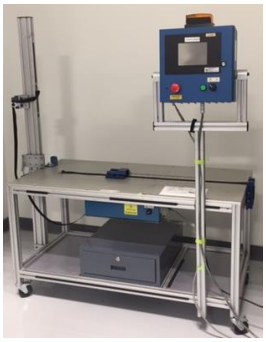
Operations Manual

Torso Flexion Test Stand

TMA-001



Torso Flexion Test Stand Operations Manual TMA-001-9900 [Rev. A]

HUMANETICS®
Innovative Solutions

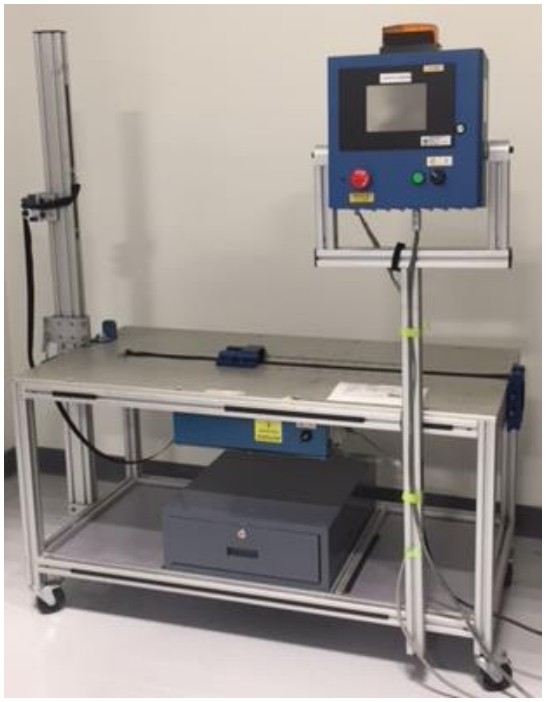


Table of Contents

List of Figures

List of Tables

Section 1. Introduction

1.1 General information

1.1.1 Regulatory Information

Electromagnetic Interference (EMI) is any signal or emission radiated in free space or conducted along power or signal leads, that endangers the functioning of a radio, navigation or other safety service or seriously degrades, obstructs, or repeatedly interrupts a licensed radio communications service. Radio communications services include but are not limited to AM/FM commercial broadcast, television, cellular services, radar, air-traffic control, pager, and Personal Communication Services (PCS). These licensed services, along with unintentional radiators such as digital devices, including the TMA-001 Torso Flexion Test Stand, contribute to the electromagnetic environment.

1.1.2 EMC Conformity

Electromagnetic Compatibility (EMC) is the ability of items of electronic equipment to function properly together in the electronic environment. The TMA-001 has been designed, tested, and is compliant to the EMC requirements of EN55022 for class B Information Technology Equipment, EN55011 for Industrial, Scientific, Medical Equipment, and the emission requirements of EN61326-1. Changes or modifications could impact compliance to these standards.

1.1.3 A Notice about Shielded Signal Cables

To reduce the possibility of interference, use only shielded cable. Using shielded cables ensures that you maintain the appropriate EMC classification for the intended environment.

1.1.4 Interference

While this test stand has been designed and determined to be compliant with regulatory agency limits for EMI/EMC, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference with other devices, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the device receiving interference.
- Relocate the test stand with respect to the device receiving interference.
- Move the test stand away from the device receiving interference.
- Plug the power cord into a different outlet so that the test stand and the device receiving interference are on different branch circuits.

1.2 Safety Instructions

Read and understand this manual before attempting to use the equipment. The operator is responsible for reading and following the procedures described in this document. The proper installation and use of the equipment is the responsibility of the operator. The equipment should be fully installed and inspected before performing tests.

The Safety Alert Symbol is used to indicate hazards and to inform the operator as to any and all safety related information that could or will, if not heeded, lead to death, injury or equipment damage. The Safety Alert Symbols in this manual are structured and defined as follows:

	DANGER Refers to an immediately dangerous situation, which may lead to death or serious injury if not prevented.
	WARNING Refers to a potentially hazardous situation, which may lead to death or serious injury if not prevented.
	CAUTION Refers to a potentially dangerous situation, which may lead to minor or moderate injuries or material damage if not prevented.
	NOTICE Indicates useful tips, recommendations and information for an improved or more efficient and trouble-free operation.

Section 2. Product Description

The Torso Flexion test is currently required for certification of the Hybrid III Three Year Old (HIII-3YO), Six Year Old (HIII-6yo) and Fifth percentile Female (HIII-5F) dummies. The Torso Flexion test is a static measurement of the upper torso assembly's flexibility. The test requires that the dummy's upper torso be flexed to a specified angle (45° ± 0.5°) and the resulting force be measured. Once the force is recorded, the dummy is released and the return angle of the upper torso is measured.

Development of the Torso Flexion test started in late 1997 out of concerns that the newer HIII style anthropomorphic test devices (ATD) (HIII-3YO, 6YO and 5F) lumbar spine stiffness was significantly different from the older style (VIP-3C, HII-6YO) ATDs used to establish the existing vehicle test regulations. Because of the variety of variables that influence the ATDs overall upper torso bending stiffness it was decided that the best method of testing this stiffness would be a "whole" dummy test.

After over two years of discussion and experimentation, the Torso Flexion test was incorporated into the HIII-6YO certification regulations and subsequently it was also incorporated into the HIII-3YO and HII-I5F ATD regulations as they became part of the testing requirements.

The Humanetics Torso Flexion test fixture is capable of performing the certification test on all the test dummies specified by the U.S., National Highway Safety Administration (NHTSA) and the tests designed by the Society of Automotive Engineers (SAE). While not yet regulated, the Humanetics flexion stand can also perform the flexion test for HIII-95M and by following the software setup descriptions in this manual the operator will be able to add any tests necessary in the future.

The Humanetics Torso Flexion test fixture is a fully automated stand. The test stand is integrated with a single-board computer that controls the drive motor and clutches and collects, analyzes and displays the transducer output data in standard engineering units for easy operation. The belt drive section, including a drive motor and two clutches, pulls a heavy duty belt to move the upper torso through the specified range of motion for complete control of the force applied to the torso.

All testing functions are performed through the integrated controller unit with a user-friendly key pad on the test fixture. The controller unit allows the operator to check transducer function with a real-time voltage display showing each device and gives the operator the added flexibility of performing tests in a manual mode, where the operator can move the upper torso through its range of motion and view transducer outputs through the entire range. An optional software package would permit the operator to store digital test data to and print results from a desktop computer.

2.1 Instrumentation

The Humantics Torso Flexion fixture uses: one (1) uniaxial load cell (Capacity: 890 N (200 lbf)) and one (1) angle sensor (Range: ± 70°), both are included with the fixture. It is recommended that the operator have these devices calibrated at least once each year or whenever the device's capacity, or range, is exceeded.

2.2 Necessary Tools

The tools necessary to perform the Torso Flexion are, with a few exceptions, standard certification laboratory equipment:

- Hex wrenches
    - Metric and English (T-handle, L.-key (Allen®)) Sizes: 1/16.-3/8. and 1.5 mm- 8 mm.
- Screwdriver, standard tip (3/8 width tip)
- Open-End wrench (3/4 and 1/2)
- Torque wrench, adjustable (from 0.23 Nm (2 in-lbf) to1.24 Nm (11 in-lbf))
- Used for initial fixture setup and verification:
    - Small level (Bullseye or tube type, no more than 2 in. (50 mm) long)
- Standard level (at least 24 in. (60 cm) long)
- Angle Indicator (Inclinometer)

	CAUTION To avoid injury and/or equipment damage the ac power to the stand must be properly wired to line and neutral and the ac power must have a good ground line so the stand is properly grounded.

Section 3. Torso Flexion Fixture

The Torso Flexion test is performed on the complete dummy assembly. The lower leg assemblies are optional for all dummy types but for the purpose of this manual we will assume that the full dummy assembly is used. Before placing the dummy on the test fixture it is important to ensure that the fixture is level and in a stable location. Also, the lumbar spine cable should be checked to ensure that it is properly tightened and the arm joints, shoulder and elbow, should be adjusted to meet the standard 1 'G' testing requirement. The 1 'G' setting or, one 'G' adjustment, is a setting used to control the movement of the limbs during testing. If you were to hold your arm straight out from your body so that it was parallel to the floor, the tension in your muscles necessary to keep your arm horizontal would be 1 'G' or, one times the effect of gravity. This is the adjustment desired when the dummy is setup for testing. If you hold the dummy's arm horizontal, it should stay in position without support. However, a light tap to the arm in a downward direction should cause it to move freely downward.

CAUTION

Both the controller and motor drive boxes MUST be grounded. Grounding lugs are provided on each box for this purpose. During installation the provided grounding strap must be fastened to the test fixture.

The figure below shows the components of the Torso Flexion Test Fixture.

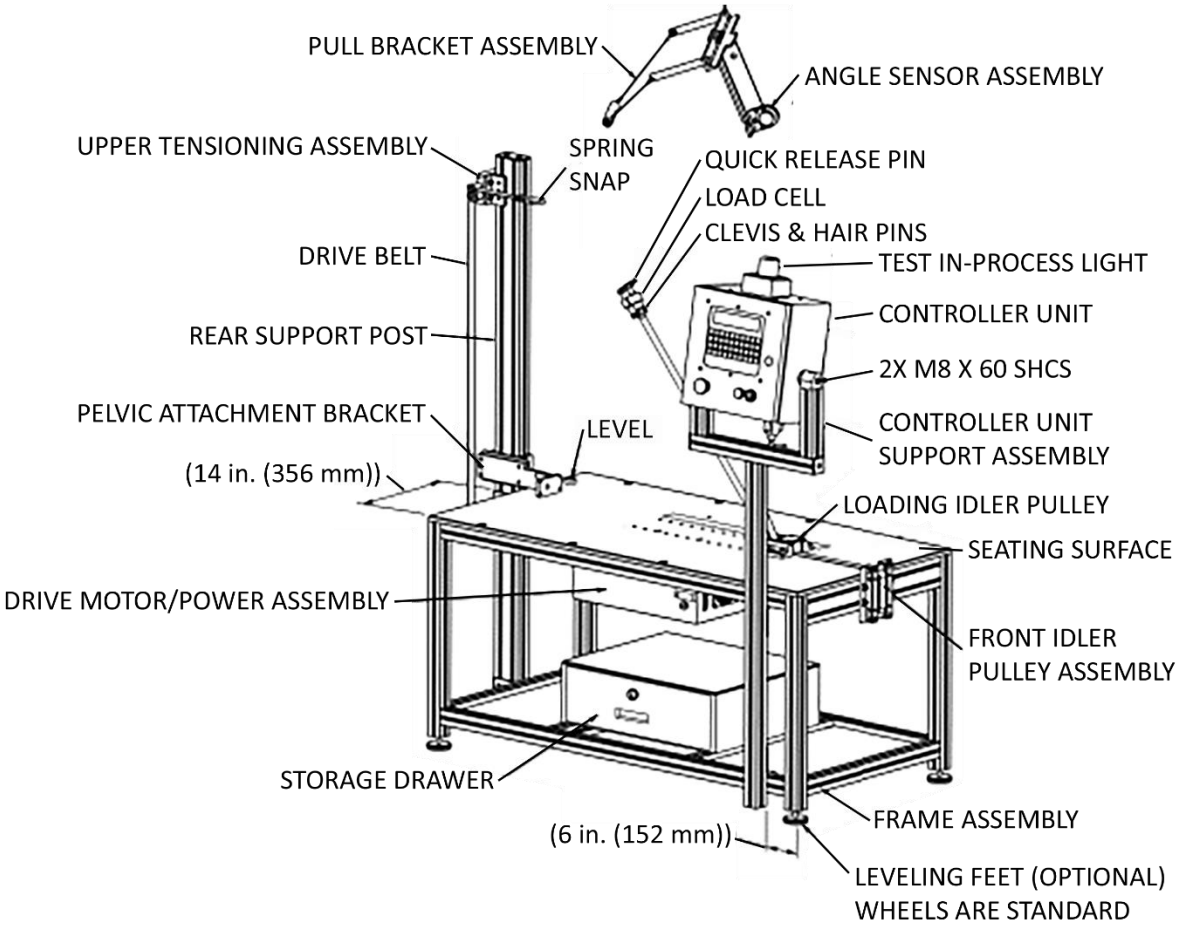


Figure 3.1 Torso Flexion Test Fixture Components

3.1 Attaching Hybrid III Style ATD's to Fixture

To attach the dummy to the fixture, first attach the pelvic attachment bracket to the dummy's pelvis bone. With the exception of the HIII-3YO, this is done by installing the attachment into the pelvic instrumentation cavity at the rear of the pelvis. The HIII-3YO attachment bracket is fastened to the top of the flange of the lumbar load cell, located at the top of the pelvic bone.

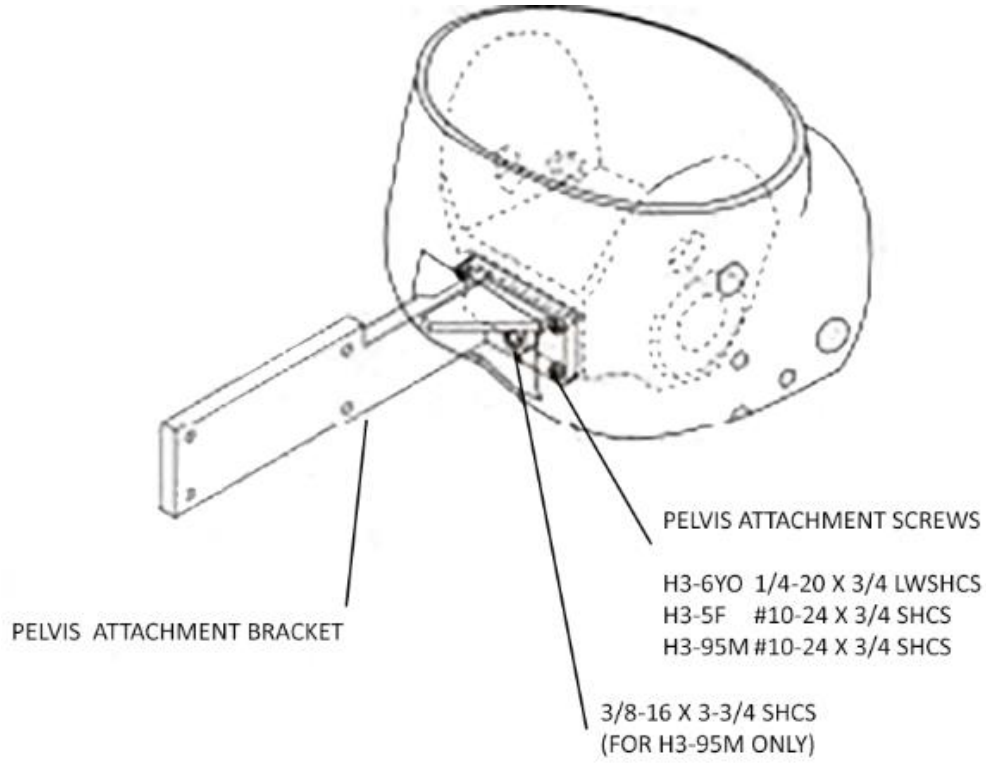
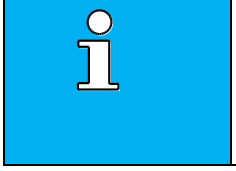


Figure 3.2 Pelvis Attachment Bracket

	NOTICE It is recommended that a 3/8-16 x 3-1/4 Socket Head Cap Screw (SHCS) be used for the HIII-95M pelvic attachment bracket along with the four (4) #10-24 x 3/4. SHCS.

NOTICE

The HIII-6YO has two (2) 1/4-20 x 7/8 SHCS holding the lumbar adapter to the pelvis that must be removed to install the pelvis attachment bracket. Be sure to re-install the screws before testing.

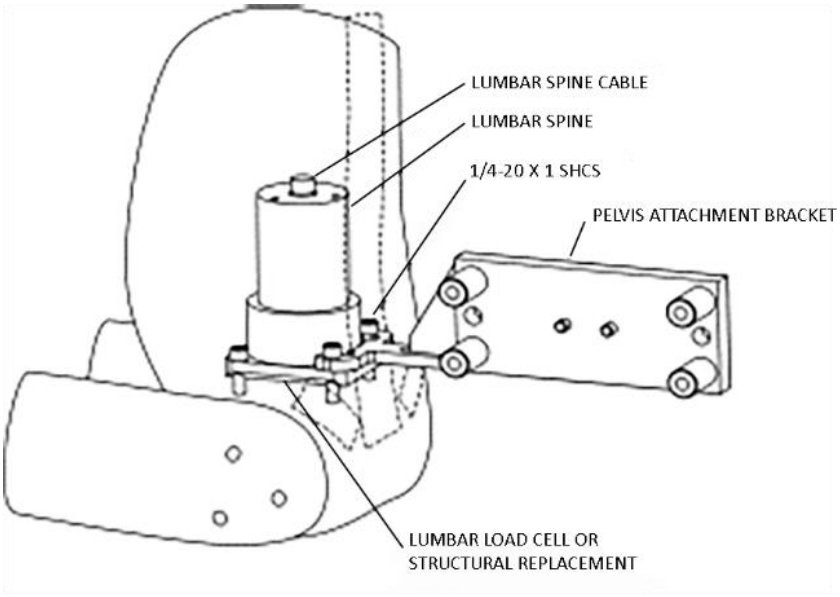


Figure 3.3 Remove Lumbar Adapter

Pelvis Attachment Screws

- HIII-3YO
  - 2X 1/4-20 X 1 LG. SHCS
- HIII-6YO
  - 4X 1/4-20 X 3/4 LG. LWSHCS
- HIII-10YO
  - 2X upper 1/4-20 X 1/2 LG. SHCS
  - 2X lower 1/4-20 X 3/4 LG. SHCS
- HIII-5F
  - 4X #10-24 X 3/4 LG. SHCS
- HIII-50M*
  - 4X #10-24 X 3/4 LG. SHCS
- HIII-95M
  - 4X #10-24 X 3/4 LG. SHCS

*HIII-50M uses the HIII-95M pelvis bracket.

The HIII-3YO pelvis attachment bracket is installed on the top surface of the lumbar load cell flange. The rear two (2) load cell attachment screws (1/4-20 x 3/4. SHCS) are replaced with two (2) 1/4-20 X 1 LG. SHCS to secure the bracket to the top of the load cell flange. After the pelvis attachment bracket is installed, the pull bracket is fastened to the rear of the spine box at the back plate with the pull cable assembly in front of the neck. Attach the bracket to the spine box using the following screws for each type of dummy:

Pull Bracket Attachment Screws

- HIII-3YO
  - 4X #8-32 x 1/2. SHCS*
- HIII-6YO
  - 4X #6-32 x 1. SHCS*
- HIII-10YO
  - 4X #10-32 x 1/2. SHCS
- HIII-5F
  - 4X #10-32 x 3/8. SHCS
- HIII-50M
  - 4X #10-32 x 1/2. SHCS
- HIII-95M
  - 4X #10-32 x 1/2. SHCS

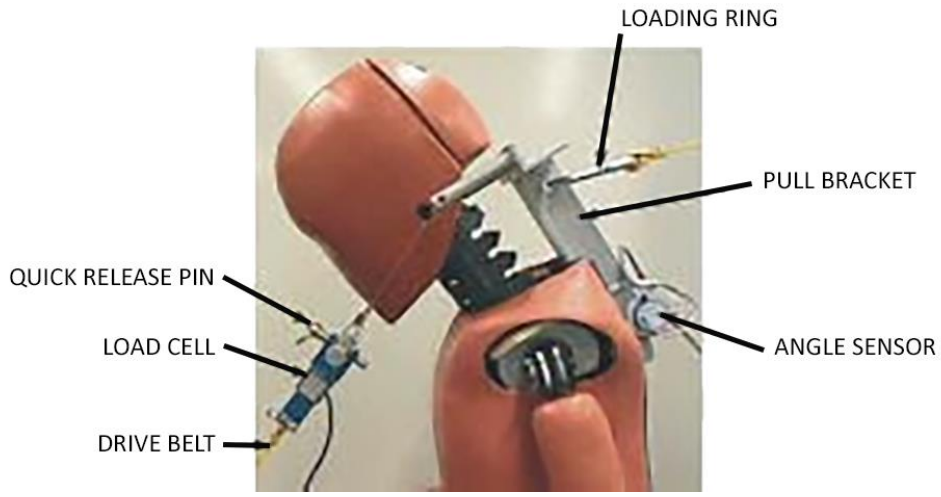


Figure 3.4 Pull Bracket Fastened to Rear

After the pull bracket is securely fastened to the dummy's spine box, zip up the torso flesh as far as possible without over stretching the flesh. Next, seat the dummy on the test fixture and secure the pelvis attachment bracket to the rear support post using four (4) M8 X 25 mm SHCS (except for the HIII-10C: (4) M8 X 40 mm SHCS). Loosen the bracket slider release handle at rear of the fixture to adjust the position of the attachment bracket. The pelvis attachment bracket is positioned so that the pelvis D plane, pelvis to lumbar joining surface, is horizontal (0°) to the test table surface. Position both leg assemblies parallel to the midsagittal plane, an imaginary line through the center of the dummy's body from front to rear that divides it into left and right halves. With the dummy in its relaxed position, place the upper arm parallel to the midsagittal plane and the lower arm assembly to be parallel to the table surface. In doing this, the forearms will appear to be raised when the dummy is pulled back and being held in its vertical position. At no point should the hands of the dummy engage the tabletop.

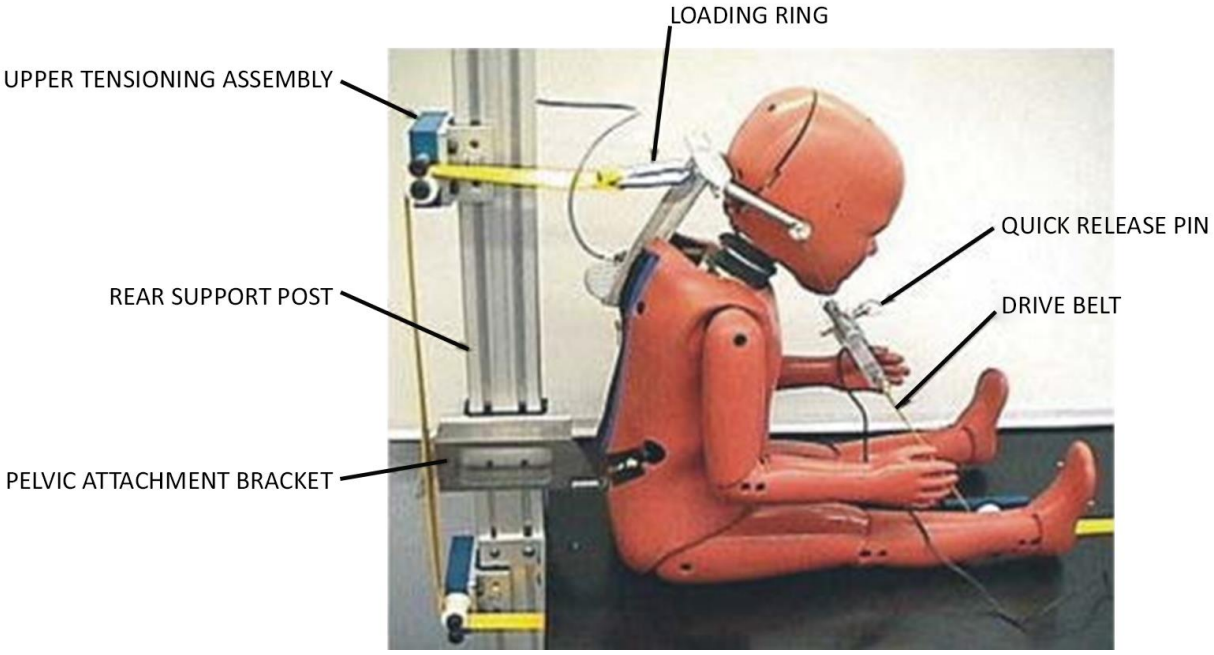


Figure 3.5 Dummy Positioned on Tabletop

Next, install the angle sensor on the pull bracket at the dowel pins just above the bottom of the bracket. Secure the sensor using a #10-24 X 3/8 LG. SHCS. The sensor is attached to the left side of the bracket (dummy's left). Attach the loading ring to the pull bracket through the hole at the top of the bracket. Position the upper tensioning assembly so that the drive belt is approximately parallel to the table surface when attached to the pull bracket at the test start position, the dummy's upright seated position. Next, attach the drive belt to the load cell using the lower load cell bracket and the belt release pin. Attach the pull bracket to the upper load cell bracket using the quick release pin. Position the front edge of the loading idler pulley at the center of the arrow of the marking appropriate for the dummy being tested. The arrow label on the loading idler pulley bracket shows the mounting direction. The arrow points away from the dummy, in the pulling direction.

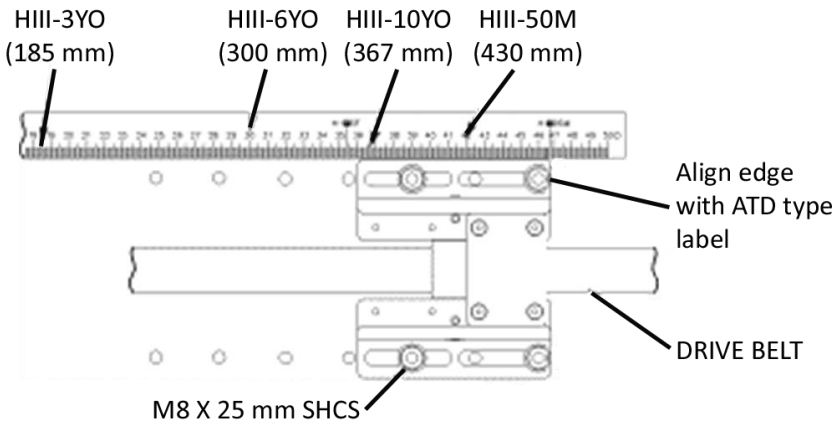


Figure 3.6 Idler Pulley Positioning

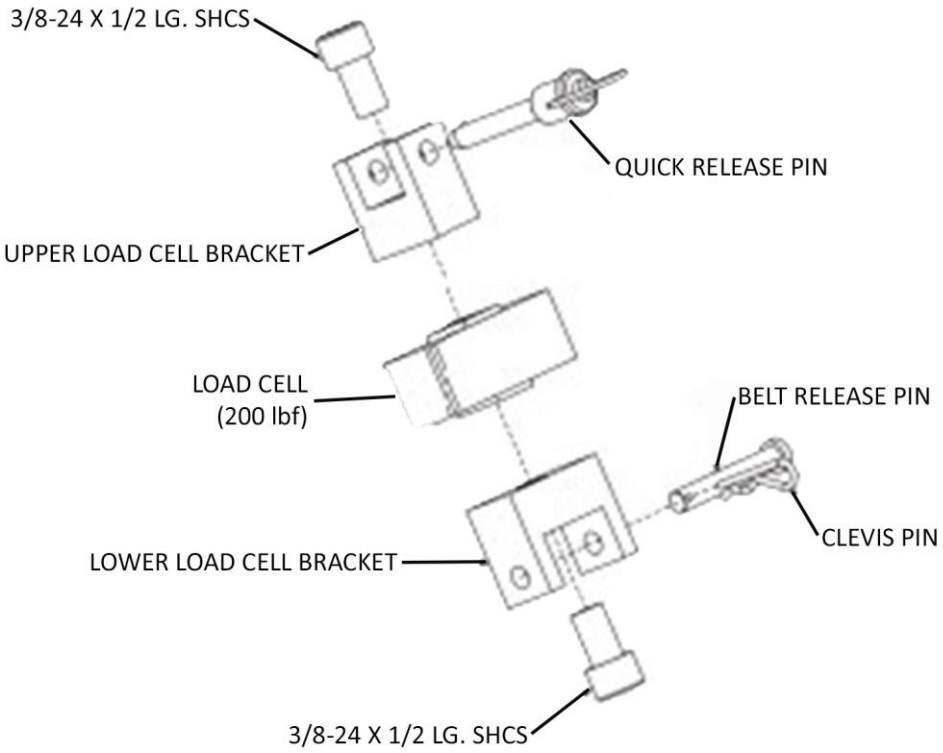


Figure 3.7 Load Cell Assembly

3.2 Attaching Hybrid II Style ATD.s to Fixture

Attaching the Hybrid II style ATD's to the test stand is very similar to the Hybrid III ATD's just discussed. There are however a few differences that need to be discussed. First, the head and neck assemblies for both the HII-3C (also known as VIP or SA 103C 001), and the HII-6C must be removed from the dummy. The head and neck assemblies are replaced with a neck adapter assembly. The neck adapter is a 2.0 inch diameter aluminum cylinder with attachments for a drive belt and angle sensor. The neck adapter for the HII-3YO is 2.8 inches in height and the HII-6C adapter is 2.6 inches in height.

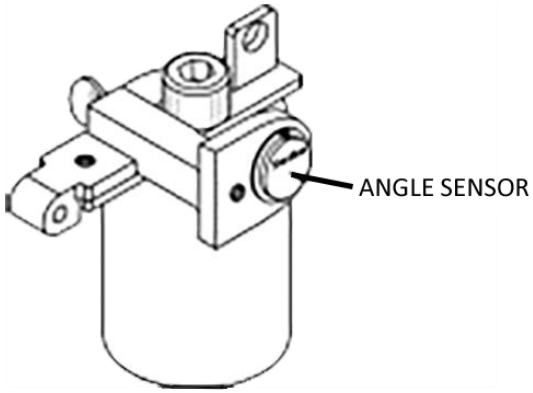


Figure 3.8 Neck Adapter Assembly

The lower leg assemblies and the lumbar attachment bolt are also removed. The lumbar attachment bolt, accessed through the bottom of the pelvis, is replaced with the modified bolt supplied with the H-II child torso flexion adapters is used to attach the dummy to the table top. Be sure to tighten the modified bolt so that the lumbar spine is secure held to the pelvic assembly. Before attaching the dummy to the torso flexion table, torque the hip joint screws to 50 in-lbf. On the HII-6YO the hip friction adjustment is in front of the pelvis at the leg-pelvis junction.

The knee hold-down brackets are attached to the tabletop with one M8 X 25 SHCS for each bracket. A special bolt is inserted into the top plate for bracket alignment.

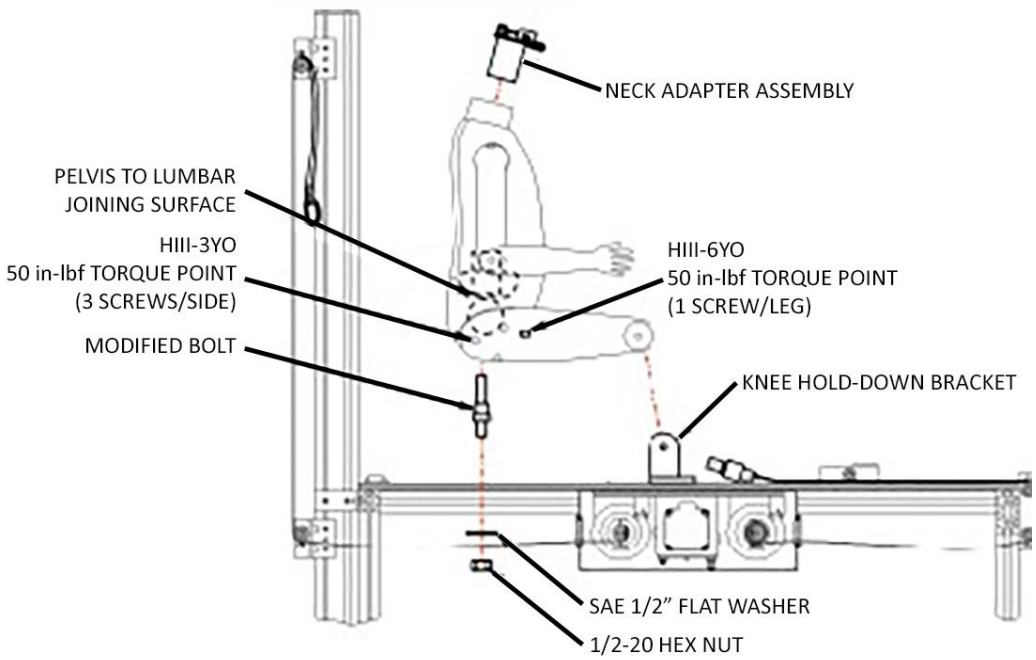


Figure 3.9 HII-3YO Setup

Insert bolts into the first set of tapped holes for the HII-3YO and the second set for HII-6YO. Do not tighten the hold down screws until alignment with the dummy knees is checked. To attach the dummy to the test surface, position the pelvis so that the exposed end of the modified bolt is through the attachment hole in the tabletop plate. Make sure the pelvis-to-lumbar attachment surface ('D' plane) is horizontal. Place an SAE ½" flat washer on the modified bolt at the underside of the table top and secure the dummy pelvis to the test table with a 1/2-20 Hex Nut. With the through holes aligned, push the release pins into each side of the knee hold-down bracket. Once the knees and brackets are positioned, tighten the bracket screws.

3.3 Torso Flexion Test

Once the dummy is properly attached to the fixture, the test can be started. There are five phases involved in the NHTSA Torso Flexion test. The following describes a typical test sequence, however, test parameters are editable as described in the software controller operations section.

The first phase is the lumbar "exercise" phase. During this phase the upper torso is flexed, chest toward the knees, three times to an angle of 30° ±2° from the vertical. There is no speed specified for this phase, it is assumed that the "exercise" will occur in a relatively quick manner. After each exercise, or pre-flex, the abdomen must be reseated so that it is in the original position in the pelvis assembly.

After exercising the lumbar spine the upper torso is supported so that the upper torso is in a "vertical orientation" for thirty (30) minutes, this is the second phase.

In the third phase, the upper torso support is removed and after two (2) minutes the upper torso angle is measured (see Test Specification Table for required values), this is the Initial Angle.

In the fourth phase, a pulling force is applied to the upper torso at a 0.5° to 1.5° per second rate. The upper torso is pulled toward the dummy's knees to an angle of 45° ±0.5° relative to the vertical. The force is held for ten (10) seconds and peak force during the ten (10) second period is recorded (see the Test Specification Table). During this phase, the dummies arms are not to engage the tabletop. Setting the forearms parallel to table while the dummy is in it relaxed position should eliminate this from happening. In doing so, the forearms will appear to be raised when the dummy is pulled back and being held in its vertical position.

In phase five, the pulling force is released as quickly as possible and the upper torso allowed to freely move to its initial position. After three (3) minutes, the final return angle is measured (see the Test Specification Table).

The Humanetics Torso Flexion fixture performs each of the five phases almost entirely without any operator interaction. The test fixture exercises the upper torso, holds the torso for thirty minutes after exercise pulls the torso over at the specified rate and displays the peak force during the ten second measurement period and then it releases the torso so that it can return to its initial position and displays the return angle after three minutes.

3.4 Test Specifications

These test specifications are taken from the “Code of Federal Regulations,” (CFR) number 49, part 572, subparts N, O and P. Revised as of October 1, 2000.

3.4.1 Hybrid III Test Specification

The table below shows the Hybrid III Test Specifications.

Table 3.1 Hybrid III Test Specifications

ATD TYPE	INTIAL ANGLE (RELATIVE TO VERTICAL)	MAX. PULL FORCE	RETURN ANGLE (RELATIVE TO START ANGLE)
HIII3YO	less than 15°	130 N – 180 N	less than 10°
HIII-6YO	less than 22°	147 N – 200 N	less than 8°
HIII-10C	less than 20°	180 N – 240 N	less than 8°
HIII-5F	less than 20°	320 N – 390 N	less than 8°
*HIII-50M	less than 15°	205 N – 258 N	less than 12°
*HIII-95M	less than 27°	450 N – 550 N	less than 8°

NOTES:
1. CFR 49 requirement is to record the “highest applied force during the 10 second period” at 45°.
2. SAE requirement is “record the highest force required to flex the dummy” to the prescribed angle.
3. *Flexion test for this ATD not regulated under U.S. regulations at this time.
4. HIII-10YO is pulled to 35° from the vertical.

3.4.2 Hybrid II Test Specification

The table below shows the Hybrid II Test Specification.

Table 3.2 Hybrid II Test Specifications

ATD TYPE	INTIAL ANGLE (RELATIVE TO VERTICAL)	FORCE @40° (RELATIVE TO START ANGLE)	RETURN ANGLE
HII-3YO	0°	(151.2 – 209.1 N)	±5°
HII-6YO	0°	(204.6 – 231.3 N)	±5°

3.5 TorsoFlex II Controller Software Operations

The Humanetics Torso Flexion stand is driven by a user-friendly controller that allows the operator to run the standard NHTSA or SAE tests without changing any test setup parameters. The flexible programmability that the controller offers allows the operator to use the “standard” setups and/or system parameters but also provides the means for customizing test setups, corridors and system parameters. The following sections will describe the four main controller functions. The four main controller functions are listed below.

- Setup
- Start Test
- Test Data
- Diagnostics

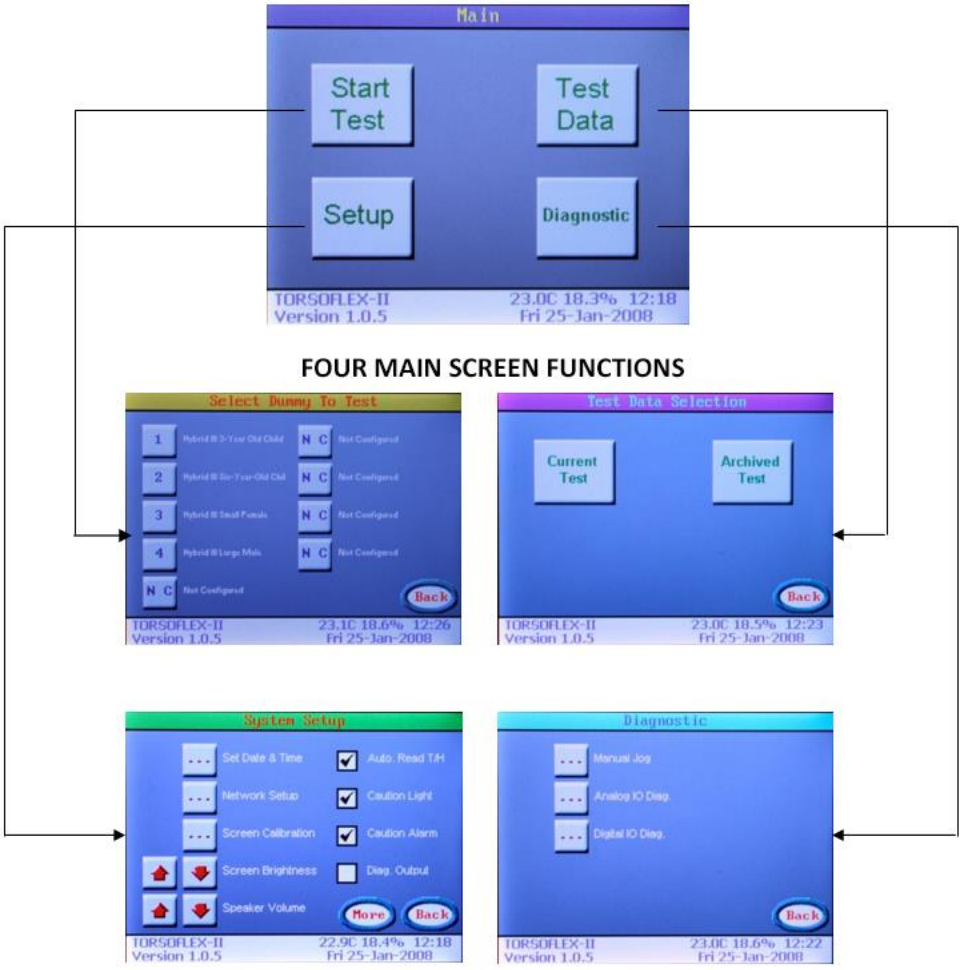


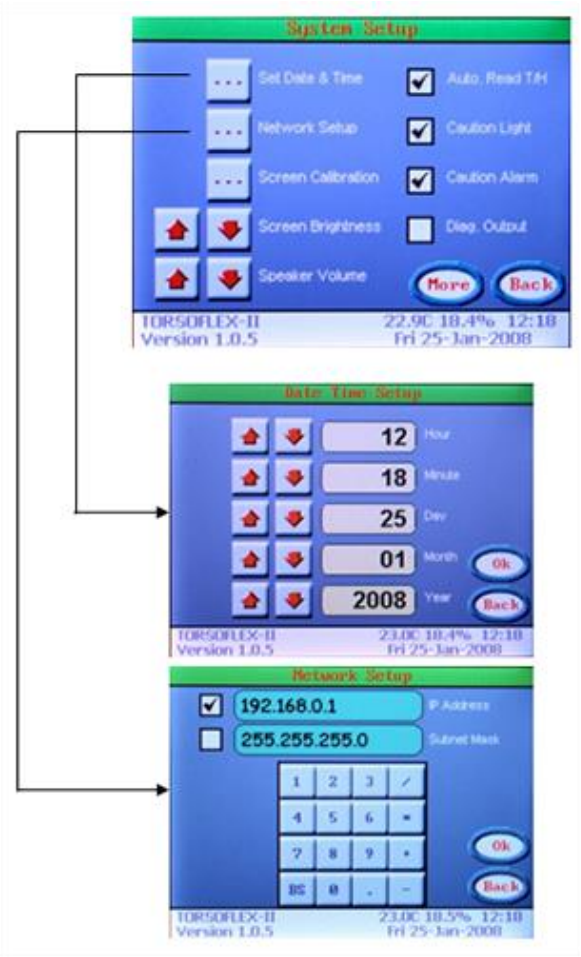
Figure 3.10 Four Main Screen Functions

3.5.1 Setup

System setup is password protected. Enter password to access setup functions.

Figure 3.11 System Setup Password

3.5.1.1 Setup Screen #1



Check Auto Read T/H if using Temp/Humid probe, else manually enter T/H at test time. Note: this item must be checked when performing the A to D (ADC) calibration. Enable/disable caution light and/or alarm.

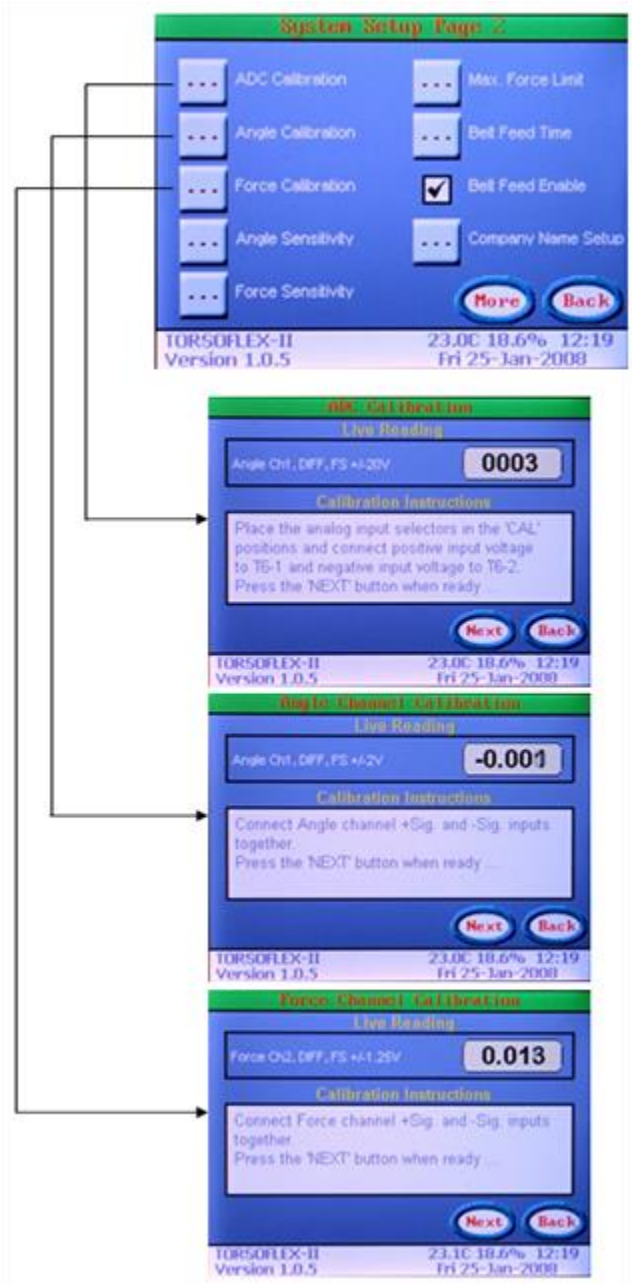
Note: Diag. Output should remain unchecked unless otherwise instructed.

Set system time and date.

Set system IP address.

Figure 3.12 Setup Screen #1

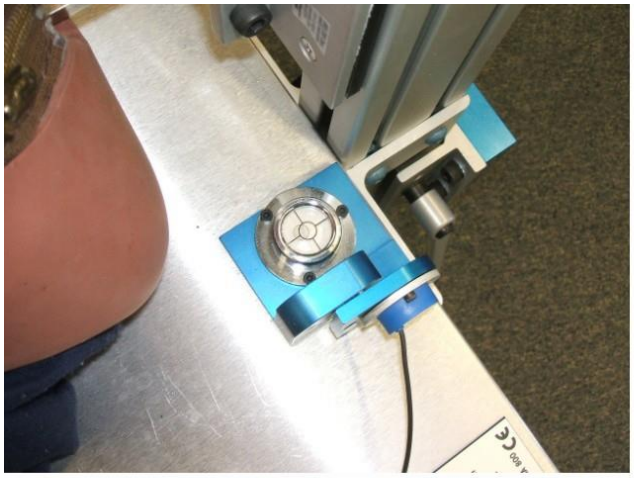
3.5.1.2 Setup Screen #2



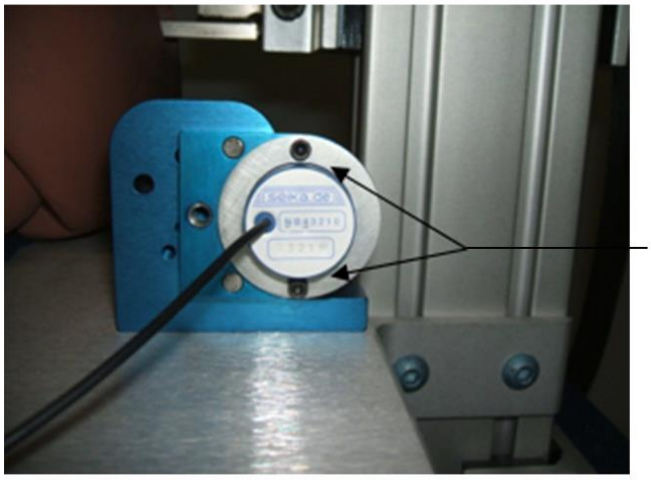
The controller ships from the factory completely calibrated, but periodically should be re-calibrated.

Using a precision 4 ½ digit DVM, voltage source and supplied calibration cables, follow on screen prompts for performing A to D, Angle and Force channel calibrations.

Figure 3.13 Setup Screen #2, Calibration

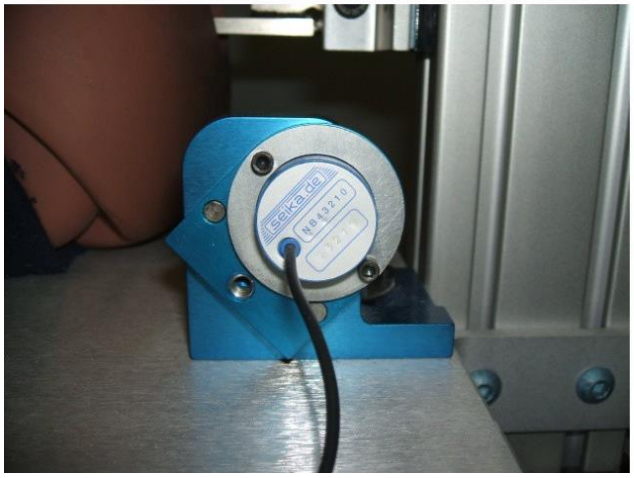


As part of the calibration procedure or as required, the angle position sensor (inclinometer) should be zeroed. To begin the procedure, make sure that the stand is level using the bubble level attached to the angle sensor bracket.



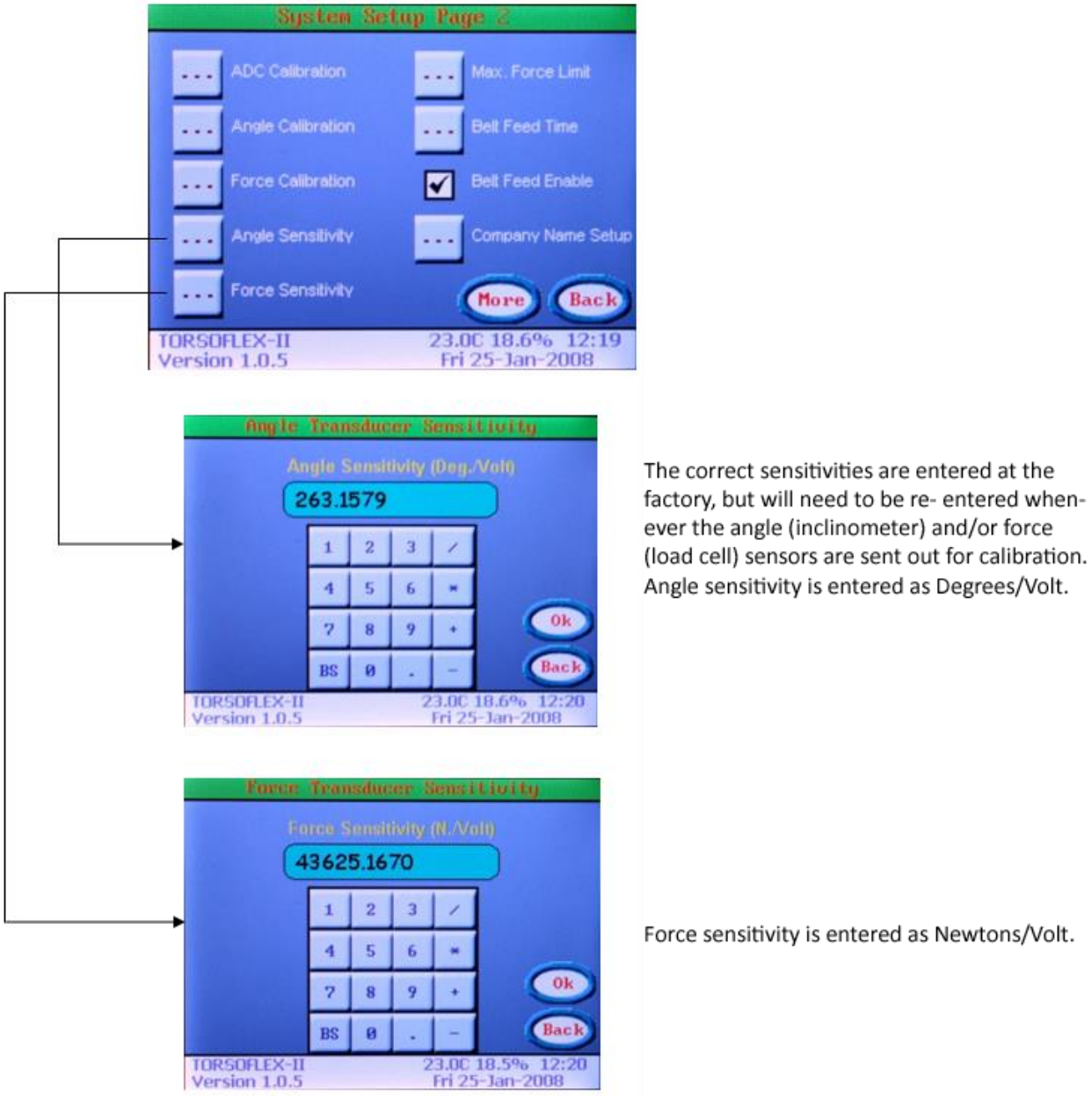
Attach the angle sensor to the sensor bracket as shown with the manufacturer's name horizontal.

Loosen the screws on the angle sensor and rotate the body until zero degrees is indicated on the live angle readout of the diagnostic Manual Mode Job screen (see Diagnostic section).



Tighten the screw and then move the sensor to the 45 degree position of the sensor bracket. The displayed angle should read 45 degrees +/- 0.5 degrees which would indicate proper A to D and channel gain calculations.

Figure 3.14 Angle Sensor Position



The correct sensitivities are entered at the factory, but will need to be re- entered whenever the angle (inclinometer) and/or force (load cell) sensors are sent out for calibration. Angle sensitivity is entered as Degrees/Volt.

Force sensitivity is entered as Newtons/Volt.

Figure 3.15 Setup Screen #2, Sensitivity

Enter the maximum force limit in Newtons. This is a system safety limit. If exceeded in manual operation or during a test, the operation will be aborted.

Adjust for the amount of time the belts will feed out (slack) after the dummy is pulled to a position and then released.

Enter your company name in order to identify your test data.

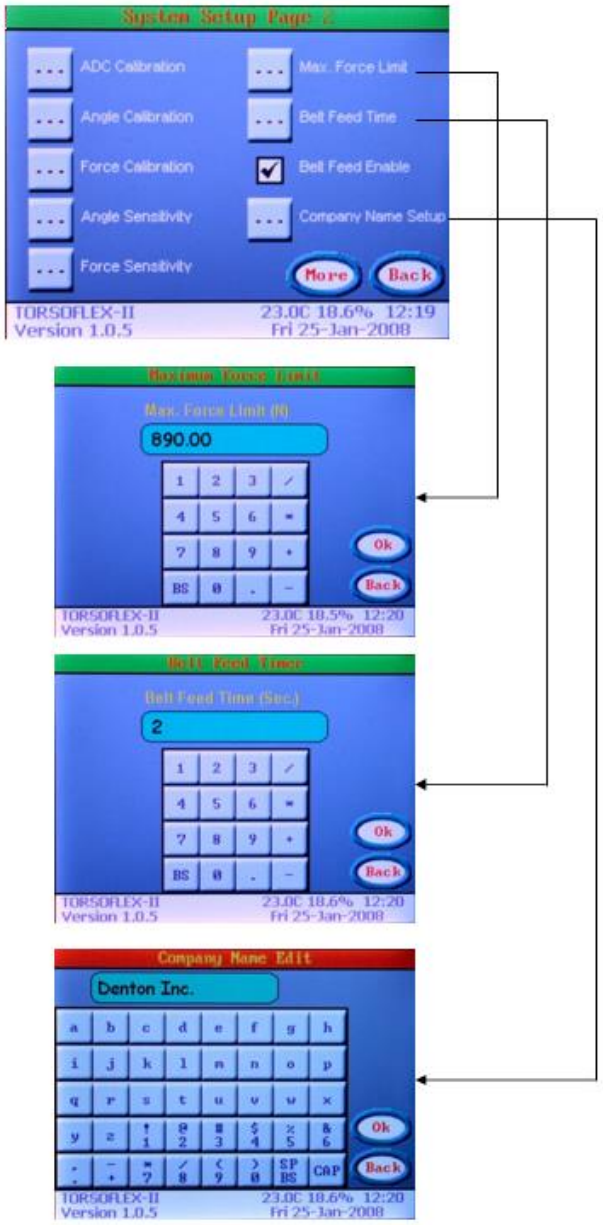
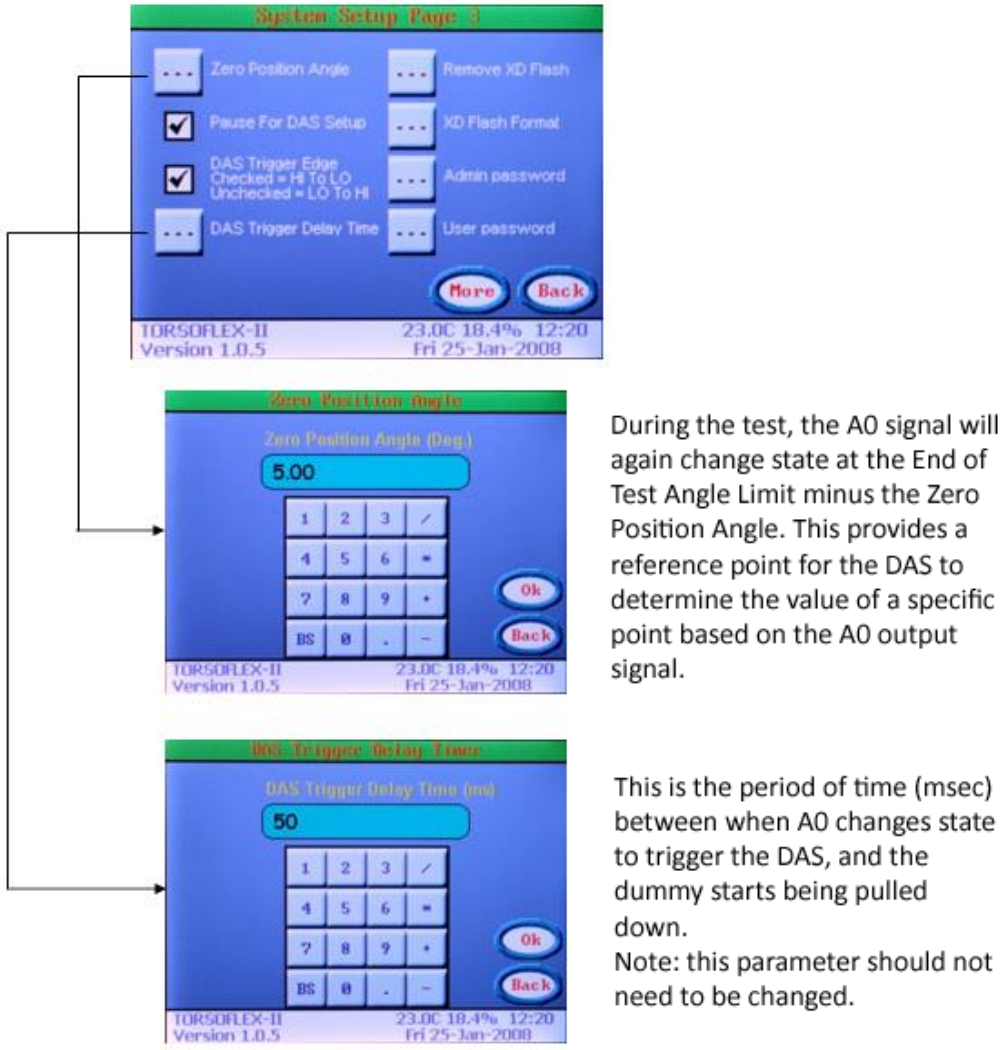


Figure 3.16 Setup Screen #2, Max Force and Belt Feed Timer

3.5.1.3 Setup Screen #3



During the test, the A0 signal will again change state at the End of Test Angle Limit minus the Zero Position Angle. This provides a reference point for the DAS to determine the value of a specific point based on the A0 output signal.

This is the period of time (msec) between when A0 changes state to trigger the DAS, and the dummy starts being pulled down.
Note: this parameter should not need to be changed.

Figure 3.17 Setup Screen #3, Zero Position and DAS Trigger Delay Timer

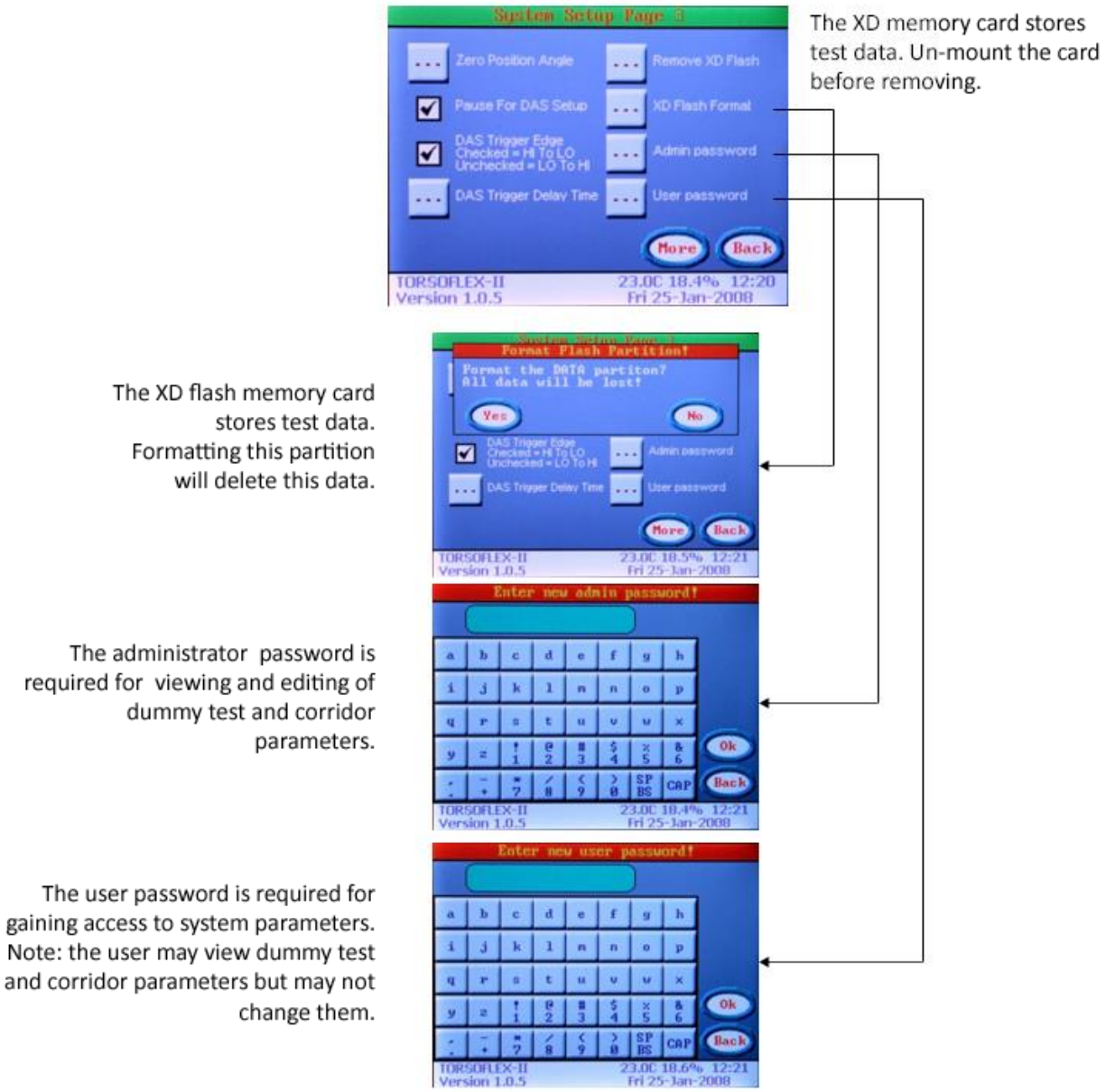


Figure 3.18 Setup Screen #3, XD Memory

3.5.1.4 Setup Screen #4

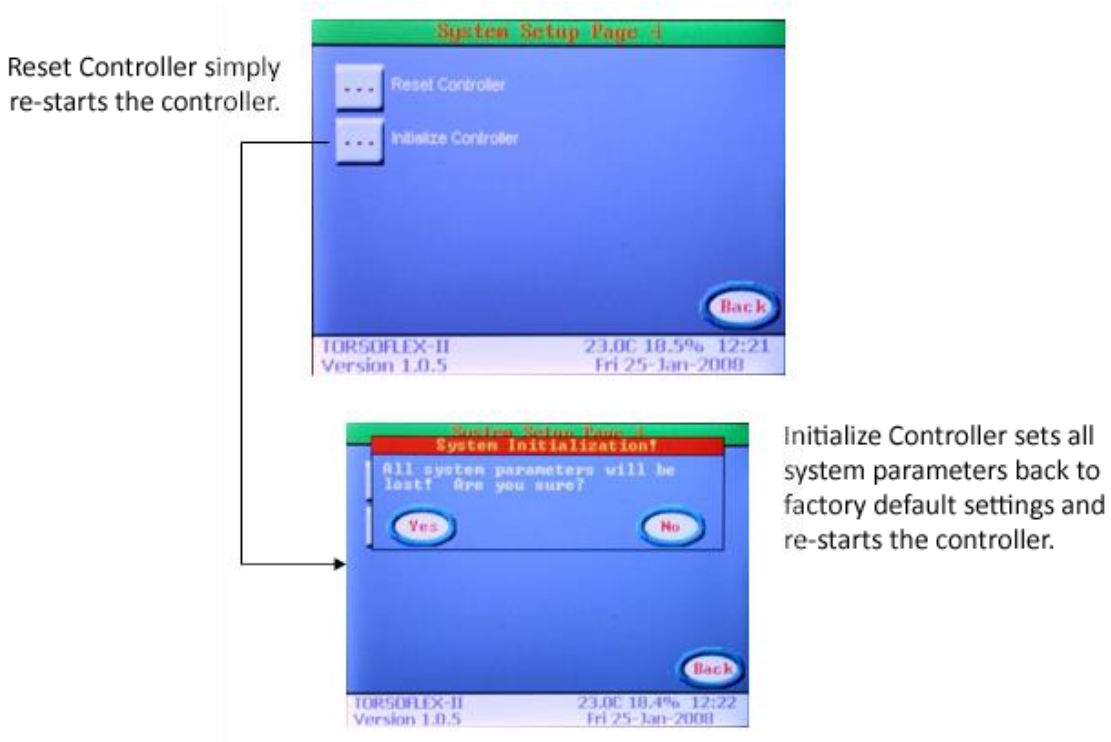
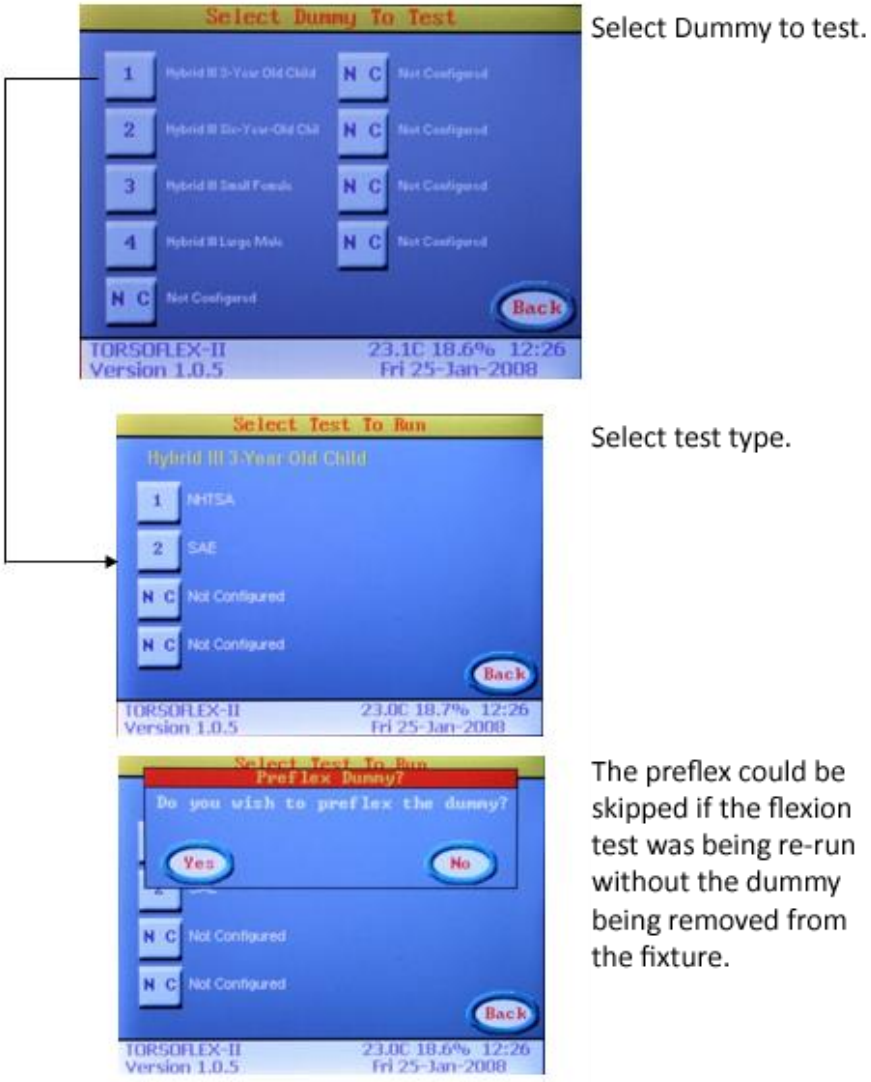


Figure 3.19 Setup Screen #4, Initialize Controller

3.5.2 Start Test



Select Dummy to test.

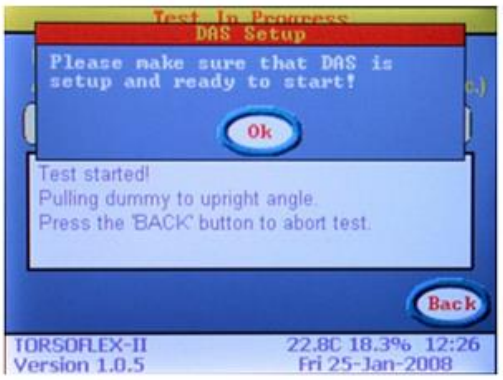
Select test type.

The preflex could be skipped if the flexion test was being re-run without the dummy being removed from the fixture.

Figure 3.20 Start Test, Select Dummy and Test

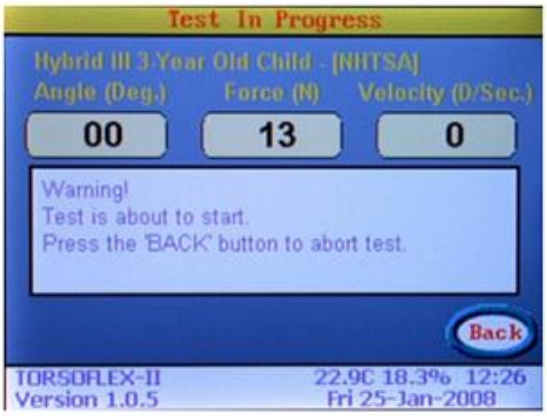
Make sure dummy is positioned properly.

Shortly after the test strobe light begins, about three (3) seconds, the motor starts to pull the upper torso to the starting position, 5° forward of the vertical or as set. The preflex begins after the torso reaches the starting position. The preflex will run through the required range of motion the number of times as set and then return the torso to the upright position and then run the final segment of the test.



If the controller is connected to a DAS, make sure that the DAS is armed and ready to collect data before proceeding.

Figure 3.21 Start Test, Align Dummy Properly



The motor and clutches will be released allowing the torso to spring forward to the initial position.

The initial angle of the torso is measured after 10 sec or the amount of time as set.

In the final segment of the test, the fixture will pull the torso down to 45°, or as set, and hold that angle for 10 sec, or the amount of time as set. During the 10 second holding time, the controller is reading the force measured by the load cell. At the end of the holding time the motor and clutches will be released allowing the torso to spring back to the return angle position. The final angle of the torso is measured after 3 minutes, or the amount of time as set depending on the dummy type. The final angle is the difference between the starting and return angles.

Figure 3.22 Start Test, Initial Angle and Final Segment

Should it be necessary to stop the test for any reason press the large red button on the controller unit, the motors and clutches will be instantly locked. To unlock the fixture twist the red button in the direction of the arrows (clockwise) and the button will release along with the clutches (make sure that the area behind the dummy is clear). The software will display a message notifying the user to touch the screen to restart.
NOTE: the preferred method of stopping a test while in progress is by pressing the BACK button.

Figure 3.23 Stopping a Test

	CAUTION Be aware that aborting the test by using the BACK button will immediately release the clutches allowing the dummy to snap back to the rest position.

	CAUTION In order to prevent injury and/or entanglement from possible unexpected release of the ATD, keep all personnel, tools and material away from the test surface and test specimen.

3.5.3 Test Data

Following a test, the operator can view the test results (see **Test Data** section) after which the operator will be prompted to allow or disallow storage of test data. If saved, the archived test data may be viewed at a later time and/or downloaded to a network connected PC.

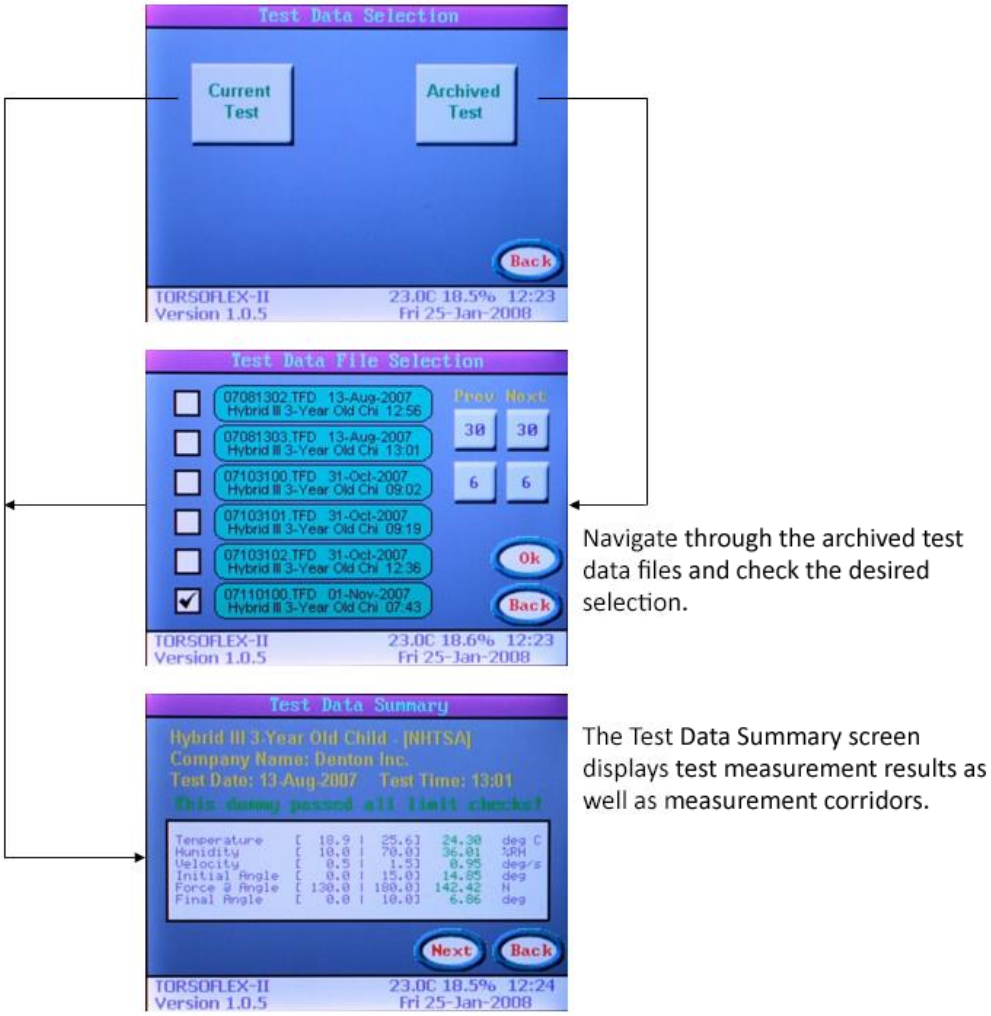
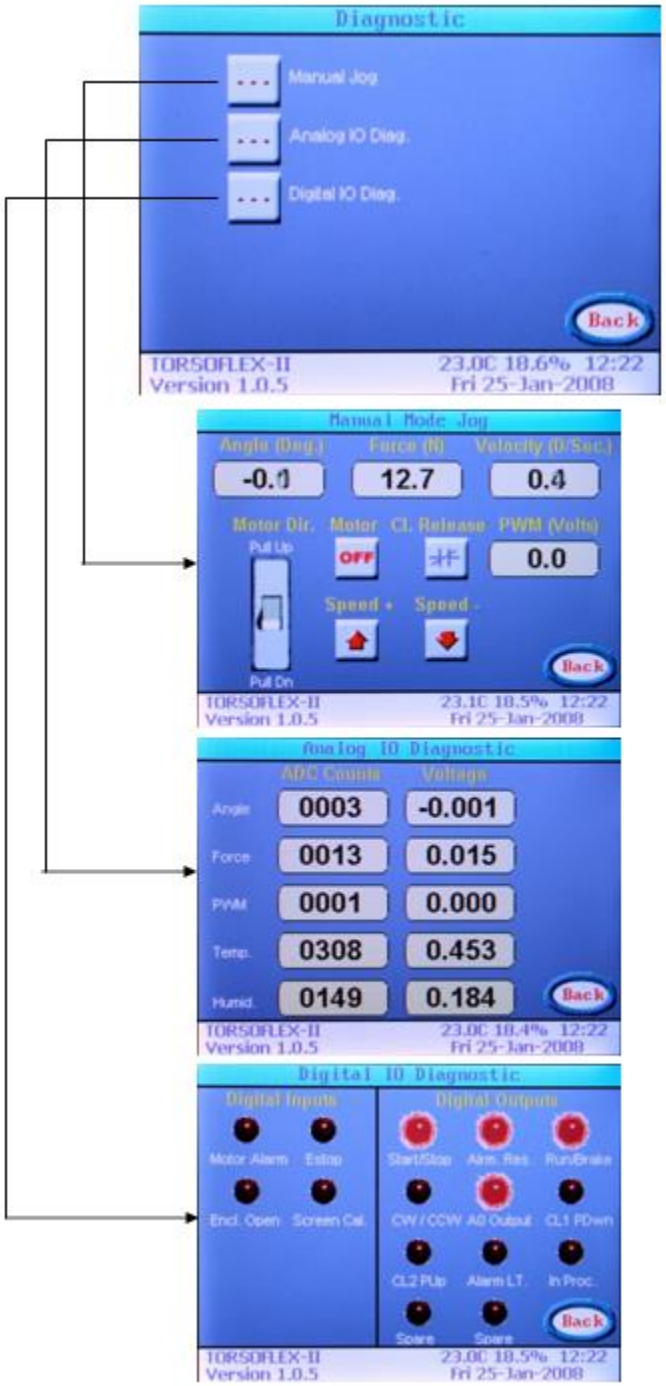


Figure 3.24 Test Data Selection

Press Next to generate and view Force and Angle plots.

Figure 3.25 Test Data, Force Plot and Angle Plot

3.5.4 Diagnostic



Use this screen to manually enable/disable the motor and engage/release the clutch in order to advance/retract the belts. The PWM (pulse width modulation) voltage controls the motor speed. This screen may also be used to check operation of the transducers.

Use this screen to monitor the transducer and PWM live channel outputs voltages.

This screen may be used to monitor the status of the system inputs and manually enable/disable system outputs.

Figure 3.26 Diagnostic

Section 4. Maintenance

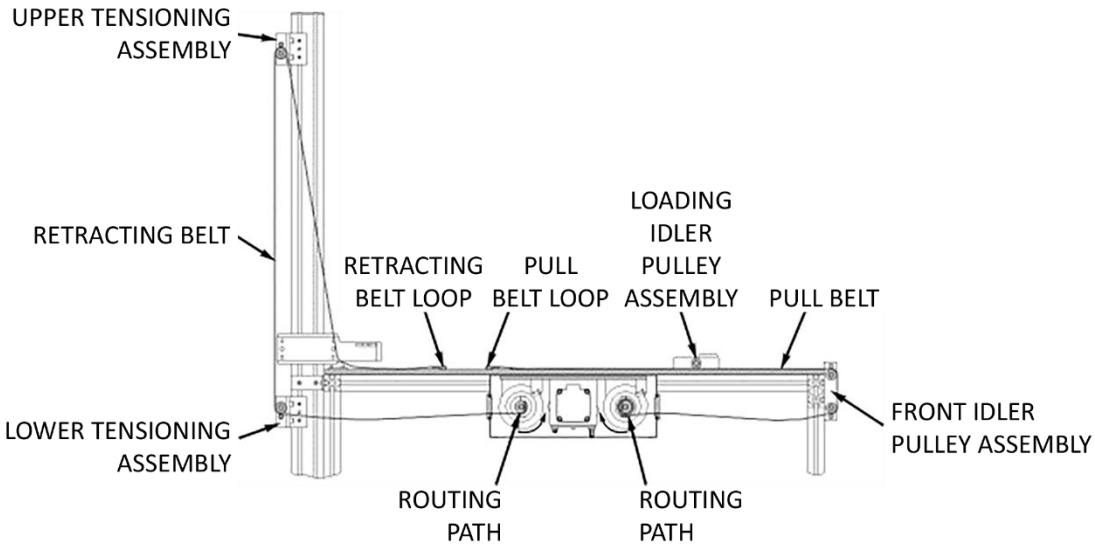


Figure 4.1 Drive Belt and Pulley Assembly

	CAUTION Before working on any electrical assembly, remove the input power by disconnecting the AC power cable on the drive/power box.

Maintenance on the Torso Flexion Test Stand is an on-going operation consisting primarily of inspection. The drive belt and pulley assemblies should be inspected each day to avoid excessive wear on the components. Inspect the drive belt for fraying fibers and cuts or tears to the belt material. If fraying or cuts are present replace the belt.

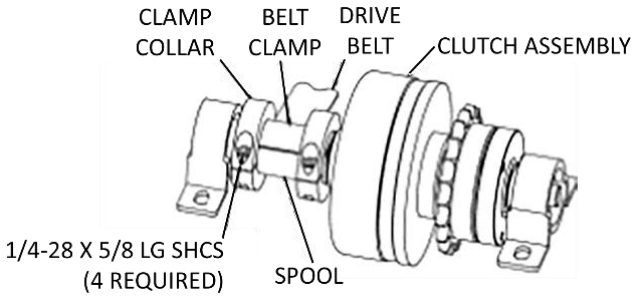


Figure 4.2 Drive Belt

4.1 Replacing the Drive Belt

If the drive belt is worn or cut it must be replaced. The above diagram shows the routing path for the two belts on the test stand. The retracting belt and the pull belt can be ordered and replaced separately. The drive/power box cover must be removed. Remove the cover by loosening the eight (8) screws that secure the cover in place. The screws are held into the cover and shouldn't be completely removed. To replace the drive belt, first remove the old belt by pulling on the belt until the spool stops. Once all of the belt is unwound, loosen the four (4) clamp collar screws (1/4-28 X 5/8. SHCS) that secure the belt to the spool on the clutch shaft.

To reinstall the drive belt, loosen the clamp collar screws (1/4-28 X 5/8. SHCS) and insert the belt thru the belt guide in the side of the enclosure. Insert the belt in between the belt clamp and spool on the clutch shaft. The belt should be flush with the inside edge of the spool flat surface and center between the two (2) clamp collars. The clamp collars are to be flush with the edges of the spool and belt clamp. Be sure to tighten the belt clamp sufficiently to hold the belt in position. Wrap the belt around the spool in the direction shown.

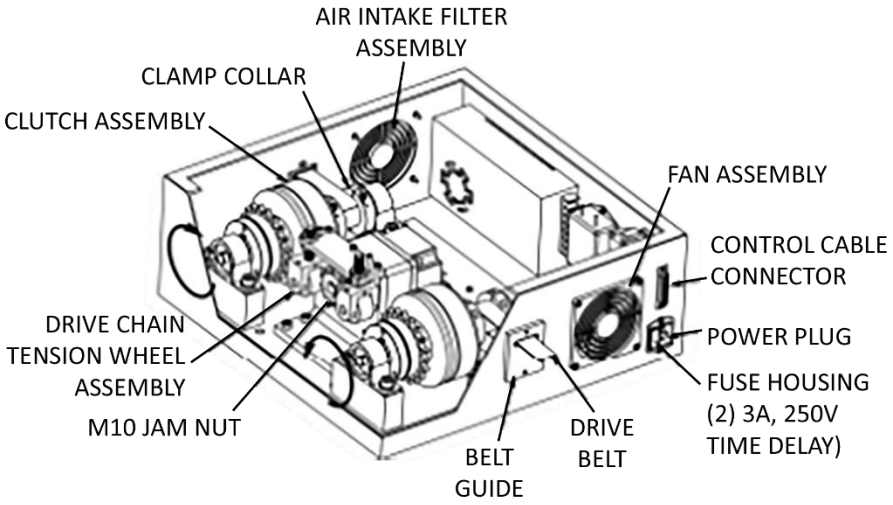


Figure 4.3 Drive Belt Box

4.2 Fuses

The drive/power box assembly contains two (2) time delay fuses in the power plug connector housing. These fuses are: 3 amp, 250 volt time delay The fuses must be replaced with the same type of fuse as specified here.

4.3 Fan Filter

The fan assembly draws air through the drive/power box to reduce the heat build inside the box. On the rear side of the box there is a filter to help control the amount of dust that is drawn inside the box by the fan. This filter should be removed and cleaned at least once per year, based on typical laboratory conditions. To remove the filter, remove the cover on the Air Intake Filter assembly by gently prying away the tabs on the cover. No tools should be necessary. The filter can be pulled away from the cover and rinsed in warm water. Allow filter to completely dry before reinstalling.

4.4 Drive Chain

There is no maintenance required for the chain. However, if the chain should loosen it can be tightened by loosening the M10 Jam nut located at the top of the Drive Chain Tension Wheel assembly. Adjust the tension by turning the M10 nut closest to the tension wheel. Retighten the two M10 nuts once the operation is complete.

4.5 Cleaning

The test stand seating surface should be cleaned as needed to remove dirt and oil left from the dummy flesh. Clean the surface using isopropyl alcohol and a clean cotton cloth or paper towel.

4.6 Sensors/Gains

The two (2) sensors, load cell and angle transducer, used in the torso flexion test should be calibrated at least once per year. Both devices can be returned to the test stand manufacturer for calibration or to a third party. The channel gains should be calibrated twice a year using the procedure described in the Setup section.

4.7 Miscellaneous Information

To decommission the test stand for disposal the lithium-ion power cell on the main processor board and all circuit boards must be removed and properly disposed of according to local governmental regulations.

Section 5. Electrical Connections

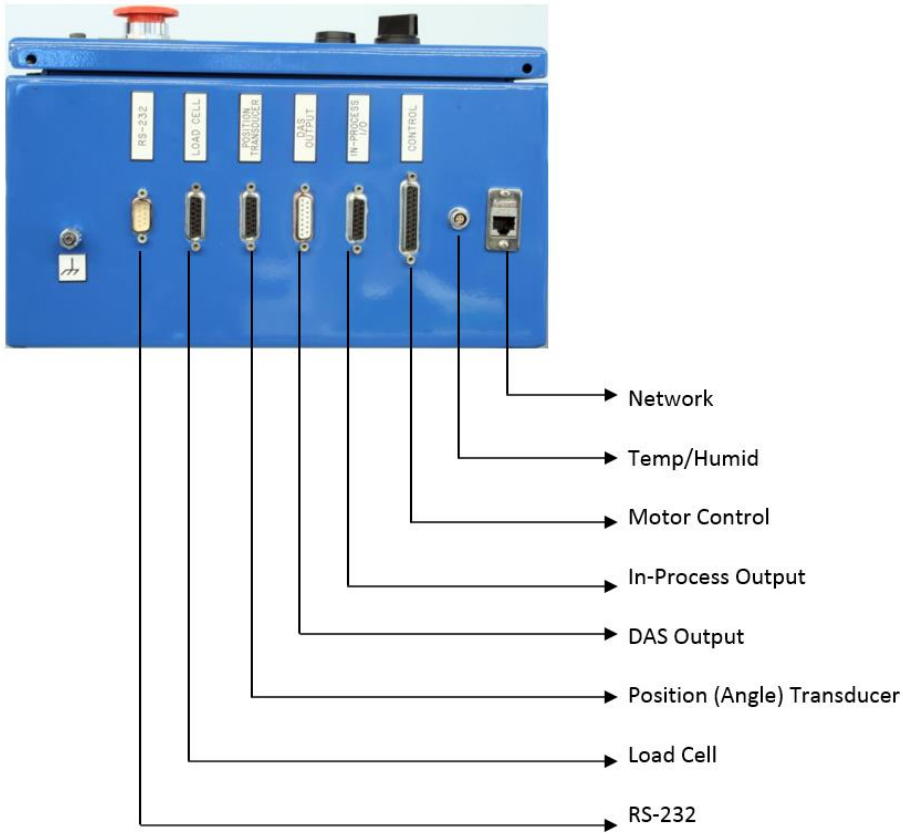


Figure 5.1 Electrical Connections

Table 5.1 Wiring

Load Cell Wiring ***Pin Description***	**Angle Transducer Wiring** ***Pin Description***	**DAS Outputs Wiring** ***Pin Description***	**In-Process IO** ***Pin Description***
1 +exe	3 GND	1 A0 Output	5 Shield (GND)**
2 +sig	4 Cal GND	2 +sig Load Cell	14 Customer
3 –exe	5 Shield (GND)	3 DAS GND	In-Process Return
4 –sig	6 +5 volts	4 -sig Load Cell	15 Customer
5 Shield (GND)	7 Signal	5 Shield (GND)	In-Process Output
		7 +sig Angle Xdcr	
		9 -sig Angle Xdcr	
		14 Force/Ref. GND	

Section 6. Controller Box and Main Circuit Board

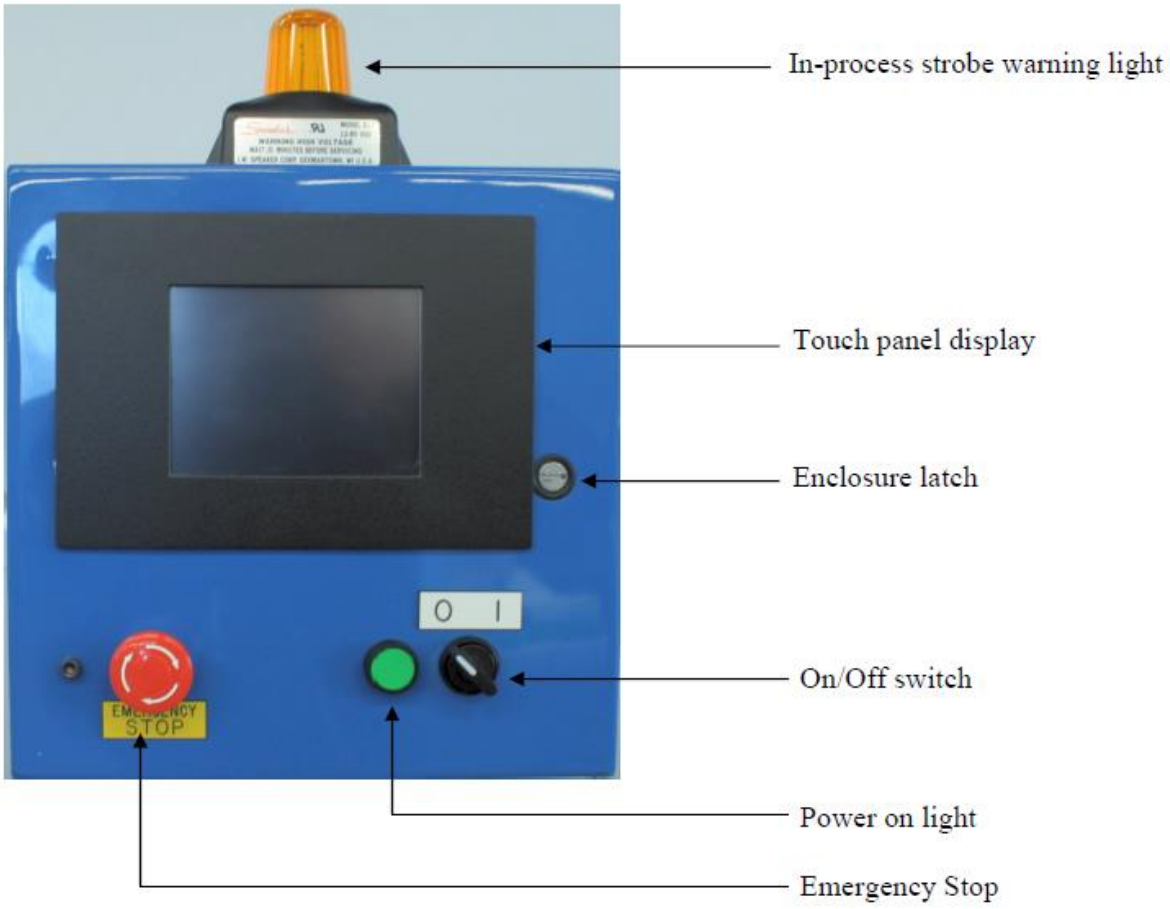


Figure 6.1 Controller Box

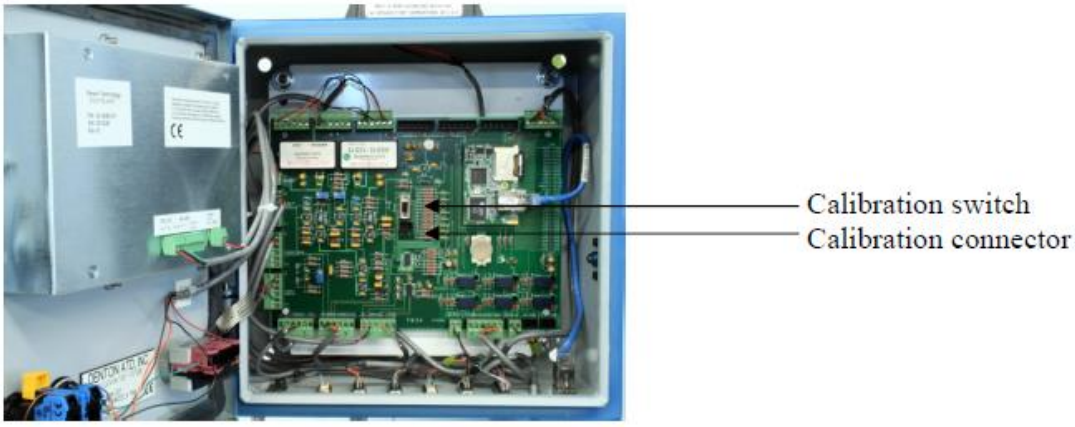


Figure 6.2 Circuit Board

6.1 Included Components/Parts

The following parts are included with the Torso Flexion Test Fixture:

Table 6.1 Torso Flexion Test Fixture

Quantity	Part Description
1	Test Stand Frame Assembly
1	Controller Unit Assembly
1	Drive/Power Unit Assembly
1	Storage Drawer Assembly
	Inside storage drawer:
2	15-pin .D. shell male connectors (used for customer DAS and I/O cables)
2	.D. shell connector covers (used for customer DAS and I/O cables)
1	Rear Vertical Post Assembly
10	M8 X 15 mm BHCS (blue) (for attaching Rear Vertical Post and Controller Unit Support assembly)
1	Controller Unit Support Assembly
2	M8 X 60 mm SHCS (for attaching Controller Unit to support post assembly)
1	Pull Bracket Assemblies
	HIII-3YO
4	#8-32 x 1/2. SHCS
	HIII-6YO
4	#6-32 x 3/8. SHCS
	HIII-5F
4	#10-24 x ¾ LG. SHCS
1	Pelvis Attachment Brackets
	HIII-3YO
2	1/4-20 x 1 LG. SHCS
	HIII-6YO
4	1/4-20 x ¾ LG. LWSHCS
	HIII-5F
4	#10-24 x ¾ LG. SHCS
1	Angle Sensor Assembly
1	Load Cell (200 lbf capacity)
1	Shielded AC Power Cord (USA or European)
1	Control Cable (Parallel: 25 pin, 5 foot (1.5 M))
1	Level, small round
1	Quick Release Pin
1	Clevis Pin and Hair Pin
1	Spring Snap with Drive Belt
4	Leveling Feet (optional)
1	Operation's Manual

6.2 Accessory Requirements

- For RS-232 Cable: Manufacturer - Black Box p/n: EDN12H-0025-FF (25 ft. length)
- For DAS Output & In-Process I/O: Manufacturer - Belden 8164 (low capacitance with four (4) individually shielded twisted pairs with overall foil/braid shield).

Section 7. Legal Disclaimer and Notices

7.1 Disclaimer

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For additional information on Humanetics and its products and services, please refer to www.humaneticsatd.com or contact:

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Section 8. User Manual Update Log

Revision Level	Revision Date	Revision Author	Revision Description
A	Jul. 2018	MGT	Release