-Play Report



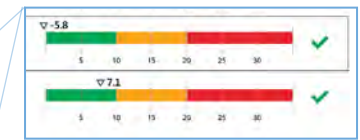
Limb symmetry index

When Limb Symmetry Index is 90% or greater, risk of reinjury is reduced.<sup>1</sup>

### Hamstring Reports

Supports two commonly used hamstring rehab protocols:

### Lengthened State – Multiple Angle Comparison Test



Lengthened state and average deficits

When deficits in lengthened state and average of all angles are less than 20%, predisposition to reinjury is significantly reduced.<sup>2</sup>

### Mixed H/Q Ratio Test



Eccentric Hamstring/Concentric Quadriceps Ratio

If the ratio exceeds 1.4, hamstring injury is greatly diminished.<sup>3</sup>

References:  
 1. Kyritsis P, et al. (2016). Br J Sports Med; 50:946–951. • Grindem H, et al. (2016). Br J Sports Med; 50:804-808.  
 2. Schmitt B, Tyler T, McHugh M (2012). Int J Sports Phys Ther. 7(3): 333-341. • Heiderscheit BC, et al. (2010). J Orthop Sports Phys Ther., 40(2): 67. • Askling C, Karlsson J, Thorstensson A (2003). Scand J Med Sci Sports, 13(4): 244.  
 3. Croisier JL PT PhD, et al. (2008). Am J Sports Med 36: 1469.

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Learn More



**White Paper:**

Dynamometer Technology Helps Employers Meet Challenging Change in the Global Workforce

# The Markets

## Highly Versatile.

As the premier multi-joint system for objective testing, the Biodex System 4 Dynamometer helps you provide the best outcomes for your patients, supports your research, and separates your facility from the rest.

### Sports and Orthopedic Medicine

Isolate performance data for a broad range of upper and lower body joints.

- Anterior cruciate ligament
- Hamstring injury
- Shoulder dysfunction
- Knee osteoarthritis
- Lateral ankle sprains
- Patellofemoral dysfunction
- Preseason screening, injury prevention and athletic performance enhancement

### Occupational Medicine/Workplace Health

- Helps employers gauge physical competence of applicants.
- Reduces injury and workers' compensation claims.
- Objective measurement for pre-employment testing as outlined by the Department of Labor
- Optional attachments designed to simulate specific work-related motions.

### Research

Used in over 1,000 published studies.

- **Integrated Analog Signal Access Settings**  
Provides real-time analog voltage output of torque, position and velocity from the dynamometer. Perfect for integration with EMG devices.
- **Customizable Protocols**  
Protocol Based Activities can be predefined or created and saved at the time of testing. Saved protocols are easily retrievable via a dynamic list of frequent activities.

### Neurorehabilitation

- Helps patients build strength, endurance and coordination. Spasticity management includes objective quantification at specific contraction.
- Passive mode is used for repetitive exercises.
- Eccentric mode is useful for controlled strengthening.
- Specially designed upper extremity attachments for hemiparetic patients promote neuro recovery and improve strength.

### Pediatrics

- Used to treat children worldwide.
- Isokinetic muscle testing provides objective data for neuromuscular control and strength.
- Pediatric attachments and age-based normative data goals are available.

### Older Adult

- Objective testing and training for balance disturbances.
- Isokinetic testing will identify weakness.
- Exercise improves ankle and leg strength.

### Military Strength Training

- Used by military special forces for injury prevention and performance optimization.
- Strength testing identifies residual deficits and predisposition for repeat injury.



## Expand the use of your Biodex Dynamometer



### Upper Extremity Attachments to accommodate hemiparetic patients

Lightweight, carbon-fiber attachments promote neuro recovery and improve strength, accommodating the impaired grasp associated with hemiplegia. The eccentric mode is especially useful for controlled strengthening.



### Work Simulation Tools

Replicate job-specific tasks for the hand, wrist, elbow and shoulder, recreating job challenges in ranges of motion, strength and endurance.



### Closed Kinetic Chain Attachment

Designed to provide early, safe, progressive rehabilitation for both the upper and lower extremity.



### Hamstring Attachment

Objective testing provides valuable, isolated muscle-performance data for pre-emptive injury screening, managing rehabilitation and determining readiness for return to play.



### Pediatric Attachments

Isokinetic muscle testing on children helps clinicians by providing objective data for neuromuscular control and strength.



### Dual Position Back Extension/Flexion Attachment

Objectively measure back muscle extension/flexion and rehabilitation in the semi-standing and seated-compressed lumbar positions.



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[Learn More](#)

## Additional Attachments/Accessories

### Ankle Attachment

Provides stability during ankle and foot testing and rehabilitation.

### Shoulder Input Tube

Enables quick access between shoulder rotation and scapular elevation exercises.

### Hip Attachment

Included with PRO configuration. Separate attachment for hip abduction/adduction testing and exercise and extension/flexion.

### Anti-Shear Attachments

Designed for use with anterior cruciate patients. Pads put pressure high and low on the tibia to provide protection from posterior shear.

### Chair Wedge

Designed to fill the gap created when seat is flat, making the seat more comfortable for supine, prone or side lying exercises.

### Wide Seat

Factory installed extra wide seat and back, plus longer straps to accommodate larger patients. Max weight 430 lb (195 kg).

**Shared Specifications:**

**Performance:**

- Concentric speed up to 500 deg/sec
- Eccentric speed up to 300 deg/sec
- Concentric torque up to 500 ft-lb (680 Nm)
- Eccentric torque up to 400 ft-lb (542 Nm)
- Passive speed as low as 0.25 deg/sec
- Passive torque as low as 0.5 ft-lb (0.68 Nm)
- Isotonic torque as low as 0.5 ft-lb (0.68 Nm)

**Dynamometer and Positioning Chair:**

- Pneumatically assisted dynamometer height adjustment
- Precision dynamometer rotation and tilt
- Front-to-back chair adjustment with 360 degrees of horizontal rotation
- Seat-back tilt from 90 to 0 degrees

**Clinical Data Station:**

- Windows 10 Enterprise LTSC Operating System
- Biodex Advantage BX Software
- 22" LCD Flat Panel Touchscreen Monitor with Integrated Speakers
- Color Printer

**Accessories:**

- Attachment Cart
- Calibration kit
- Wall Chart

**Power:** 230 VAC, 50-60 Hz, 20 amp

**Certifications:**

- ANSI/AAMI ES60601-1:2005+A1:2012+C1:2009 +A2:2010. CAN/CSA C22.2 No. 60601-1:14. IEC 60601-1-2:2014. IEC 60601-1:2005 (Third Edition) + CORR. 1:2006 + CORR.2:2007 + A1:2012 (or IEC 60601-1: 2012 reprint).

**Warranty:** One year parts and labor



**System 4 PRO**



850-000

**System 4 MVP**



852-000

**System 4 Quick-Set**



840-000

**Compare Systems**

	System 4 PRO™	System 4 MVP™	System 4 Quick-Set™
<b>Chair Height</b>	Motorized adjustment	Fixed	Fixed
<b>Dynamometer Positioning</b>	Side to side	Side to side	Fixed
<b>Knee Attachment</b>	Standard	Standard	Standard
<b>Shoulder Attachment</b>	Standard	Standard	Standard
<b>Ankle Attachment</b>	Standard	Standard	Standard
<b>Elbow Attachment</b>	Standard	Standard	Standard
<b>Wrist attachment</b>	Standard	Standard	Standard
<b>Hip Attachment</b>	Standard	Optional	Optional
<b>Hamstring Attachment</b>	Optional	Optional	Optional
<b>UE Hemiparetic Attachment</b>	Optional	Optional	Optional
<b>Dual Position Back Extension/Flexion Attachment</b>	Optional	Optional	Optional
<b>Closed Kinetic Chain Attachment</b>	Optional	Optional	Optional
<b>Work Simulation Tools</b>	Optional	Optional	Optional
<b>Anti-Shear Attachments</b>	Optional	Optional	Optional
<b>Pediatric Attachments</b>	Optional	Optional	Optional
<b>Wide Seat</b>	Optional	Optional	Optional

**Support**

**Installation**

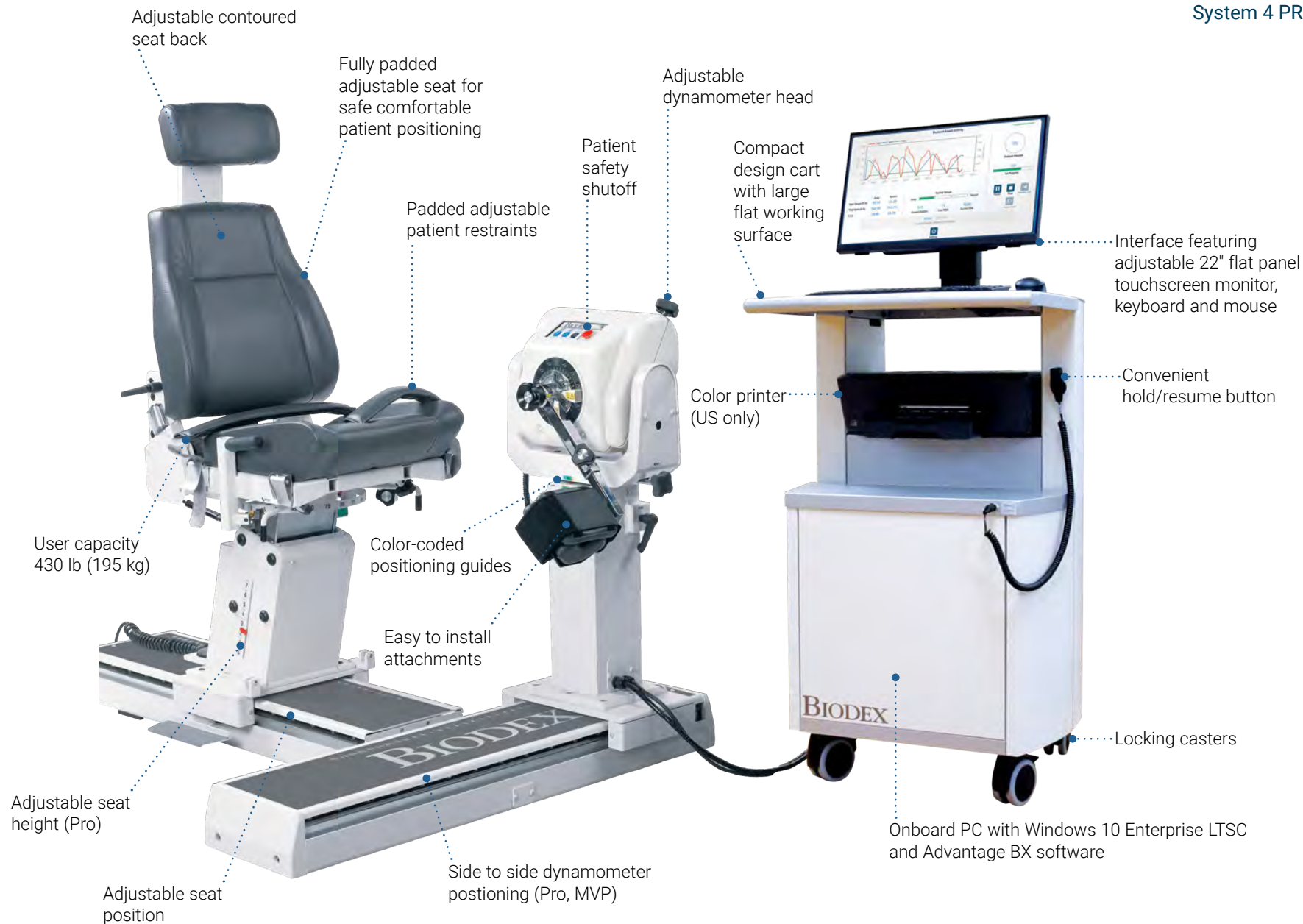
It all starts upon delivery of your System 4. Biodex devices are installed by certified application specialists and include a one day in-service training program. Step-by-step hands-on training will show you how to use and maximize the System 4 to help meet your specific demands.

**Service**

Biodex stays with you every step of the way. Phone support and on-site field service allow you to concentrate on treating patients, not your equipment.



System 4 PRO™ shown





# Driving Radiation Safety, Science and Medicine Forward

**At Mirion Technologies, our customers do incredible work that benefits humanity every day.**

Headquartered in Atlanta Georgia, USA, with over 2,800 employees in 13 countries worldwide, Mirion Technologies is a leading provider of detection, measurement, analysis and monitoring solutions to the nuclear, defense, medical and research end markets.



From securing our borders and providing clean energy, to fueling space exploration and curing cancer, there is essential and inspiring work being done by those we serve. By helping our customers meet challenges in radiation detection, measurement and medicine, we help to keep these brave and brilliant people at the forefront of their industries, while safeguarding and supporting their contributions to the world.



**MIRION**  
TECHNOLOGIES

## A Better Path to Injury Recovery and Performance



Balance System SD™  
and BioSway™  
Balance Technology



BioStep™ 2  
Elliptical Ergometer



Sit2Stand™  
Squat Assist-Trainer



Gait Trainer™ 3 with  
Music-Assisted  
Therapy



NxStep™  
Unweighing System



medBike® Cycle



Upper Body Cycle



Mobility™ Assist  
Device



FreeStep SAS

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