

DUAL POSITION BACK EX/FLEX ATTACHMENT

OPERATION MANUAL

830-450



BIODEX

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**This manual contains instructions for the following
Biodex product:**

#830-450 Dual Position Back Ex/Flex Attachment

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INTRODUCTION



Figure 1: The Biodex Multi-Joint System with Dual Position Back Ex/Flex Attachment. The patient is exercising in the semi-standing (functional) position. For exercise or testing in the seated-compressed position, remove the lumbar pad, raise the seat to the inclined position, and insert both the sacral pad and lower extremity compression device.

The Dual Position Back Ex/Flex Attachment was created to provide clinicians with greater versatility in back testing and rehabilitation. With this system, patients can perform both semi-standing and seated-compressed lumbar back extension/flexion. This allows the clinician to objectively measure muscle performance in both functional and isolated capacities. The attachment is easily connected or disconnected from the dynamometer and conveniently rolled aside for storage when not in use.

The ability to test or exercise in a functional pattern is important because, in real life activities, musculature other than the abdominals and erector spinae are used to perform such tasks as lifting. The semi-standing position, in which the seat is slightly reclined from horizontal, allows for hip involvement and a range of motion comprising both lumbar and sacral movement. This position simulates an upright standing position with respect to the musculature that contributes to this posture but reduces some of the compressive forces acting at the low back. Past history has demonstrated that this position is comfortable for the patient and results in greater compliance to the rehabilitation program. Many clinicians consider the semi-standing position effective for functional assessment of lower back extension/flexion motion. A necessary degree of stabilization is achieved through the use of a cervical support, thoracic support, chest harness, scapula pad, pelvic support, thigh strap, and foot cuffs.

Effective lumbar isolation, on the other hand, is achieved by placing the patient in the "seated compressed" position and using the femurs to immobilize the pelvis. This fixation is accomplished by positioning the patient in the seat against a specially designed sacral pad and securing him/her into this surface with the lower extremity compression pad. Laterally, the patient is secured by the contour of the pad. Of course, all the stabilization features noted for the semi-standing position are also incorporated to ensure maximal stabilization. Range of motion should be limited to that which is produced from the lumbar area.

When placed in the seated-compressed position with the seat slightly inclined from horizontal, the patient maintains some degree of lordosis, resulting in less deformation of the discs and reduced loads on the lumbar region. The sacral pad also helps to maintain this lordotic position and reduced compression. Because of these factors, isolated lumbar testing is very safe — especially when performed isometrically.

Numerous reasons for isolated lumbar testing have been recognized. One important factor stems from a research standpoint. As with joint testing, the more isolated the motion and the better the stabilization, the more reproducible the task. Because the movement is isolated the clinician may be sure that the abdominals and erector spinae are being exercised to full capacity with minimal contributions of hip, gluteal, and other lower extremity musculature.

PARTS AND ADJUSTMENTS

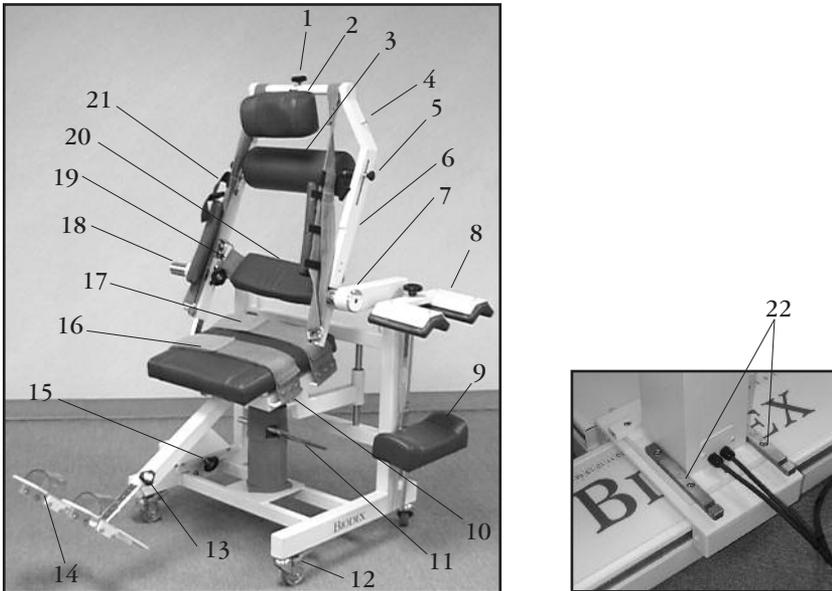


Figure 2: The Biodex Dual Position Back Ex/Flex Attachment major components and adjustment mechanisms.

1. Headrest Adjust Lock Knob
2. Cervical Headrest
3. Scapula Roll
4. Back Attachment Support Arm
5. Scapula Roll Adjustment Knob
6. Torso Straps with Clavicle Pads
7. Goniometer
8. Lower Extremity Compression Device
9. Sacral Pad
10. Seat Tilt Lever
11. Height Foot Pedal
12. Positive-Lock Casters (all four wheels)
13. Footrest Adjust Lock Knob
14. Footrest
15. Docking Clamp with Lock Knob
16. Femur Strap
17. Pelvic Strap
18. Connecting Hub
19. Connecting Hub Lock Knob
20. Lumbar Pad
21. Torso Strap Buckles
22. Ex/Flex Mounting Bars (inset)

SETUP AND INSTALLATION

Attaching the Ex/Flex Mounting Bars

(See Figure 3.)

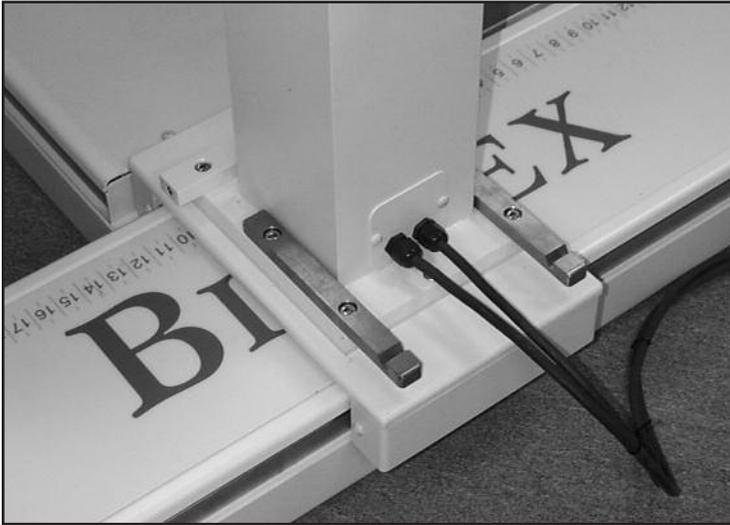


Figure 3. The Ex/Flex Mounting Bars installed on the dynamometer base.

1. Using a 5/16" Allen wrench, remove the three bolts each on the left and right side of the dynamometer pedestal base that secure the base to the dynamometer travel. Discard the bolts.
2. Position the ex/flex mounting bars over the dynamometer pedestal base and install with the two new bolts supplied.

Connecting the Back Attachment to the Biodex Multi-Joint System

(See Figures 4 - 8.)



Figure 4. The Biodex Dual Position Back Ex/Flex Attachment secured to the Biodex Multi-Joint System.

1. Position the dynamometer facing out from the chair at the center of the top of the T-base (0-degrees rotation).
2. Loosen the dynamometer height, tilt and rotation locking knobs.
3. Set the controller to Set-Up mode.
4. Rotate the dynamometer shaft so that the red dot is up.
5. Lift up on the back attachment support arm to align the red dot on the connecting hub with the red dot on the dynamometer shaft.
6. Push the back attachment connecting hub onto the dynamometer shaft until it is fully seated, adjust the dynamometer height, tilt and rotation as required for a proper fit.
7. Fully tighten the back attachment connecting hub lock knob.
8. Secure the docking clamp at the base of the back attachment to the ex/flex mounting bars at the base of the dynamometer. Push the bracket down as you tighten the knob. The lip of the bracket will be drawn into the grooves on the bars. Fully tighten the knob to draw the back attachment against the bars.

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9. Lock all four casters on the back attachment.
 10. Tighten the dynamometer height, tilt and rotation locking knobs.
The system is now ready for use.



Figure 5. Align the connecting hub red dot with the dynamometer shaft red dot.

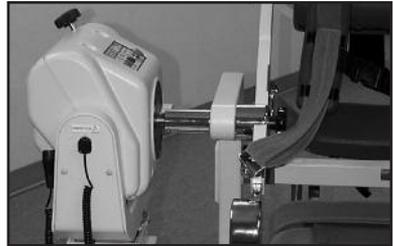


Figure 6. Tighten the connecting hub lock knob to draw the back attachment securely to the dynamometer.

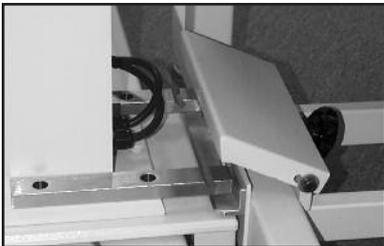


Figure 7. Secure the docking clamp at the base of the back attachment to the bars at the base of the dynamometer. Push the bracket down as you tighten the knob.

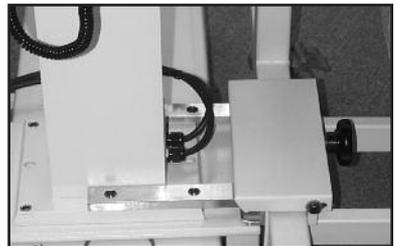


Figure 8. The docking clamp fully secured to the dynamometer base.

Releasing The Back Attachment From the Dynamometer

1. Loosen the back attachment docking clamp knob until the bracket pops out of the grooves in the dynamometer bars.
2. Unlock all four back attachment locking casters.
3. Loosen dynamometer height, tilt and rotation locking knobs.
4. Fully loosen the back attachment hub locking knob and pull the back attachment off the dynamometer.

PATIENT POSITIONING & STABILIZATION

Semi-Standing (Functional Position)

(See Figure 9.)



Figure 9. The Biodex Dual Position Back Ex/Flex Attachment and Biodex Multi-Joint System with a patient in the semi-standing (functional) position.

NOTE: It is recommended that patients remove their glasses during testing or exercise with this attachment.

1. Place controller in Setup mode and press Standby.
2. Holding back attachment support arm firmly with one hand, press ON, then Start to allow rotation of the dynamometer shaft. Use the dynamometer Balance Adjustment dial to balance the attachment in the vertical position. Move the support arm to 50 degrees on attachment goniometer. Press Stop on controller or dynamometer to lock the support arm in place.
3. Ensure seat is in down position (front of seat tilted down approximately 15°. If not, lift up on seat, flip up seat adjustment lever and lower seat appropriately.
4. Ensure that lumbar pad is installed and that both the sacral pad and lower extremity compression device are removed and stored in their respective holders.

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5. Seat patient. Move patient anteriorly or posteriorly to approximate longitudinal spinal axis with the fixed axis of the Back Ex/Flex Attachment.
 6. Position footrest so that femur is nearly parallel to seat. Knee angle will be approximately 15 degrees. Note the value indicated on the footrest position scale so that it may be entered under subject setting.
 7. Adjust patient axis height by pumping seat up or down using Seat Height Foot Pedal located at back of chair base. Align the fixed axis of the machine with the subject's anterior superior ileac spines (ASIS). Half-strokes move seat up. Full strokes held down lower seat.
 8. Stabilize lower extremity firmly with pelvic and femur straps. With the lower torso properly stabilized the patient assumes a posterior pelvic tilt with a slight degree of knee flexion. Maintenance of posterior pelvic tilt throughout the range of motion places the extensor muscles in an elongated position which, when moving into a flexion posture, allows exercise of a broader range of extensors.
 9. Adjust Lumbar Pad to provide desired firmness or maximum patient comfort. To do this, tighten or loosen the Lumbar Pad's Velcro® strap.
 10. Adjust Scapula Roll to rest between the level of the scapular spines and inferior angles. To do this, press in simultaneously on the Scapular Pad Adjustment Knobs and slide the pad up or down into any of the notches provided. Affirm that this is a comfortable position for the patient.
 11. If necessary, loosen the Headrest Adjusting Knobs and adjust Cervical Headrest to below the occipital protuberance, or to patient comfort.
 12. Apply torso straps firmly and adjust clavicle pads on straps for maximum patient restraint and comfort. Secure tethering strap across the patient's chest.

The torso straps can also be crisscrossed over the chest by sliding one strap through the slot of the cervical pad on the second strap. This is generally the most comfortable strap arrangement for most patients. The torso straps can also be used independently on each side. In either case, each strap is guided through the D-Ring on the appropriate side near the base of the back attachment frame and doubled back to be secured via the Velcro® patches. Slide the shoulder pads up or down the strap to position for patient comfort.

***NOTE:** Because different body types require different torso strap angles for maximal patient comfort, the straps may be positioned above or below the strap peg located where the straps are secured to the back attachment frame. It is also acceptable to wrap the strap around the frame itself in order to accommodate large body types.*

13. Provide speed to the dynamometer. Manually assist patient through range of motion while still in Setup mode to determine if axis of rotation is properly set.

***NOTE:** Instruct patient to maintain proper posture, or support patient manually, while in Setup mode or during mode changes. When changing modes, place patient in flexion with manual assist (if necessary) to reduce possibility of undesired movement into extension from gravitational effects. Always secure the support arm when turning mode switch on controller past Setup mode.*

14. Set ROM Limits 1 and 2 in Setup mode. Set Percent Range dials 1 and 2 if required by patient protocol.
15. Proceed to the desired test/exercise mode. Select "Lumbar" as the joint to be tested and "semi-standing" as the test pattern (refer to your Advantage Software Operations Manual.) The system is now ready for patient testing or exercise.

***NOTE:** Use the Back Ex/Flex goniometer to establish anatomical reference. Flexion is "towards," extension is "away." Begin the test/exercise with the patient in the flexed position. The initial movement is extension (away.)*

Seated-Compressed (Isolated Lumbar Position)

(See Figure 10.)



Figure 10. The Biomedex Dual Position Back Ex/Flex Attachment and Biomedex Multi-Joint System with the patient in the seated-compressed (isolated lumbar) position.

NOTE: It is recommended that patients remove their glasses during testing or exercise with this attachment.

1. Place controller in Setup mode and press Standby.
2. Holding back attachment support arm firmly with one hand, press ON, then Start to allow rotation of the dynamometer shaft. Use the dynamometer Balance Adjustment Dial to balance the attachment in the vertical position. Move the support arm to about 50 degrees on attachment goniometer. Press Stop on the controller or dynamometer to lock the support arm in place.
3. Remove Lumbar Pad and insert Sacral Pad, with scale facing up, into Sacral Pad Receiving Tube.
4. Ensure seat is in inclined position (front of seat tilted upward approximately 15°). If not, lift up on seat until it locks into the proper position.

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5. Seat patient. Move patient anteriorly or posteriorly to approximate longitudinal spinal axis with the fixed axis of the Back Ex/Flex Attachment.
 6. Position footrest so that it will not interfere with patient positioning.
 7. Adjust patient axis height by pumping seat up or down using Seat Height Foot Pedal. Align the fixed axis of the machine with the subject's anterior superior iliac spines (ASIS's). Half-strokes move seat up. Full strokes held down lower seat. Note the value indicated on the seat height scale so that it may be entered under subject settings.
 8. Adjust Sacral Pad to provide desired firmness or maximum patient comfort. To do this, loosen the Sacral Pad locking knob and slide the pad to that it is flush against the patient's sacrum.
 9. Insert the Lower Extremity Compression Device into the receiving tube directly beneath the center of the seat. The Compression Device Locking Knob should be on bottom with the pads pointing up. Place the patient's legs between the anterior and posterior pads and slide the device in toward the chair until there is firm contact with the femur and the lower leg is perpendicular to the supporting surface. Tighten the locking knob for the compression device. Secure pelvic and femur straps.
 10. Adjust Scapula Roll to rest between the level of the scapular spines and inferior angles. To do this, press in simultaneously on the scapular pad adjustment knobs and slide the pad up or down. Affirm that this is a comfortable position for the patient.

With the lower torso properly stabilized the patient assumes a posterior pelvic tilt with a slight degree of knee flexion. Maintenance of posterior pelvic tilt throughout the range of motion places the extensor muscles in an elongated position which, when moving into a flexion posture, allows exercise of a broader range of extensors.

11. If necessary, loosen the Headrest Adjustment Knobs and adjust Cervical Headrest to below the occipital protuberance, or to patient comfort.
12. Apply torso straps firmly and adjust clavicle pads on straps for maximum patient restraint and comfort. Secure tethering strap across the patient's chest.

The torso straps can also be crisscrossed over the chest by sliding one strap through the slot on the cervical pad of the second strap. This is generally the most comfortable strap arrangement for most patients. The torso straps can also be used independently on each side. In either case, each strap is guided through the D-Ring on the appropriate side near the base of the back attachment frame and doubled back to be secured via the Velcro® patches. Slide the shoulder pads up or down the strap to position for patient comfort.

***NOTE:** Because different body types require different torso strap angles for maximal patient comfort, the straps may be positioned above or below the strap peg located where the straps are secured to the back attachment frame. It is also acceptable to wrap the strap around the frame itself in order to accommodate large body types.*

13. Provide speed to the dynamometer and manually assist patient through range of motion while still in Setup mode to determine if axis of rotation is properly set.

***NOTE:** Instruct patient to maintain posture, or support patient manually, while in Setup mode or during mode changes. When changing modes, place patient in flexion with manual assist (if necessary) to reduce possibility of undesired movement into extension from gravitational effects. Always secure the support arm when turning mode switch on controller past Setup mode.*

14. Set ROM Limits 1 and 2 in Setup mode. Set Percent Range dials 1 and 2 if required by patient protocol.
15. Proceed to the desired test/exercise mode. Select "Back Velocity Spectrum" from the Advantage Software "Operations/Test" menu (refer to Advantage Software Operations Manual.) The system is now ready for patient testing or exercise.

***NOTE:** Use the Back Ex/Flex goniometer to establish anatomical reference. Flexion is "towards," extension is "away." Begin the test/exercise with the patient in the flexed position. The initial movement is extension (away.)*

CLINICAL APPLICATIONS

PASSIVE MODE

1. The passive mode may be used to assist patients through a range that they cannot actively move through, thereby helping to increase range of motion.
2. Non-reciprocal contraction types (Concentric/Eccentric, Eccentric/Concentric) or eccentric contractions types may be performed in a passive mode. Although research on eccentrics involving the back is scarce, the functional importance is well known. Submaximal eccentrics are commonly performed during activities of daily living.
3. Placing the patient in the Passive mode may help overcome the apprehension some patients experience when using isokinetic equipment. Patients may feel more comfortable knowing that they do not have to move the equipment, but that the equipment will assist them.
4. Using the Percent Range dials, a patient may be worked through a limited portion of the range of motion to limit apprehension or work in an area where a deficit has been detected.
5. In patients who are experiencing pain and/or weakness at specific positions, the passive motion can aid them through these points while they are able to relax the involved muscles.

ISOKINETIC MODE

1. Loading is concentric/concentric.
2. Recommended for:
 - Healthy athletes
 - End-stage rehabilitation
 - Pre-employment screening
 - High-speed testing
3. Not recommended for acute mechanical pain. Patients with acute inflammation may first be rehabilitated in the passive or isometric mode.

ECCENTRIC MODE

1. Eccentrics emphasize the elastic nature of muscle and therefore a patient can work eccentrically at a greater physiological efficiency. This translates to greater patient compliance in many cases since the exercises are subjectively not as hard to perform.
2. There is evidence that eccentric contractions can result in similar strength gains as concentric contractions. In early stages of rehab this may be attractive to the clinician and patient.
3. Mark Rowinski, PhD, PT, (Biodex Clinical Protocol Manual, 1988) states:

"The therapist must focus on the motor control mechanism, and since bending is assisted by gravity, the eccentric activity of the trunk extensors should be the prime focus early in the rehabilitation process. Therapy should progress slowly from eccentrics of the trunk extensors to concentrics of the flexors and, finally, to concentrics of the trunk extensors.

This progression makes sense in relation to the sensitivity of the structures involved and the capabilities of the muscles, since the extensors are about two to three times stronger than the trunk flexors."

ISOMETRIC MODE

1. Since no movement is involved, patients can safely exercise muscle flexors or extensors at specific angles while placing only minimal stress on the trunk and back.
2. In the acute stages of rehab, submaximal exercise can be utilized to maintain or increase strength at specific ranges in the ROM.

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