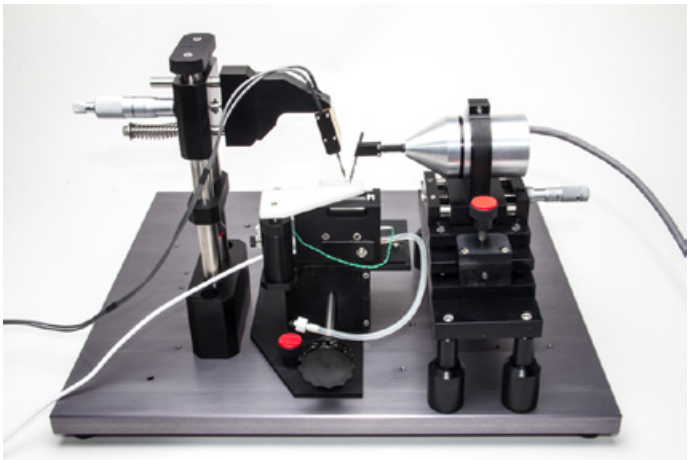
SI-MKB

Comprehensive Muscle Tester

BASIC SYSTEM ASSEMBLY INSTRUCTIONS

Serial No._____



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World Precision Instruments

CONTENTS

ABOUT THIS MANUAL

The following symbols are used in this guide:

This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.

This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

NOTES and TIPS contain helpful information.

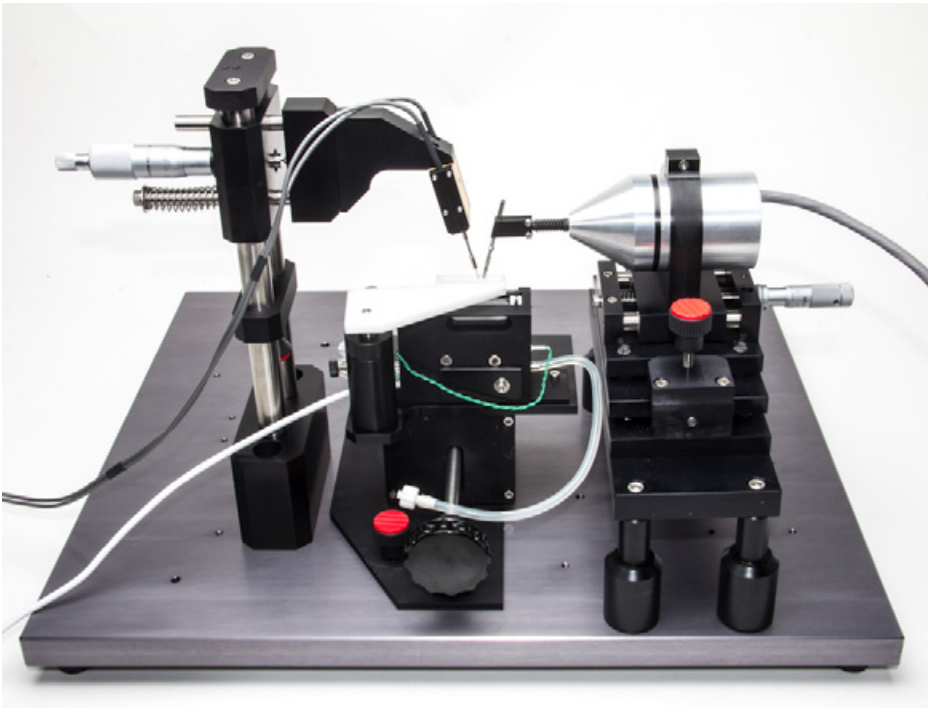


Fig. 1—This SI-MKB platform has an optical cuvette and a linear motor.

INTRODUCTION

This document details the assembly of the SI-MKB Muscle Tester. For information on using the SI-H electronics with the Muscle Testers, see the SI-H Muscle Tester Electronic Instruction Manual (www.wpiinc.com/manuals).

Parts List

After unpacking, verify that there is no visible damage to the sensor. Verify that all items are included:

(1) Base Plate Assembly
(1) Cuvette Assembly, including:
    (1) Cuvette
    (1) Psuedo cuvette
    (2) Cap screws
(1) Micrometer Assembly or Motor Assembly, including:
    (1) Micrometer or Motor
    (1) Micrometer or Motor Mount
    (4) Pedestals
    (4) Screws
(1) Force Transducer Stand Assembly, including
    (1) Force transducer stand
    (1) SI-KG Force transducer
    (2) Mounting screws
(1) Set of Tissue Mounts
(4) **2851** 6′ BNC cables (**SI-MTM** systems include (6) **2851** cables and (2) **13854** BNC T connectors.)
(1) Instruction Manual

Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 23 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or customerservice@wpiinc.com.

Returns: Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container, if possible. If the original container is not available, use a suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material. For further details, please read the section entitled "Claims and Returns" on page 23 of this manual.

INSTRUMENT DESCRIPTION

Before setting up the SI-MKB, carefully open each box and inspect the contents. Carefully unwrap each piece before beginning. The following instructions graphically show how to setup your MKB Muscle Tester.

NOTE: If you have a problem/issue that falls outside the definitions of this manual, contact the WPI Technical Support team at 941.371.1003 or technicalsupport@wpiinc.com.

System Parts

The major parts of the SI-MKB are pointed out in **Fig. 2** below.

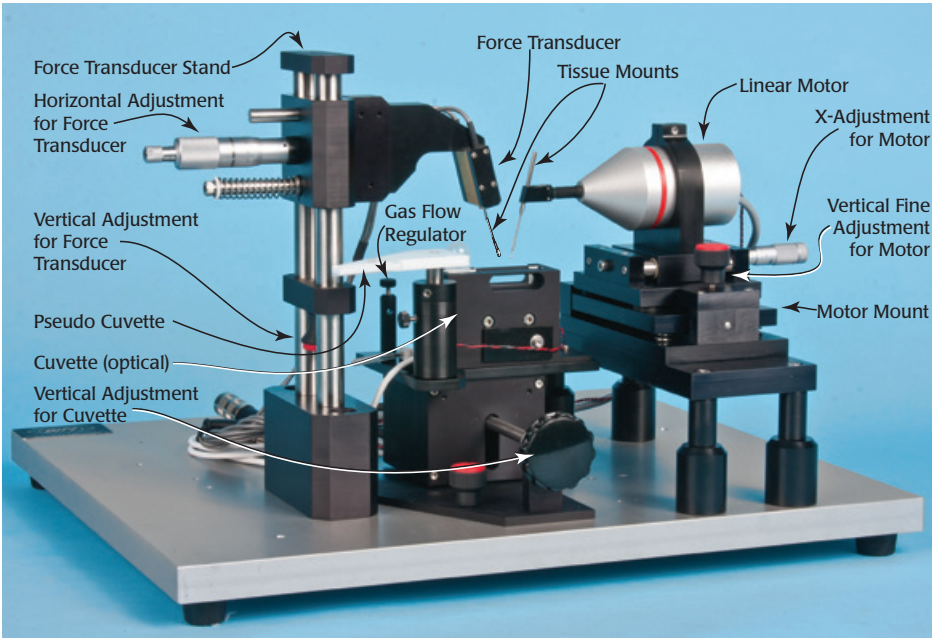


Fig. 2—SI-MKB Muscle Tester parts

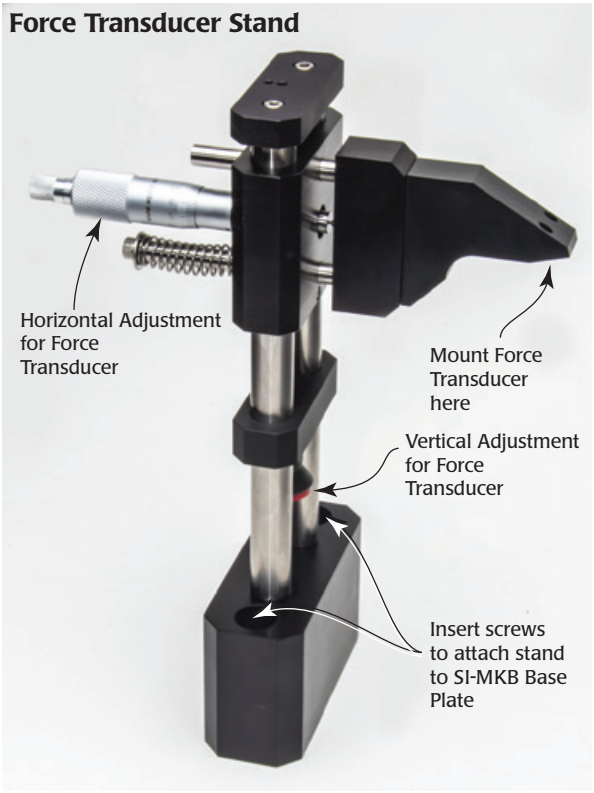


Fig. 3—The force transducer stand is labeled.

Horizontal Adjustment–Use the micrometer to adjust the left/right position of the force transducer.

Vertical Adjustment–Rotate this knob clockwise to raise the position of the force transducer or counter-clockwise to lower the position of the force transducer.

Placement Holes–When the stand is positioned over the force transducer holes on the base plate, insert two screws into these holes to secure the force transducer stand.

NOTE: Slotted holes in the base of the stand allow it to slide back and forth to adjust its position relative to the cuvette and the motor mount.

Cuvette (Optical)

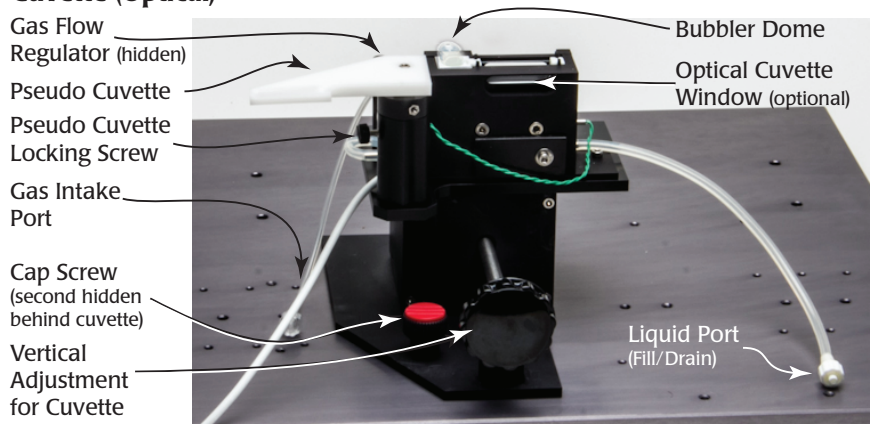


Fig. 4—The cuvette assembly is labeled.

Gas Flow Regulator–The gas intake tube runs through the regulator. Tighten the screw on the top of the regulator to restrict the flow of gas or loosen it to allow more gas to flow.

Pseudo Cuvette–Use this tray to hold a tissue while mounting, Then, rotate it out of the way or remove it. The height of the tray can be adjusted by moving the bumper up or down. See Fig. 5. (Loosen the set screw to adjust the bumper. When it is properly positioned, tighten the setscrew again.) Tighten the pseudo cuvette locking screw to secure the position of the pseudo cuvette.

CAUTION: Before rotating the pseudo cuvette into position for use, verify that the cuvette is in the lower position, and be careful of the mounting hooks as you rotate.

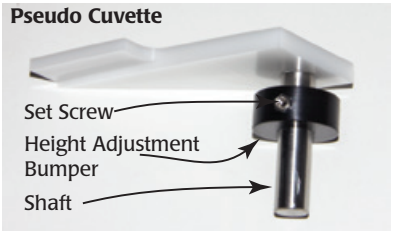


Fig. 5—The height of the pseudo cuvette can be adjusted by moving the bumper up/down.

Gas Intake Port–Connect the oxygen or carbogen gas to this port to bubble it into the buffer solution inside the cuvette.

Thumb Screws–Use the two red thumb screws to attach the cuvette to the base plate. The cuvette assembly has grooves so it can move forward/backward to align it with the force transducer stand and the motor/micrometer. When it is properly aligned, tighten the thumb screws.

Vertical Adjustment–Rotate this knob clockwise to raise the cuvette into position or counter-clockwise to lower it out of the way when you are mounting a tissue.

Bubbler Dome–This translucent dome covers the gas inlet to contain any buffer solution that might splatter on the equipment.

Optical Window–SI-MKB(M)-WIND systems include the optical cuvette with a window. The SI-MKB(M)-OXY systems have the standard cuvette without a window.

Liquid Port–Connect this port to the vacuum system. It is used to fill and drain the cuvette.

Motor Mount Assembly

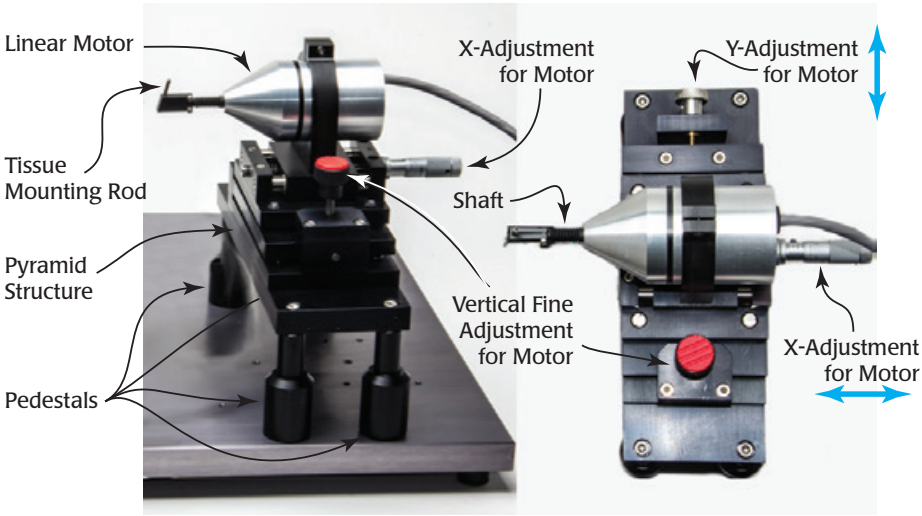


Fig. 6—The motor mount assembly is shown with a front view and a top view.

Linear Motor–The SI-MKBM systems include a linear motor. SI-MKB systems include a micrometer. Both are mounted in a similar fashion.

Tissue Mounting Rod–This hollow tube holds the tissue mounts. Choose from a variety of tissue mounts. See "Tissue Mounts" on page 7. To install, push the tissue mount into the tissue mounting rod until the tip of the two tissue mounts are even.

Pyramid Structure–This structure is shipped as a unit and holds either the motor or micrometer.

Pedestals–Four pedestals are included. They screw into the base plate and are used to securely attach the pyramid structure.

X-Adjustment–This micrometer is used to move the motor closer to or further from the center of the cuvette.

Shaft–The carbon fiber shaft moves in and out of the motor to stretch/release the muscle tissue. Because of this, it is not flexible. Handle it gently to prevent breakage.

Vertical Adjustment–This red knob is used for fine adjustment of the height of the motor.

Y-Adjustment–This knob is used to align the motor/micrometer with the force transducer and the cuvette.

Tissue Mounts

Mounting hooks are sold in kits. Currently, there are 12 kit configurations (Fig. 7), each available in four different sizes. The mounting hook size that is required depends on the force transducer used. The primary tissue mounting hooks include:

- Baskets
- Pointed hooks
- Blunt hooks
- Tweezers
- Spring clips
- Screw clamps
- Tendon hooks

Vascular hooks are also available for mounting blood vessels (rings). They are normally used with a pair of blunt hooks (**SI-TM8**). For larger muscles, screw clamps (**SI-TM11**) and spring clips (**SI-TM9, SI-TM10**) are available for use with the large sized **SI-KG2** force transducers. The micrometer and motor receive a large (**SI-KG4** size) tissue mount. If a smaller tissue mount is used, an adapter is required. This adapter is included with every Muscle Tester system.

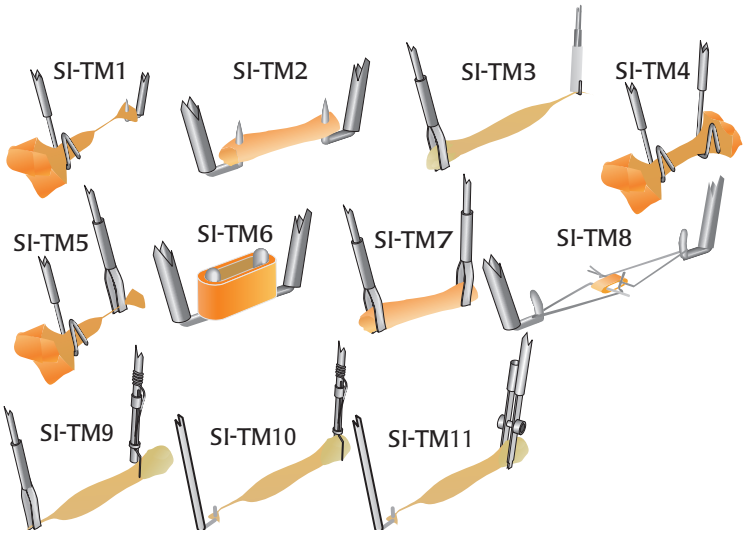


Fig. 7—Mounting hooks can be used in a variety of combinations, depending on the type of tissue to be examined.

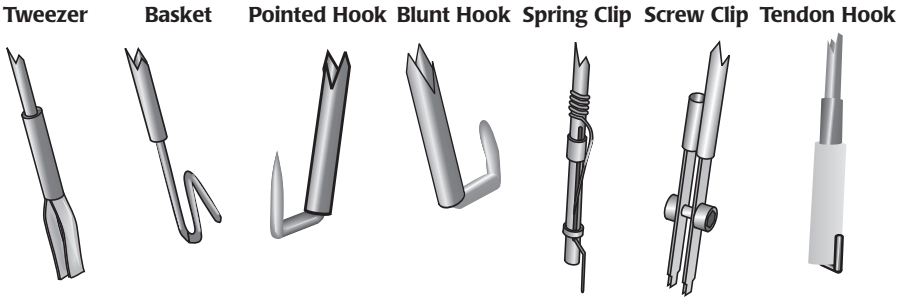


Fig. 8—A variety of tissue hook styles are shown

Tissue Mount Kit	Force Transducer Mount	Micrometer/Motor Mount
SI-TM1 Papillary Muscle	Basket	Pointed Hook
SI-TM2 General Purpose	Pointed Hook	Pointed Hook
SI-TM3 Small Skeletal Muscle	Tweezer	Tendon Hook
SI-TM4 Trabeculae	Basket	Basket
SI-TM5 Papillary Muscle	Basket	Tweezer
SI-TM6 Muscle Rings	Blunt Hook	Blunt Hook
SI-TM7 General Purpose	Tweezer	Tweezer
SI-TM8 Muscle Rings	Blunt Hook/ Vascular Hook	Blunt Hook/Vascular Hook
SI-TM9 Strong Skeletal Muscle	Tweezer	Spring Clip
SI-TM10 Strong Skeletal Muscle	Pointed Hook	Spring Clip
SI-TM11 Very Strong Skeletal Muscle	Pointed Hook	Screw Clamp

Force Transducers

The table below shows the various SI-KG optical force transducers available for the Muscle Testers.

	Range	Range (g)	Noise (µN)	Compliance (µm/mN)	Resonance Frequency	Compatible Systems
SI-KG2	0-2 N	0-200	250	0.15	1.3 kHz	SI-H only
SI-KG2A	0-0.5 N	0-50	300			SI-H only
SI-KG4	0-50 mN	0-5	15	0.5	1.2 kHz	SI-H only
SI-KG4A	0-20 mN	0-2	4	1	1.2 kHz	SI-H only
SI-KG7	0-5 mN	0-0.5	0.2	10	250 Hz	SI-H only
SI-KG7A	0-5 mN	0-0.5	0.4	5	500 Hz	SI-H only
SI-KG7B	0-10 mN	0-1.0	1	1.5	550 Hz	SI-H only

SYSTEM ASSEMBLY INSTRUCTIONS

1. Position the base plate so that two motor mount screw holes are located in the front right corner as shown in the image below.

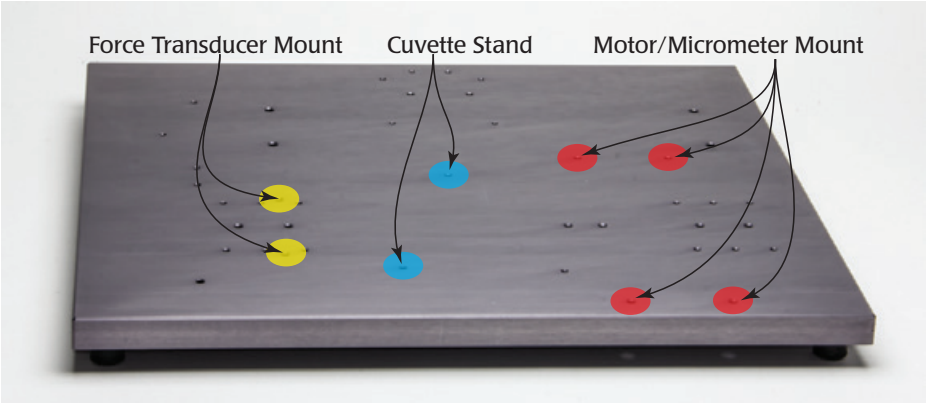


Fig. 9—Position the SI-MKB base plate as shown here so the motor/micrometer mount holes are on the right.

2. Position the cuvette stand over the two cuvette stand screw holes (blue) in the center front of the base plate. Use the two red thumbscrews to secure the cuvette stand. The stand can slide back and forth to align the cuvette with the motor/micrometer and the force transducer. When it is properly positioned, tighten the thumb screws.

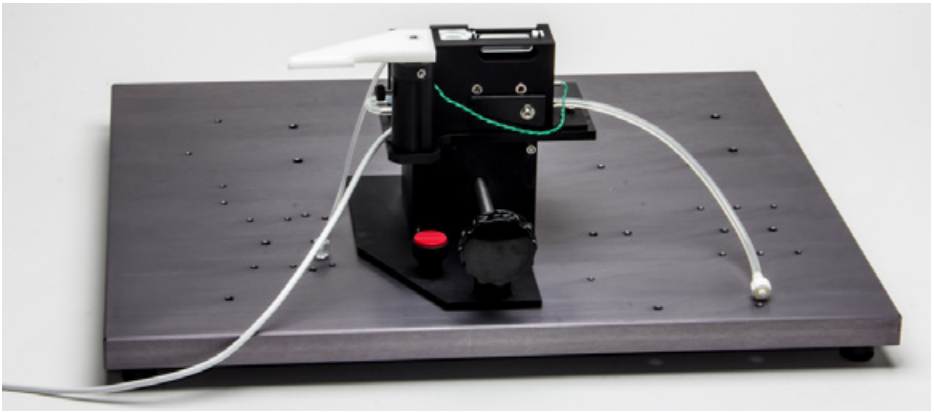
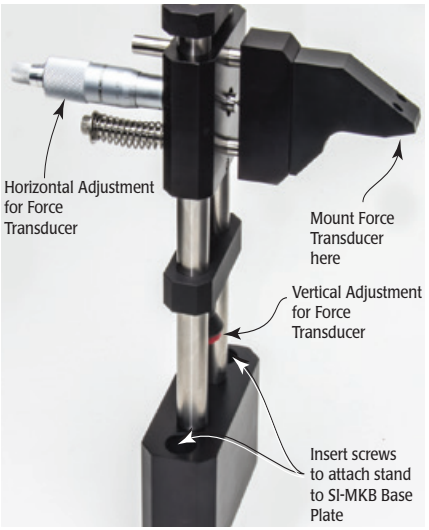


Fig. 10—The cuvette stand is secured to the base plate using two red thumb screws.

3. Position the force transducer stand (Fig. 12) on the left side of the base plate so that the holes in the base of the stand align with the yellow holes in the base

plate (Fig. 9). The force transducer mount must face the cuvette. Insert the two mounting screws through the mounting holes in the base of the stand and into the two holes on the left side of the base plate. The stand can slide forward or back to align the force transducer with the cuvette and the motor/micrometer. When it is in position, use an hex wrench to tighten the screws.



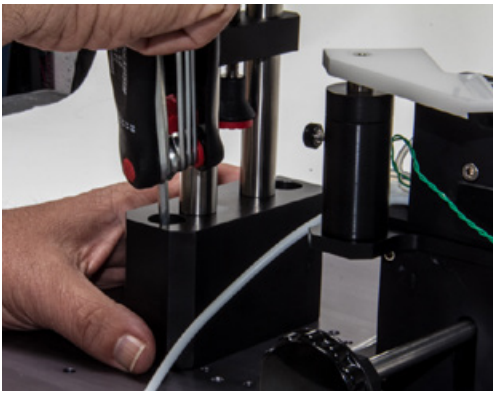
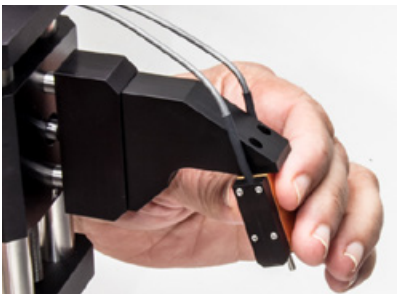


Fig. 11—(Left) The force transducer is shipped separately from the force transducer stand.

Fig. 12—(Right) Use an hex wrench to tighten the screws that secure the force transducer stand to the base plate.

4. To install the force transducer on the force transducer stand, remove the two screws from the top of the force transducer. Line up the screw holes on the force transducer with the holes in the arm of the force transducer stand. Use a small Phillips screw driver to re-install the screws in the force transducer.



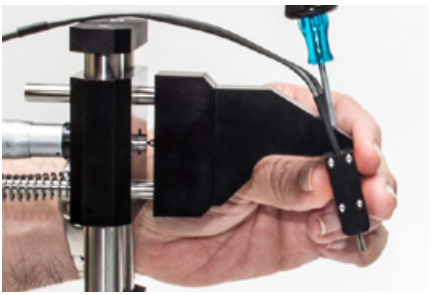
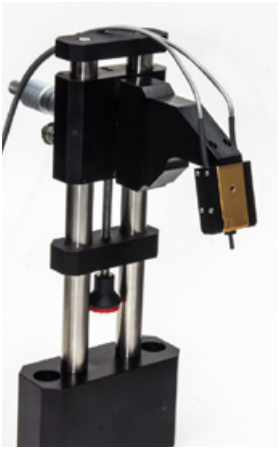


Fig. 13—(Left) Line up the screw holes on the force transducer with the holes on the stand.

Fig. 14—(Right) Use a screw driver to re-install the screws.



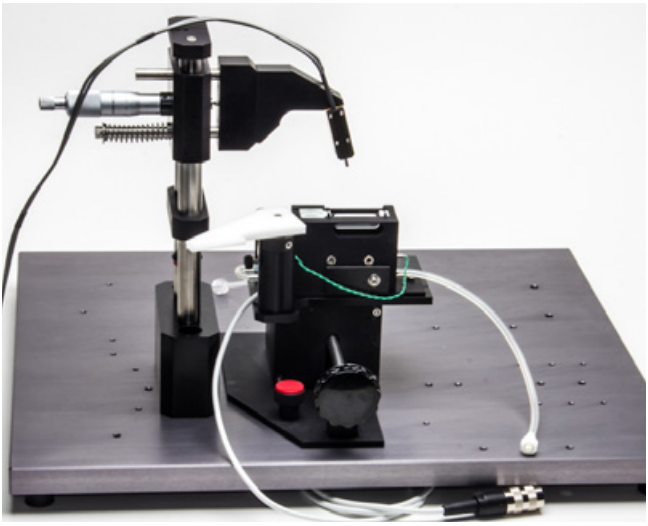


Fig. 15—(Left) The force transducer is installed on the stand.

Fig. 16—(Right) The force transducer stand is properly positioned and mounted on the left side of the cuvette assembly.

5. To install the motor/micrometer mount assembly, first install the four pedestals. Screw them into the four (red) holes (Fig. 9) on the right side of the base plate.

Fig. 17—The four pedestals hold the motor/micrometer mount assembly.

Fig. 18—Screw the pedestals in the appropriate holes finger tight.

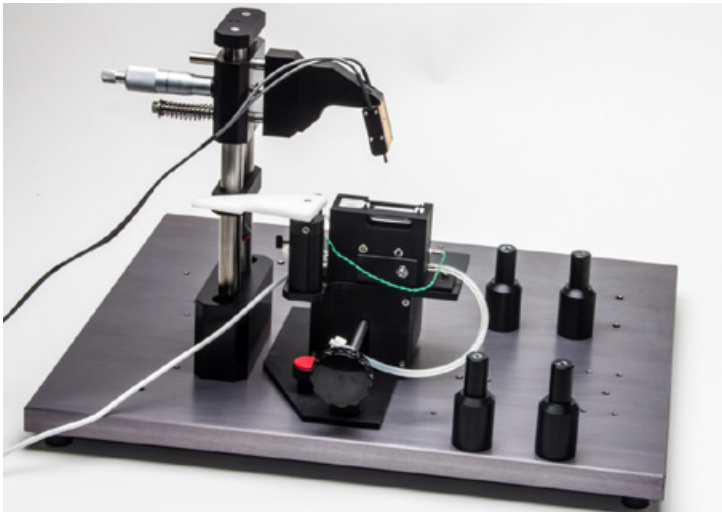


Fig. 19—The four pedestals are installed on the right side of the base plate.

6. Position the pyramid structure of the motor/micrometer mount assemble over the pedestal so that the four holes in the corner of the pyramid line up with the screw holes in the top of the four pedestals. Use the four M4 screws and an hex wrench to secure the pyramid to the pedestals.

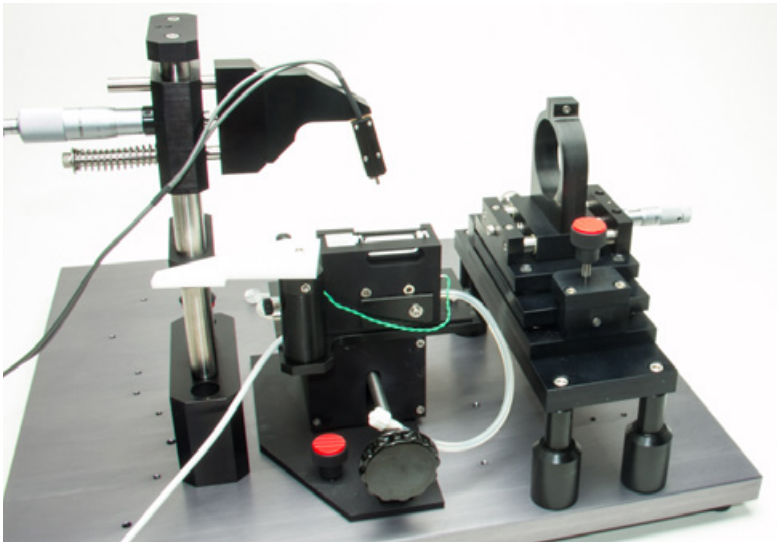


Fig. 20—The motor/micrometer mount is positioned on the right side of the base so that the X-adjustment micrometer faces towards the outside.

7. If you are mounting a motor, use an hex wrench to loosen the screw in the top of the motor mount ring.

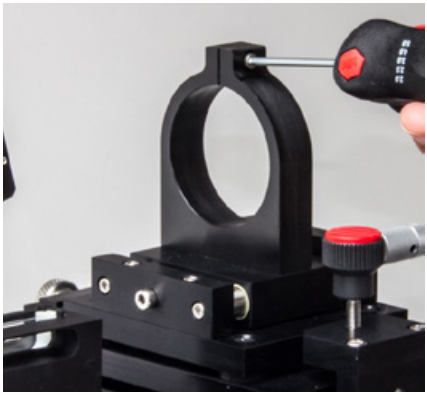


Fig. 21—Loosen the screw at the top of the motor mount ring.

8. Slide the conical end of the linear motor into the motor mount ring so that the tissue mount rod is vertical. The exposed end of the tissue mount rod should be up and angled toward the right (Fig. 23) if the motor is installed correctly. When the tissue mount is installed, its tip should be positioned near the center of the cuvette, but should not touch the tissue mount attached to the force transducer. (Fig. 25) It may be necessary to slide the motor in or out to adjust the position of the tissue mount. When the motor is properly positioned, use the hex wrench to tighten the screw on the motor mount ring.

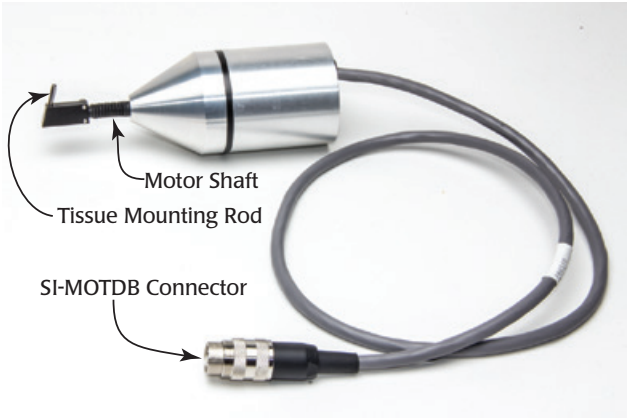


Fig. 22—The linear motor is extremely precise. The carbon fiber motor shaft is fragile.

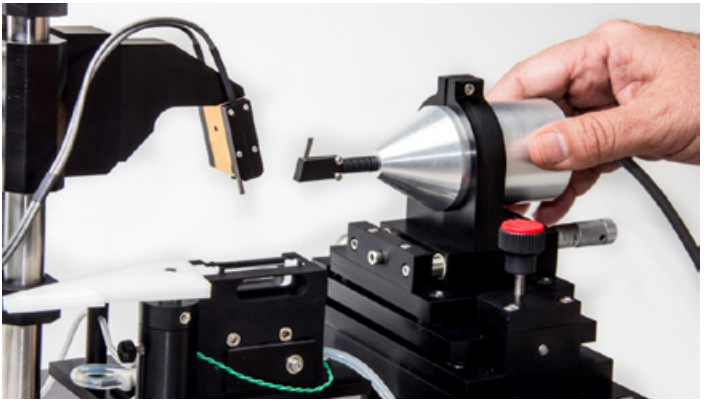


Fig. 23—Orient the motor so that the tissue mounting rod is pointing toward the center of the cuvette bath.

9. To install the tissue mounts:
   A. Lower the cuvette by rotating the cuvette vertical adjustment knob counter-clockwise.
   B. If necessary, raise the force transducer using the vertical adjustment knob.
   C. Then, gently push the tissue mounts into the tissue mount rods on the force transducer and the arm of the linear motor.
   D. Carefully raise the cuvette to the upper position by turning the cuvette vertical adjustment knob clockwise. The tips of the tissue mounts should NEVER touch the bottom of the cuvette. If necessary, use the vertical adjustment knob on the motor to fine tune the position of the tips of the tissue mount. The tissue mount tips must be positioned in the cuvette so that they are submerged when the cuvette is filled.
   E. If the tissue mount on the motor is too long, gently press it further into the mounting rod.
   F. Use the vertical adjustment knob on the force transducer to slowly lower the force transducer until the tissue mount tips are the same height as the tissue mount tips on the motor.

Fig. 24—(Left) The SI-TM9 tissue mounts are used for strong skeletal muscles. Other tissue mounts are also available.

Fig. 25— (Right) Align the tissue mounts so the bottom tips are nearly even.

10. Fine tune the position of the tissue mounts. The tips of the tissue mounts should not touch the bottom of the cuvette when it is raised into position. If necessary, use the vertical adjustment knobs for the force transducer and the motor/ micrometer mount to fine tune the position of the tissue mounts.

11. Align the motor, force transducer and cuvette (Fig. 26). Use the Y-adjustment knob on the back of the motor mount to move it. Both the force transducer stand and the cuvette assembly can slide backward or forward if you loosen the securing screws. When all three are aligned, tighten all the securing screws.

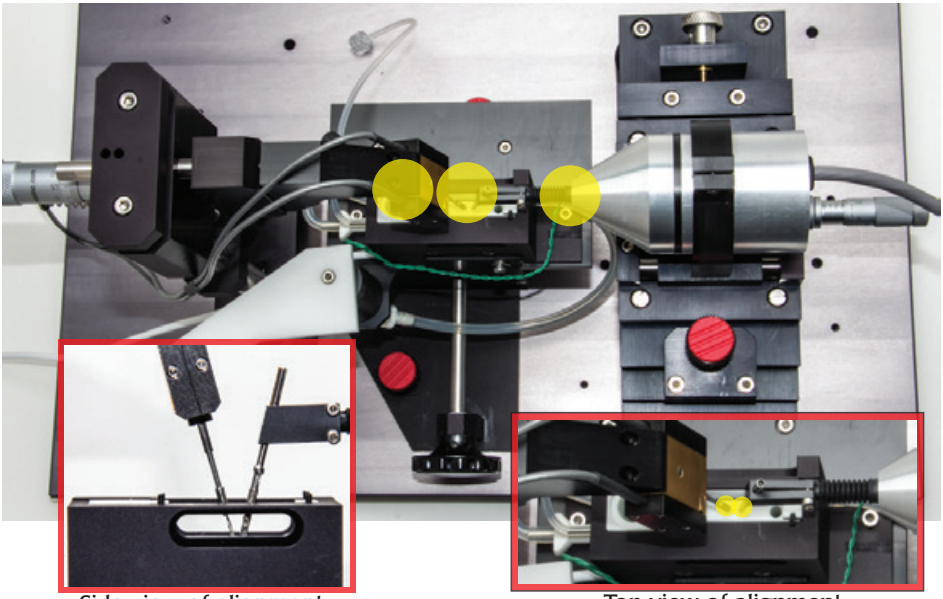


Fig. 26—Line up the motor, force transducer and cuvette.

OPERATING NOTES

Using the Psuedo Cuvette

The pseudo cuvette can be used when mounting tissues. Rotate it into position and fill the bath with buffer solution.

CAUTION: Before rotating the pseudo cuvette into position for use, verify that the cuvette is in the lower position, and be careful of the mounting hooks as you rotate. (Fig. 6).

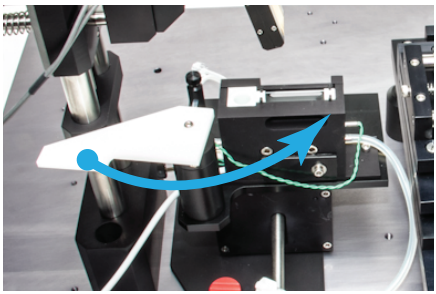


Fig. 27—(left) Rotate the pseudo cuvette into position. Do NOT let the pseudo cuvette damage the tips of the mounting hooks.

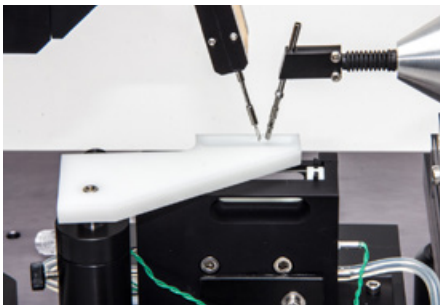


Fig. 28—(right) The pseudo cuvette (in position) can be used for mounting tissue.

Using the Field Stimulation

When field stimulation is required, place the electrode assembly into the cuvette as shown in Fig. 30. Connect the electrodes to a stimulator.

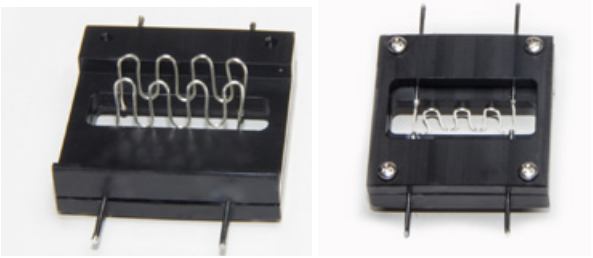


Fig. 29—The field stimulator electrode is shown from the bottom view (left) and the top view (right).

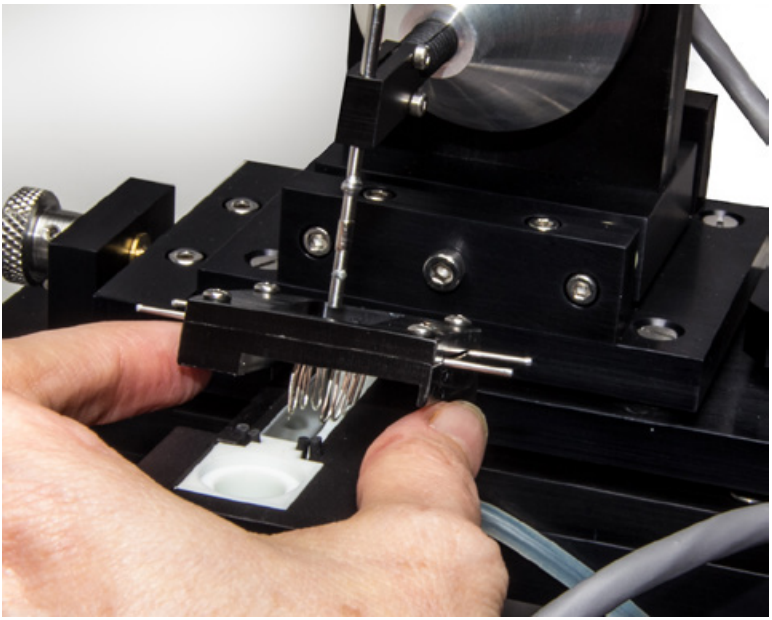


Fig. 30—The narrow end of the electrode is positioned toward the front of the cuvette, and the thick end toward the back of the cuvette. The electrode slides into the cuvette bath.

Installing a Vacuum System

An optional vacuum system includes a pump, syringe stand, syringe, waste reservoir and tubing. See Fig. 31.

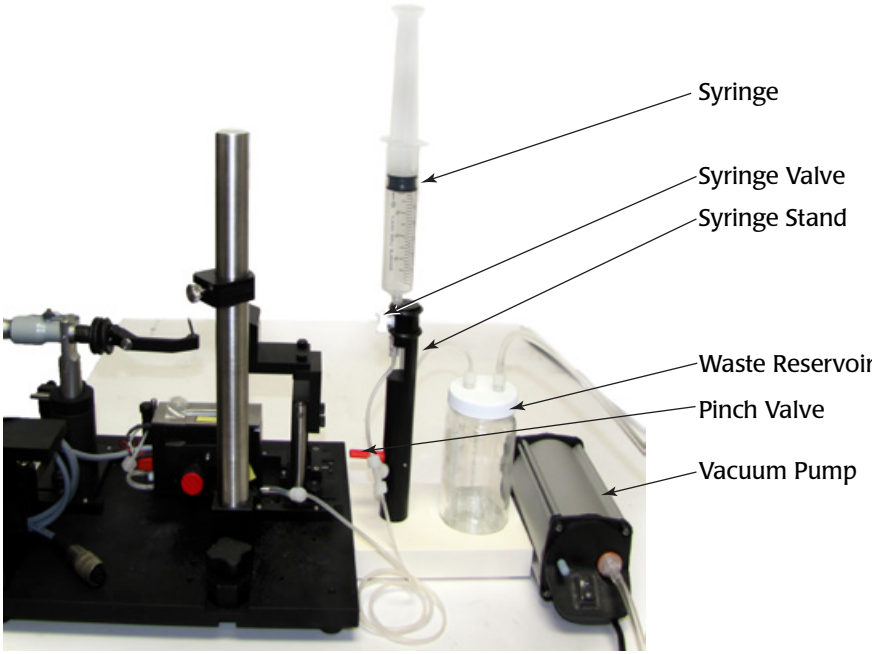


Fig. 31—Vacuum system, labeled parts. This picture shows an SI-MT system.

Assembling the Vacuum System

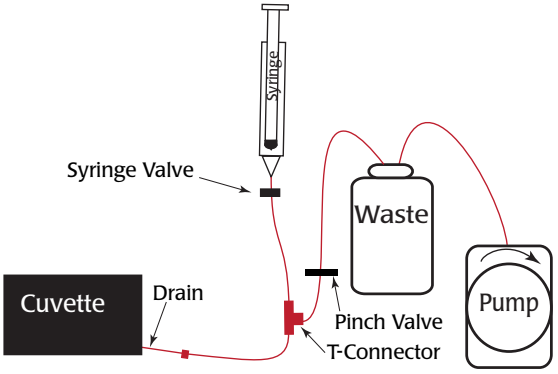


Fig. 32—Plumbing diagram for the vacuum system

1. Press the large tubing over the nipple on the pump. Press the other end over the large connector on the waste reservoir (**Fig. 33**).

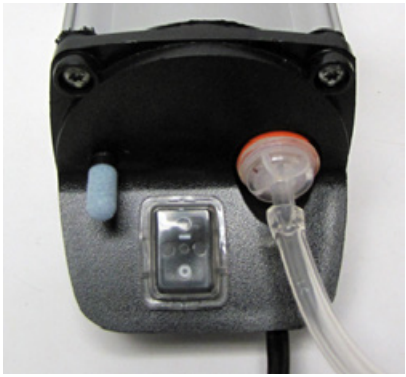


Fig. 33—Connect to the pump

2. Connect a length of thin tubing to the small connector on the top of the waste reservoir. Lift the red pinch valve and run the tubing through the black syringe stand (under the spring-loaded pinch valve). Then, connect the other end to the side of the T-connector (**Fig. 34**).

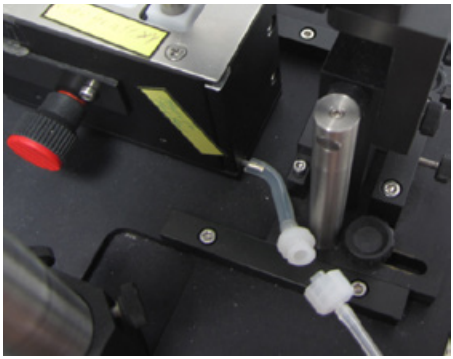


Fig. 34—(Left) Plumbing the Vacuum System

Fig. 35—(Right) Drain connector on the cuvette

3. Connect a length of thin tubing to the bottom of the T-connector. Connect the other end to the drain on the cuvette (**Fig. 35**).

4. Screw the syringe into the top of the syringe stand. The syringe valve is in the on position when the valve is positioned up and down (**Fig. 36**).

Fig. 36—Syringe valve is in the on position.

5. Connect a short length of thin tubing to the bottom of the syringe valve. Connect the other end to the top of the T-connector.

Filling the Cuvette

1. Verify that the syringe valve is in the off (horizontal) position.
2. Fill the syringe with the perfusion solution.
3. Verify that the cuvette and the drain tubing is empty. If it is not, see Emptying the Cuvette.
4. Open the syringe valve (vertical position) and gently press the syringe plunger until the cuvette is filled to the desire position.
5. Close the syringe valve (horizontal position).

Emptying the Cuvette

1. Verify that the syringe valve is in the off (horizontal) position.
2. Plug in the vacuum pump and turn it on.
3. Gently lift the pinch valve and hold it up until the liquid in the cuvette and line tubing is completely evacuated (**Fig. 37**).

Fig. 37—Lift the spring-loaded pinch valve to allow the waste fluid to be evacuated into the reservoir

4. Release the pinch valve.

WARRANTY

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. In some instances, photographic documentation may be required. Some items are time-sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*

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