

# System4

DYNAMOMETER

Identify. Treat. Document

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.

“ I find isometrics a great way of helping patients build confidence in producing force, and they have immediate biofeedback to consolidate this confidence.”

– Gareth Thomas, Scholars Therapies



# Distinguish Yourself

For people who know the difference



BIODEX

# 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.
- Ideal for proprioceptive testing – Active joint position testing stimulates joint and muscle receptors and provides a functional assessment of afferent pathways.

## Isotonic Mode

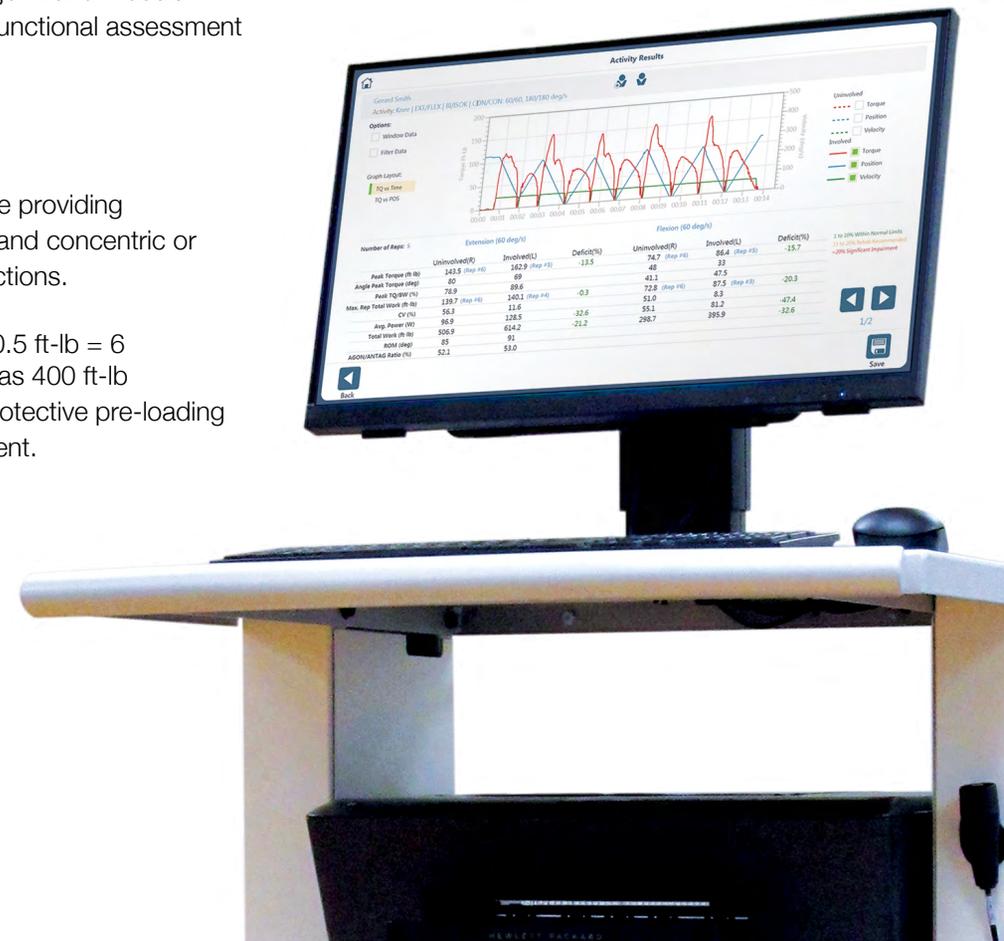
Restore function

- 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

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.



[www.biodesx.com/s4](http://www.biodesx.com/s4)



View research study

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

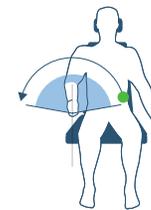
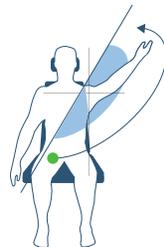
Isometric, active assistive, submaximal concentric, eccentric contractions are early strengthening techniques that are available to the System 4 user. More progressive maximal concentric, eccentric contractions are available in **Isokinetic, Isotonic, Passive and Reactive Eccentric modes**. These modes 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.



# Advantage BX™ Software

Simple. Logical. Intuitive.

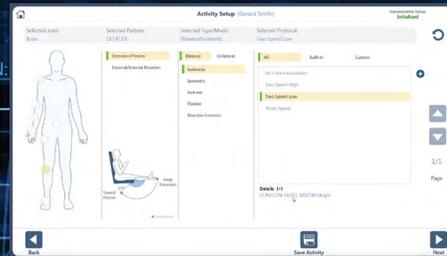
Capture and document every stage of the rehabilitation process with efficient functionality and intuitive navigation.

- **NEW** Return-to-Play Report for ACL
- **NEW** Data Management Capabilities
- Fresh, modern interface
- Intuitive navigation
- Guides you step by step through protocol-based activities
- SQL database with easy access to patient data and reports
- 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
- Integrated analog/EMG output signal scaling

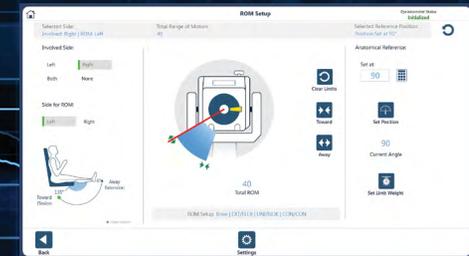
## Integrated and Enhanced Data Management Capabilities

- Easily share test data and custom protocols between dynamometers running Advantage BX
- 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

[www.biodex.com/s4](http://www.biodex.com/s4)



Setting up a protocol based activity (knee)



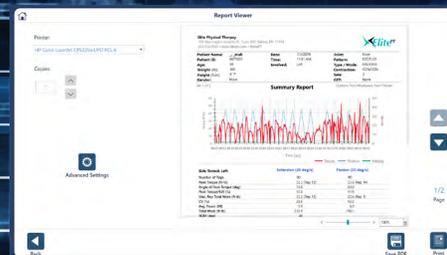
Setting the range of motion (knee)



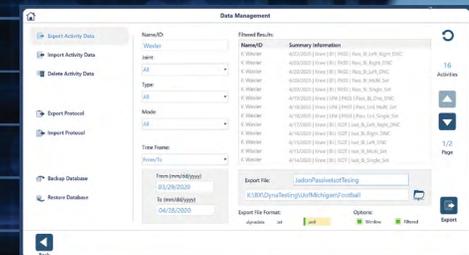
Performing a two-speed isokinetic protocol based activity on the knee



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



“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

Torque (ft-lb)  
 180  
 150  
 120  
 90  
 60  
 183.4  
 183.6  
 183.8  
 184  
 184.3  
 184.6  
 185  
 185.4  
 185.8  
 186.3

Side Test Left  
 Number of Reps  
 Peak Torque  
 Angle of Peak  
 Peak TQ/BW  
 Max. Rep  
 CV (%)  
 Avg. Power  
 Total Work  
 ROM (deg)  
 AGON/ANT  
 L to R % NC  
 L to R % NC  
 69.6  
 75.2  
 80.8  
 85.9  
 90.6  
 94.1  
 96.2  
 96.7  
 95.9  
 94.2  
 92.6  
 91.4  
 90.8  
 90.2  
 90.1  
 200.9  
 201.8  
 202.7  
 200.6

Special Thanks to Our Panel for Return-to-Play

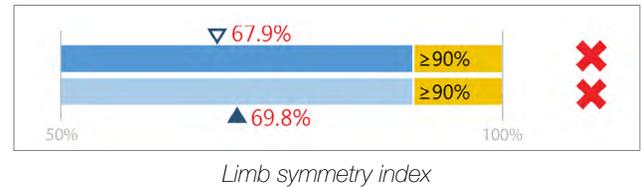
- John Cavanaugh, PT, MEd, ATC, SCS
- George J. Davies, DPT, MED, PT, SCS, ATC, LAT, CSCS, PES, CSMS, FAPTA
- Timothy Heckmann, PT, ATC
- Mark Paterno, PT, PhD
- Bryan Riemann, PhD, ATC, FNATA
- Milo Sini, ATC, PTA, CSCS
- Tim Tyler MS, PT, ATC

# NEW Reporting for ACL Return-to-Play

There's a reason for the recent resurgence of isokinetic strength testing after ACL reconstruction. Limb strength symmetry and balanced hamstring to quadriceps ratios are major components of return-to-play criteria shown to reduce reinjury in athletes after ACL-R.

- Time
- **Isokinetic strength testing: symmetry and hamstring/quadriceps ratios**
- Functional test symmetry
- Agility testing
- Psychological readiness

New reporting capabilities make it even easier to communicate with patients, doctors, third party payers and employers.



## Clearly Communicate Test Results

Grounded in the latest research and supported by a panel of field experts, Biodex introduces the first-ever Return-to-Play report. Results can be understood at a glance with clear pass/fail for isokinetic tests throughout the athlete's recovery. This unique report gives patients and referring physicians the added confidence they are ready to return to play.

References:  
 Grindem H, et al. Br. J Sports Med 2016;50 804-808. doi:10.1136/bjsports-2106-096031  
 Kyritsis P, et al. Br J Sports Med 2016;50: 946-951. doi:10.1136/bjsports-2015-095908  
 Webster K.E., Feller J.A. The Orthopaedic Journal of Sports Medicine, 6(4). doi:10.1177/2325967118763763  
 AAOS, Return to play checklist reduces re-injury for athletes following anterior cruciate ligament. Science Daily, March 6 2018

Elite Physical Therapy  
 237 Wood Street, Suite 100, Glen Head, NY 11545  
 (516) 751-9202 • www.elitephysicaltherapy.com • wendy@elitept.com

Patient Name: D. Torrance • Gender: Male  
 Patient ID: 052380 • Invoked: Left  
 Age: 29 • GET: Left 22 ft-lb at 20°  
 Weight (lbs): 178 • Height (ft, in): 5-10" • Right 19 ft-lb at 21°  
 Surgery Date: 12/4/2019  
 Test Date: 8/9/2020

### ACLR Return to Play Report - Isokinetic

Quadriceps	Uvr (R)	Inv (L)	Symmetry Ratio (%)
Avg. Peak TQ (ft-lb)	1280	873	67.9%
Total Work (ft-lb)	5667	3956	69.8%
Peak TQ/BW (%)	91.7	58.5	Goal ≥ 90
CV (%)	20.6	12.4	Goal ≤ 10-15
HIQ Ratio (%)	49.3	59.9	Goal = 60

Hamstrings

Uvr (R)	Inv (L)	Symmetry Ratio	
Avg. Peak TQ (ft-lb)	637	525	82.4%
Total Work (ft-lb)	2925	2348	80.3%
Peak TQ/BW (%)	39.2	31.7	Goal ≥ 60
CV (%)	9.3	5.9	Goal ≤ 10-15
HIQ Ratio (%)	52.9	75.4	Goal = 60

Quadriceps

Uvr (R)	Inv (L)	Symmetry Ratio	
Avg. Peak TQ (ft-lb)	2168	858	39.6%
Total Work (ft-lb)	12493	8498	67.9%
Peak TQ/BW (%)	69.6	57.5	Goal ≥ 50-65
CV (%)	12.1	18.0	Goal ≤ 10-15

Hamstrings

Uvr (R)	Inv (L)	Symmetry Ratio	
Avg. Peak TQ (ft-lb)	586	647	87.5%
Total Work (ft-lb)	6998	8372	91.1%
Peak TQ/BW (%)	39.2	31.7	Goal ≥ 30-45
CV (%)	11.1	5.1	Goal ≤ 10-15
HIQ Ratio (%)	52.9	75.4	Goal = 60

Quadriceps

Uvr (R)	Inv (L)	Symmetry Ratio	
Avg. Peak TQ (ft-lb)	798	893	87.1%
Total Work (ft-lb)	12496	10498	83.9%
Peak TQ/BW (%)	69.6	57.5	Goal ≥ 30-45
CV (%)	8.5	6.1	Goal ≤ 10-15

Hamstrings

Uvr (R)	Inv (L)	Symmetry Ratio	
Avg. Peak TQ (ft-lb)	552	463	83.9%
Total Work (ft-lb)	6008	6268	92.7%
Peak TQ/BW (%)	35.0	31.6	Goal ≥ 20-35
CV (%)	7.1	4.6	Goal ≤ 10-15
HIQ Ratio (%)	69.3	66.8	Goal = 60

Comments:  
 Diagnosis: ACL post-op.  
 Comments: Patient has been at rehab for nine months.

Client: Bob Dubois  
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Physicians can understand report at a glance with clear pass/fail results.



[www.biodex.com/s4](http://www.biodex.com/s4)



**White Paper:**  
Dynamometer Technology  
Helps Employers Meet  
Challenging Change in  
the Global Workforce



[Learn More](#)

# 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.



**BIODEX**

# 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.

## Hamstring Attachment



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

## Work Simulation Tools



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

## Pediatric Attachments



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

## Closed Kinetic Chain Attachment



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

## Dual Position Back Extension/Flexion Attachment



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



### 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).



[Learn More](#)

# Specifications

## 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



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

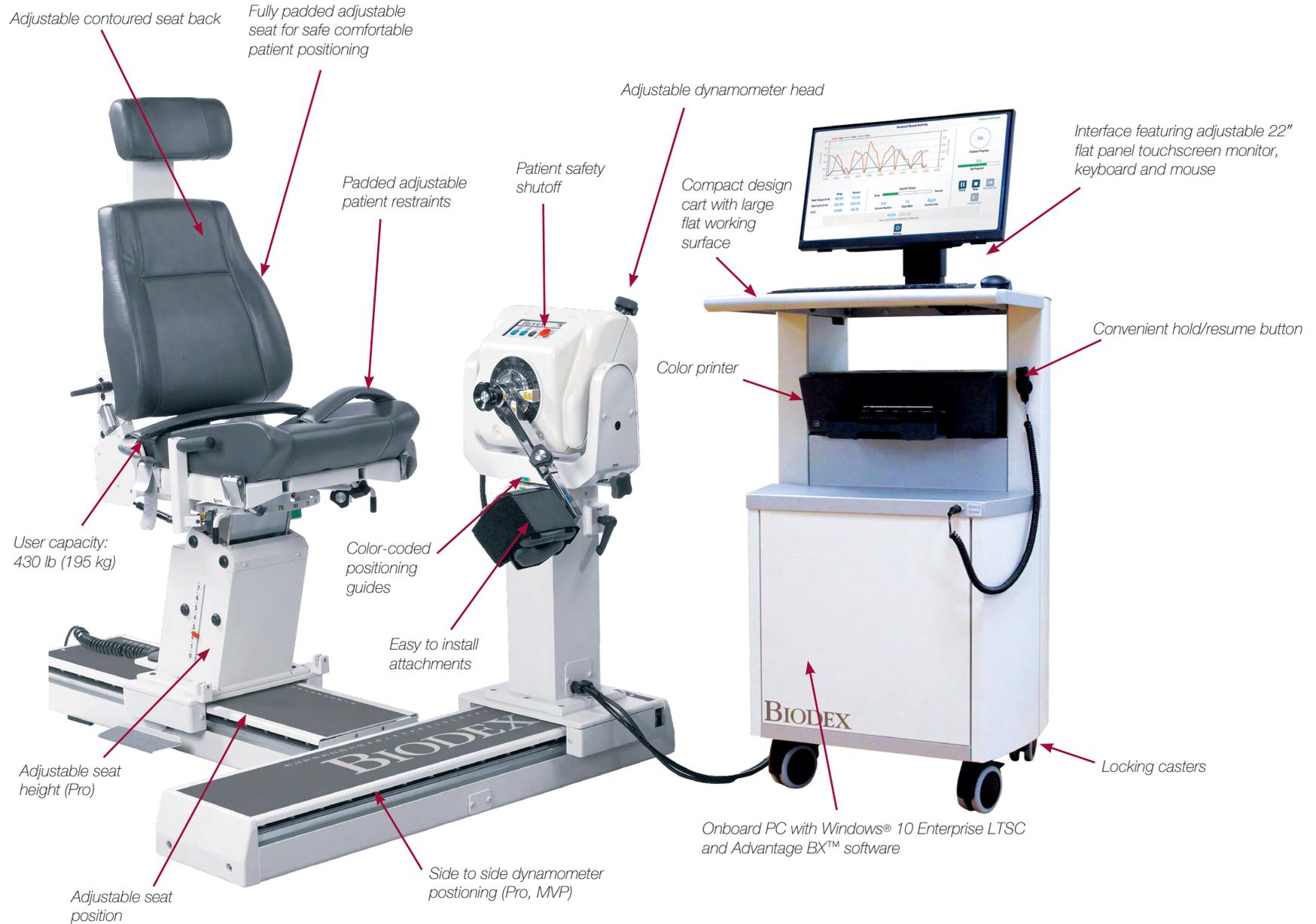
## Support Installation

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



The logo features the word "System" in a black serif font, followed by a large, stylized number "4" in a grey serif font. A thick, blue, curved swoosh underlines the text, starting from the left and ending on the right, partially overlapping the "4".

# System 4

**BIODEX**  
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