Myobath II

INSTRUCTION MANUAL

092508

World Precision Instruments

Introduction

The use of isolated tissues in the study of physiological and pharmacological function of organs has been performed for nearly a century. It is generally the mechanical properties of isolated tissues that interests us the most. However, the underlying electrical, biochemical (second messengers) and ionic (ion fluxes) alterations that mediate these responses are obviously important aspects of organ function. To a large extent, these properties can only be classified when specific tissues are studied in isolation. In terms of *in vitro* techniques, characterization of many of the properties of isolated tissues (such as blood vessels) can occur at a number of different levels of organ integrity. WPI's multichannel organ bath system is designed through years of research and development for simultaneous studies of isolated tissues *in vitro*. This easy-to-use, cost-effective bench-top system is suitable for experiments on vascular and non-vascular smooth muscle and cardiac muscle, for example, coronary artery, taenia coli, isolated atria and ventricle strips.

Fig. 1 *– Four-channel Myobath setup*

System Assembly

Tips to Setup and Experiment

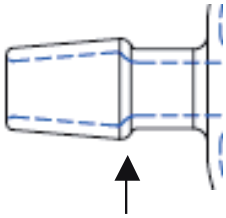


Fig. 2

- **Tubing connection to the glassware, such as organ bath, reservoir bottle, and 5-port glass manifold**

  All glassware has male slip fittings (see Fig. 2). Push the male slip into the tubing (silicone tubing or PVC tubing) or the friction connector. Water can be used to wet the male slip or the tubing to make insertion easy. Insertions of the male slip should be made at least past the arrow position.

  When disconnecting the tubing, hold the tubing around the male slip, twist the tubing clockwise and anticlockwise several times, and then pull the tubing off the slip. Do not use too much pulling force (it may break the glass and cause injury). Water instilled between the tubing and glass slip can make it easy to pull the tubing away. Insert a small flat screw driver beneath the tubing and instill water into the gap. Then twist and pull off the tubing. It should be easy to pull off after wetting.

  Occasionally, after being assembled for a long time, the tubing may stick to the glass as though glued. In this case, use a knife or razor blade to cut the tubing off the male slip.

  The friction connector can be pulled out easily by bending the connector up and down slightly.

- **The connection of valves, such as control valves and switch valve**

  Make sure the tubing matches the valve. The valves have teeth to lock tubing automatically when tubing is pushed in. After connection, the tubing should not be able to be pulled off easily. To remove tubing from a valve, push down the ring (where tubing is inserted into the valve) and pull the tubing out at the same time.

- **Flow control**

  The pinch clamps are used as an on/off switch to control the flow. They should always be open when the system is not in use. Close the pinch clamps only when necessary, such as to close the drain during experiment, to shut off the water flow when changing the organ baths, changing reservoir bottle or changing the heating circulator.

- **It is recommended to keep the oxygen (5% CO_2 in O_2) on until the experiment is finished and the organ bath is dry. Otherwise, the liquid will go into the red polyurethane aeration tubing.**

- **After experiment, rinse the reservoir, the organ bath and tubing with distill water or cleaning solution. The user can replace tubing and 6-port liquid manifold if necessary.**

Step 1: Installation of leveling feet and waste disposal tubing

1. Cut **PVC tubing** (WPI# **400199**) into the following sections:
   - 5 pieces — 100 mm (4 inches) long
   - 4 pieces — 225 mm (9 inches) long
   - 1 piece — 75 mm (3 inches) long
   - 1 piece — 125 mm (5 inches) long
2. Screw one hex nut onto each of the six leveling feet (WPI#**7467**). Install the feet on the underside (*i.e.*, the side without the grove) of the PVC baseplate (WPI#**47217**). Using the level provided (WPI#**13651**), adjust the feet so that the baseplate is horizontal. Tighten the hex nuts up against the baseplate.
3. Turn the PVC baseplate upside down (so the side with the feet is up). Screw five threaded T-fittings (WPI#**801050**) into the screw holes; connect three of them with the 100 mm lengths of PVC tubing (see Figure 4).
4. Connect the elbow fitting (WPI# **801049**) with one 75mm PVC tubing and one 225 mm PVC tubing. Push the 225 mm PVC tubing through the last through hole (near the edge). Connect the 75 mm PVC tubing into the open branch of the nearest threaded T-fitting.
5. Connect the PVC tubing and the fittings as shown in Figure 3. One elbow fitting and two T-fittings are connected with 100 mm PVC tubing. Connect the 125 mm PVC in the end. Three 225 mm PVC tubing are connected on the same side on the remaining branches. Push the 225 mm PVC tubing through the three through holes. Connect the 125 mm PVC tubing onto the branch of the threaded T-fittings at the edge.
6. Cut two sections of PVC tubing long enough to deliver the liquid to the waste collector. Connect the open branches of the threaded T-fittings with the PVC tubing. The final connection is shown in Figure 4.

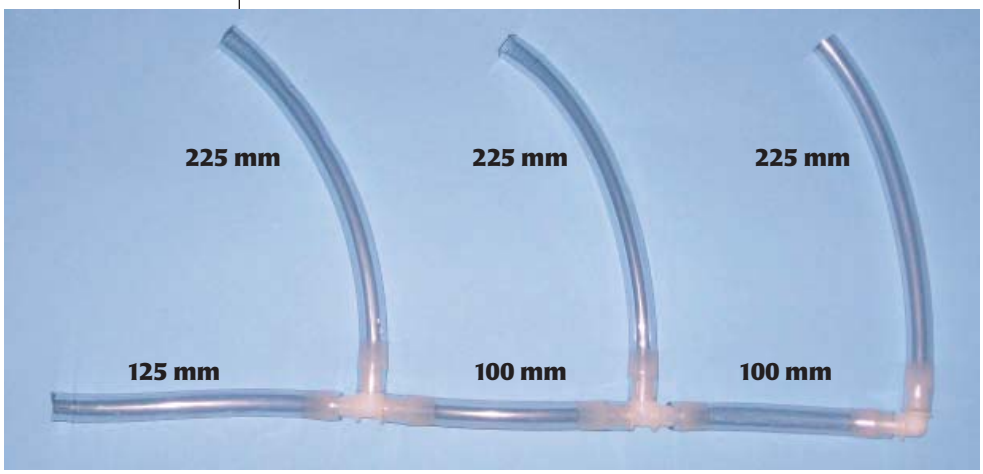


Fig. 3 *— Three 225 mm lengths of PVC tubing are connected with the middle branches of T-fittings #801051 and one branch of elbow fitting #801049. The 100 mm PVC tubing connects the elbow fitting and the T-fittings. The 125 mm PVC tubing connects into the last branch of the T-fitting.*

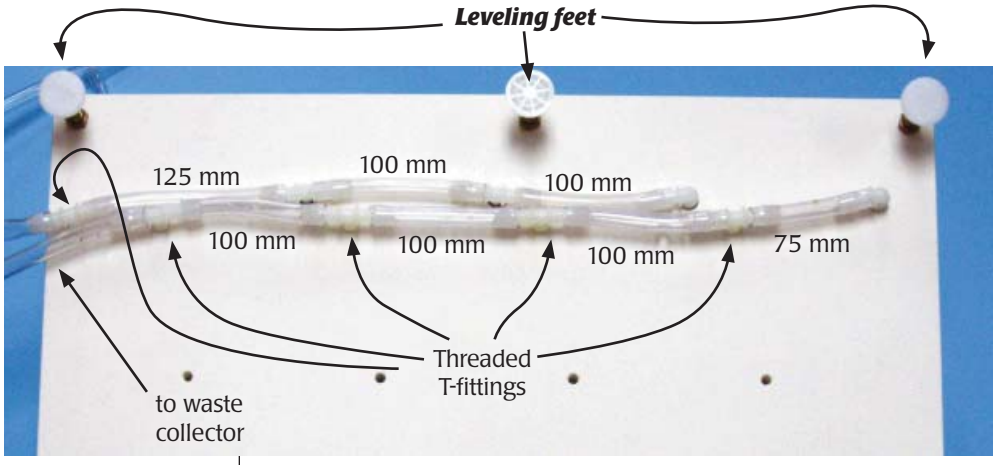


Fig. 4 *– Underside of baseplate, showing feet and drain tubing.*

Step 2: Support frame installation

7. Put the baseplate (feet down) in the place where the experiment will be performed.

8. Screw four 60 cm stainless steel posts (WPI# **503075**) into the threaded holes along the center line of the baseplate. Screw the long post (WPI# **503077**) into the threaded hole at the edge. Tighten the posts with a wrench.

9. Put one parallel clamp (WPI# **502193**) and one micrometer positioner (WPI# **47700**) onto each of the four shorter posts. Then mount the upper cross bar (WPI# **47218**) onto the four posts and tighten it with the M5 red screws (WPI# **503088**) at about 450 mm (18 in.) above the base.

10. Mount the bridge block (WPI# **47216**) onto the long side of the light rectangular plate (WPI# **503083**) from the bottom with the M8 screw (WPI# **200103**) with the slot facing down. Put the assembled plate onto the long post to the height just above the upper cross bar. Tighten the bridge block onto the cross bar with two red M5 screws. Tighten the plate to the long post with a red M5 screw. The current setup is shown in Figure 5.

11. If the Myobath is to be used with the stimulation option, mount the BNC adapters (WPI# **47232**) for the stimulation cables to the upper bar with red M5 screws.

Step 3: Organ bath installation

The jacketed organ bath has six ports with male slips, shown in Figure 6. Warm water circulates in the jacket to maintain the perfusate temperature in the center well; water comes in from the bottom port (Bath-in) and leaves at the top port (Bath-out). The Buffer-in port at the top is for filling buffer from the reservoir. The Drain port is at the bottom and the Overflow port has a slant angle. The Carbogen-in port is near the bottom of the bath and is sealed with a gas-permeable plug allowing carbogen to be bubbled into the buffer.

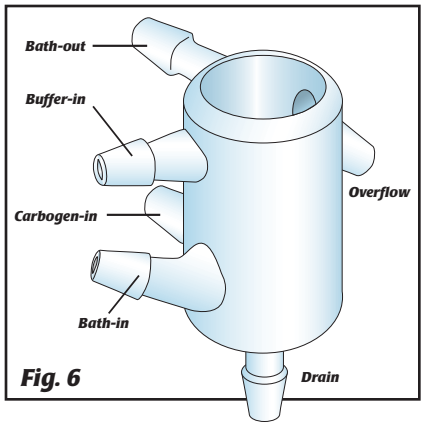


Fig. 6

12. Put the glassware holders (WPI# **14016**) into the parallel clamps and mount them on the left side of the posts.

13. Cut **silicone tubing** into following sections:

- 3 pieces — 200 mm (9 inches) long. Connect the Bath-out port of one organ bath to the Bath-in port of the next organ bath so that all four baths are joined.
- 4 pieces — 90 mm (3.5 inches) long. Put a pinch clamp (WPI# **7465**) onto each piece.
- 1 piece — (3 feet) long. Put a pinch clamp (WPI# **7465**) in the middle of the tubing.
- 1 piece — long enough to reach from the water-out port of the heating circulator to the Bath-in port of the first tissue bath. Put a pinch clamp (WPI# **7465**) onto the tubing.

NOTE: *It is usually easier to attch tubing to the bath while holding the bath in your hand. After the tubing is attached, then mount the bath in the holder.*

14. To the Carbogen-in port of each bath, attach the red polyurethane tubing (WPI# **47225**) by pushing the white connector into the male slip.

15. The buffer solution can be filled either from the top or from the bottom.

- When filling from the top, connect each Buffer-in port with the Tygon tubing (blue connector, WPI# **47228**).
- When filling from the bottom, connect the Drain port with the Tygon tubing (blue connector, WPI# **47228**).

Fig. 7

16. The drain connection is dependent on the filling connection.

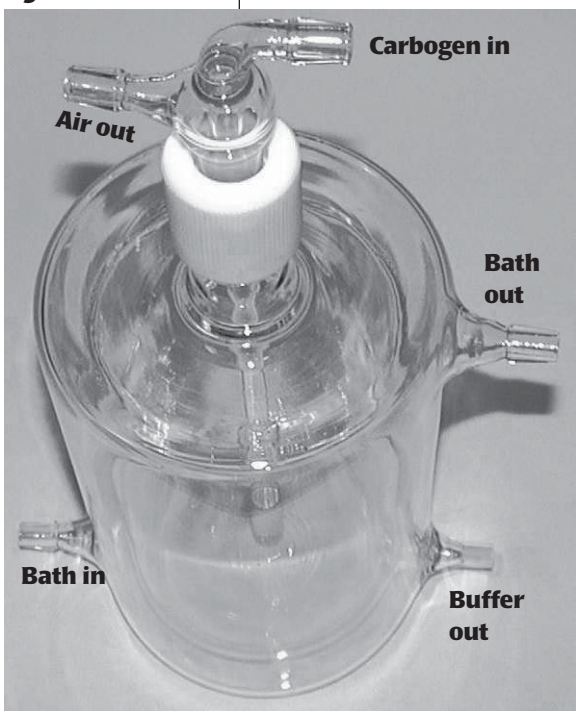
- When filling from the top, connect each barbed fitting (WPI# **14022**) with one 90 mm length of silicone tubing. Screw the barbed fitting into the thread hole where the threaded T-fitting is beneath. Match tissue baths to the barbed fittings. Connect the Drain ports of the tissue baths with the 90 mm silicone tubing accordingly.
- When filling from the bottom, there is no separate drain connection. The threaded holes on the base plates can be covered by a cap (WPI# **3560**).

17. Connect the Overflow port to the PVC tubing by pushing the male slip into the PVC tubing.

18. Adjust the glassware clamp position and put the organ baths into the glassware clamps. Tighten the clamps. The final connections are shown in Figure 7.

Step 4: Reservoir Installation

Fig. 8



The jacketed reservoir (WPI#**47220**) has five ports. Two ports are on the inlet stem: carbogen enters from the Carbogen-in port and mixes into the buffer through the porous stem end; the Air-out port lets excess air out. Warm water circulation to maintain the reservoir temperature is from the Bath-in port at the bottom to the Bath-out port at the top. Buffer flows out from the Buffer-out port. To refill the reservoir, turn the white cap to loosen it and remove the inlet stem.

18. Connect the 3-ft silicone tubing from the reservoir Bath-in port to the Bath-out port of the last tissue bath.

19. Cut one piece of silicone tubing long enough to connect the reservoir to the heating water circulator. Connect the tubing to the reservoir Bath-out port.

20. Attach the white connector of the red polyurethane aeration tubing (WPI# **47225**) to the Carbogen-in port.

21. Attach the blue connector of the 6-inch Tygon tubing (WPI# **47227**) to the Buffer-out port.

22. Mount the buffer manifold (WPI# **14055**) into the front

slot of the bridge block (WPI# **47216**) and tighten it with the thumb screw. Mount the Luer fitting of the reservoir tubing into the manifold's input port (the end port without a control valve).

23. Mount the jaw clamp (WPI# **5459**) on the tall post, about 8.5 inches above the bridge block. Put the reservoir on the platform and secure the reservoir neck with the jaw clamp.

Step 5: Aeration installation

24. Mount the aeration manifold (WPI# **47240**) onto the tall post (or any post convenient for handling).

25. Attach the red tubing from the reservoir stem into the control valve on the end of the aeration manifold. Connect the red tubing from the baths into four control valves on the manifold. The remaining control valve may be used to deliver carbogen to a dissection dish.

26. Connect the main valve to a carbogen source with 1/4-inch OD tubing (not provided).

Step 6: Tissue Holder Installation

27. Several optional tissue holders, allowing use of various tissue preparations, are described in greater detail in the next section of this manual. Tissue holders are mounted on the spindle of the micrometer head. One example is shown here.

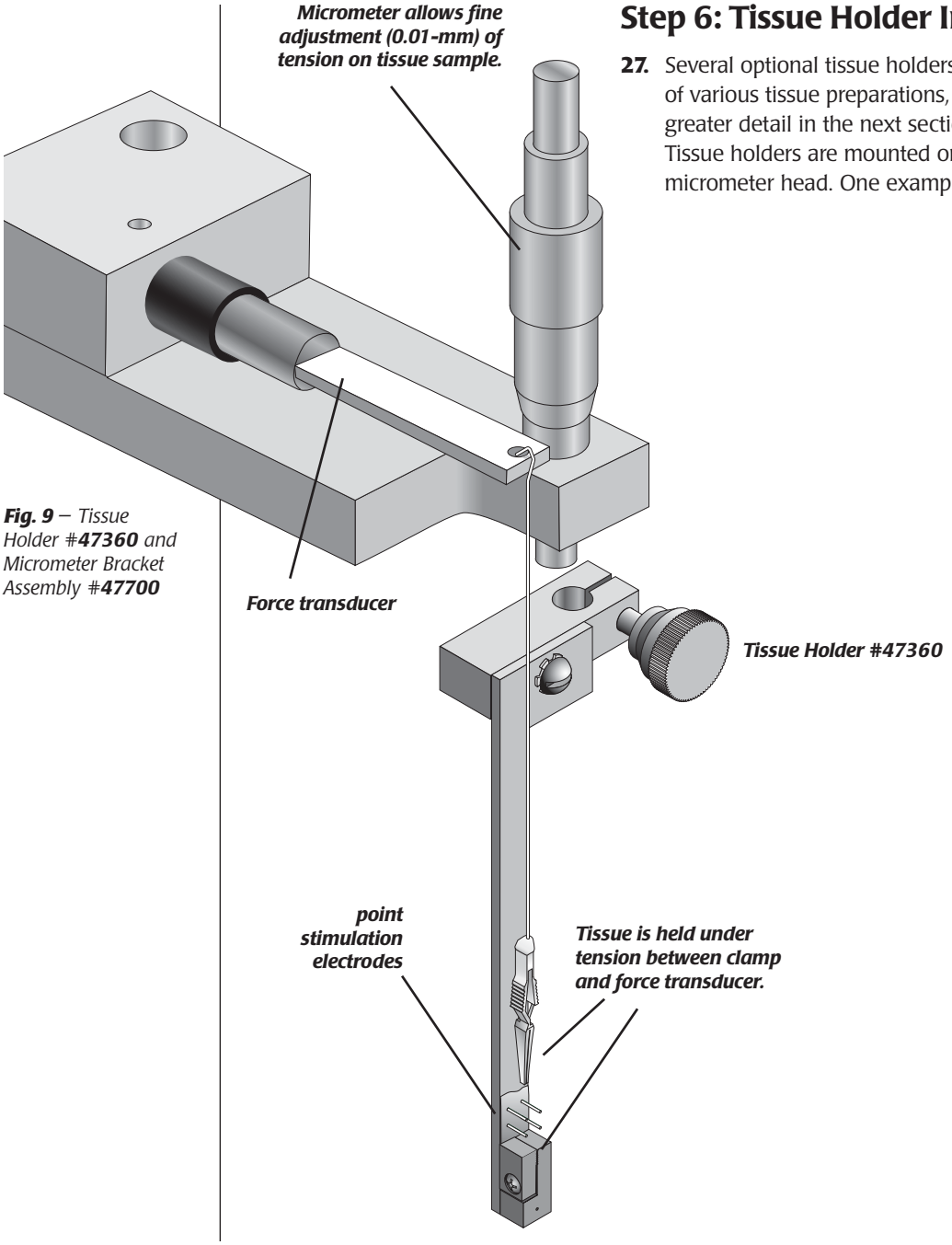


Fig. 9 *– Tissue Holder #**47360** and Micrometer Bracket Assembly #**47700***

Experimental Protocol

1. Buffer and oxygen supply

Throughout an experiment, the tissue should be bathed in a physiological salt solution. A Krebs-based solution commonly used with the MyoBath system is (composition in mM) NaCl 119, KCl 4.7, MgSO 4.7, H_2O 1.17, KH_2PO_4 1.18, $CaCl_2$ 2.5, $NaHCO_3$ 25, and glucose 11 gassed with 5% CO_2 in O_2 (carbogen). The PH of the solution is approximately 7.2-7.4. The carbogen mixture is sent to the aeration manifold for distribution to individual organ baths and the buffer reservoir. Do not have buffer present in the baths without the carbogen supply since buffer will drain back into the aeration tubing.

2. Temperature regulation

The Myobath II system uses jacketed organ baths and a jacketed reservoir for circulating heating water to maintain the temperature. Normally, a heating bath such as Haake **DC10-P5/U** (available from WPI) is used to keep the temperature at 37°C in the organ bath. The temperature difference among four organ baths is negligible (usually < 0.1°C). However, the temperature in the heating bath may be quite different from the organ bath, particularly with long circulation tubing, so the temperature in organ bath should be measured while setting the heating temperature.

3. Blood vessel

Rapidly remove the circumflex artery from the heart of a freshly killed rat and place it in ice-cold physiological Krebs solution bubbled with carbogen. The spare control valve in the aeration manifold can be used to supply carbogen here. The artery should be trimmed of connective tissue and cut into 3mm long segments. While in the dissection dish, the vascular tissue hook is passed through the lumen. The tissue is then transported to the selected bath. Using tweezers, another tissue hook is placed through the lumen of the vessel. Adjust the micrometer positioner so that the tissue is submerged in the buffer. Leave the vessel to equilibrate under zero force at 37°C in Krebs solution gassed with 5% CO_2 in O_2. After 30 minutes, adjust the micrometer so that an initial force of 5 grams is applied. After another 30-minute wait, again readjust the force to 5 grams. After a third 30-minute wait, the experiment can be performed.

4. Beating right atria

Following removal of the rat heart, the right atrium is dissected free and placed in warm, oxygenated physiological Krebs solution. The atria recover quickly and the resting rate is more stable for dissections in Krebs solution at 37°C bubbled with carbogen.

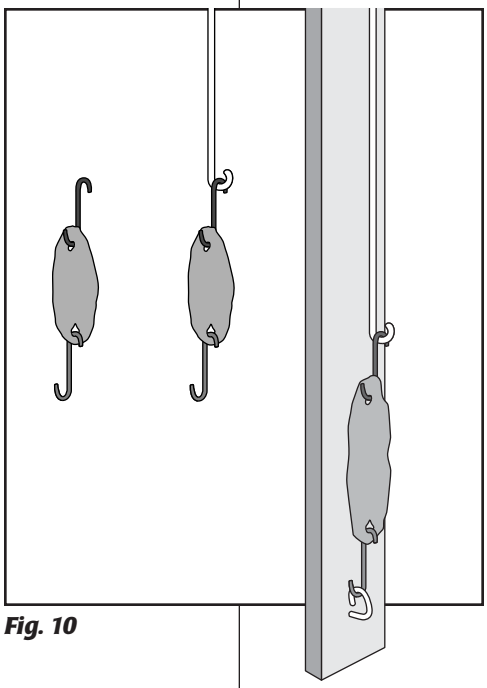


Fig. 10

With the tissue strip holder, the isolated right atrium is gripped with the clamp hook. The preparation is then moved to the Myobath and the hook is hung on the force transducer. Adjust the micrometer head until the lower clamps grip the tissue. Tighten the screw so that the tissue is gripped firmly. Adjust the micrometer positioner to merge the tissue in the buffer maintained at 37°C. Adjust the micrometer so that basal force is maintained at approximately 0.5 gram through experiment. The atrium is washed and left to equilibrate for approximately half an hour until the resting atria rate is stable.

With the atria holder, the isolated right atrium is impaled with two stainless steel atria hooks (made from 30.5 gauge needles with sharp tips). The preparation is then moved to the Myobath where the top hook is placed over the upper tissue hook (tied with force transducer). The lower tissue holder is raised until the lower tissue hook could be placed through the hook on the lower tissue holder. Adjust the micrometer positioner so that the tissue is submerged in buffer maintained at 37°C. Adjust the micrometer so that basal force is maintained at approximately 0.5 gram through experiment. The atrium is washed and left to equilibrate for approximately half an hour until the resting atria rate is stable.

5. Data acquisition and analysis

The output signals from the **Transbridge** amplifier (WPI # **TBM4M**) are recorded with a data acquisition system. Although the WPI tissue bath can be configured to work with any data acquisition system, WPI's **Lab-Trax** is the preferred recording platform. Each channel in the Lab-Trax contains its own 24-bit analog-to-digital converter, an independent stimulator output and a built-in variable gain bridge amplifier. In addition, eight programmable digital outputs are provided. These are easily configured and used to control the automated filling and draining of individual baths. The low profile device fits virtually anywhere and because all functions are integrated into the same instrument, system noise is low — and best of all, the wiring hookup is reduced to plugging in transducers and power. Bundled **Data-Trax** software includes dose response features that can manage multiple runs, calculate ED-50 and draw Schild plots.

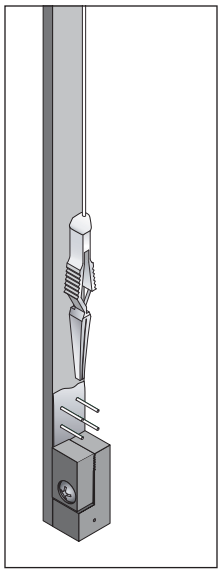


Fig. 11 *– Tissue Holder* ***47360***

Tissue mounting holders

There are three types of tissue holder: strip holder, vascular holder, and atria holder. Each type is also available in a miniature tissue version and/or a stimulation version. The miniature tissue holders are for miniature tissue preparations used in tissue baths as small as 2 or 5 mL. The stimulation tissue holders have a built-in stimulation circuit and external electrodes which are located closely to the tissue under study. The tissue holders have been successfully used in the study of cardiac muscle, vascular and non-vascular smooth muscle.

• Tissue Strip Holder

In the tissue strip holder (WPI# **47350** and WPI#**47360**) the cardiac or smooth muscle is held with serrated jaw clamps. The bottom clamp is made of PVC material and has 3.5 x 5 mm serrated jaws. The hanging hook has 8 x 1.2 mm serrated jaw. The tissue holder can be used for tissue strips as small as 0.5 mm in width, 5 mm in length and in an organ bath as small as 2 mL. The tissue strip holder WPI# **47360** also has a built-in stimulation circuit and electrodes (*see Figure 11*).

Grip the strip tissue in the dissection dish with hook clamp, then transport the preparation to the bath and hang the hook onto the force transducer. Adjust the micrometer head until the lower clamp grips the tissue. Tighten the screw so that the tissue is gripped firmly. Adjust the micrometer positioner to merge the tissue in the buffer maintained at 37°C. These holders are most suitable for measuring isometric force of 5-10 grams.

• Vascular Holder

Vascular holders (WPI# **47310** and WPI# **47330**) are designed for studying the tension and/or contraction of vessel preparations. Holder # **47310** has a stainless steel pin (0.5 mm diameter) to hold the vessel from the bottom. A triangle hook made of 0.4 mm diameter stainless steel wire (WPI# **503012**, 5 mm length or WPI# **503013**, 8 mm length) holds the vessel from the top. This tissue holder is used for vessels with ID larger than 1 mm and in baths above 10 mL.

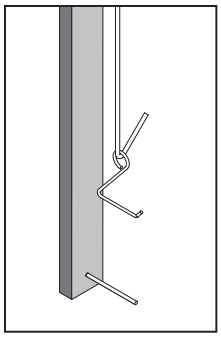


Fig. 12 *– Vascular Holder* ***47310***

Holder # **47330** has a 0.25 mm stainless steel pin to hold the vessel from the bottom. The triangle hook is also made of 0.25 mm stainless steel wire. This tissue holder is used for vessels with ID as small as 0.5 mm and in baths as small as 5 mL.

While in the dissection dish, the bottom wire of a triangle hook is passed through the lumen of the vessel. Using forceps, the triangle hook with the tissue is then transported to the selected tissue bath and hung on the upper hook (suspended from the force transducer). Adjust the micrometer head to place the pin through the lumen of the vessel. It might also be necessary to slightly rotate the green PCB board so that the pin is in the center. Tighten the screw after adjusting the PCB board. Move the micrometer positioner down to submerge the tissue in the buffer. Then follow "Blood vessel" protocol (page 8) to prepare the vascular tissues.

Fig. 13 *– Tissue hooks*

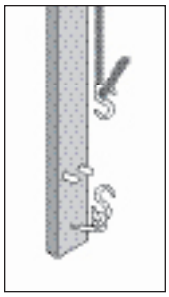


Fig. 14 *– Atria holder with stimulation* ***47250***

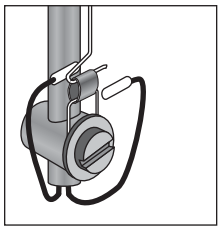


Fig. 15 *– Vascular holder with stimulation* ***47050***

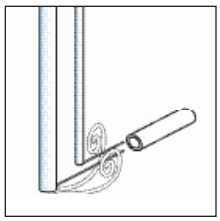


Fig. 16 *– Micro Vessel Holder* ***47120***

• Atria Holder

The atria holder is designed for mounting muscle and atria preparation. The tissue is mounted onto the two S-shaped hooks (made from 30.5 gauge needles). The S-hooks measure 2 mm in S diameter with a sharp tip on one end where tissue is pieced. The two point stimulation platinum (Pt) electrodes on the holder are 2.54 mm (0.1-in.) apart. "Beating right atria" (page 9) provides an example of atria holder application.

• Vascular Holder with Stimulation (VS)

The VS holder is designed for studying the tension and/or contraction of vessel preparations with stimulation. It has two 5 mm flexible platinum stimulation electrodes which can be positioned around the tissue. The bottom hook consists of a U-shaped wire. The top hook is an L-shaped wire. The hooks are made from 0.48 mm (0.019 in.) stainless steel wire. The U-shaped hook measures 6.35 mm (0.25 in.) at the base.

While the vessel is in the dissection dish, the lower vascular tissue hook (the U-shaped hook) is passed through the lumen. Using forceps, the tissue is then transported to the selected tissue bath and the upper tissue hook (hanging from the force transducer) is also placed through the lumen of the vessel. Use tweezers to hang the tissue on the hook. Tighten the U-shaped hook with the screw. Lower the micrometer positioner to submerge the tissue in the buffer. Follow "Blood vessel" protocol (page 8) to prepare the vascular tissues. The stimulation connector and electrodes are designed to be replaceable. The VS holder can only be used in the 25mL or 50mL baths.

• Micro Vessel Holder with Stimulation (MVS1)

MVS1 holder is designed for studying the tension and/or contraction of micro vessel preparations with stimulation. It can be used for vessel preparations as small as 500-600 microns (ID) and in baths above 5mL. It features specially designed spiral stimulation electrodes fabricated from 250-micron diameter platinum wire. The two-and-a-half turns of each spiral electrode span appropriately 4-5 mm. The positions of the spiral electrodes can be adjusted with respect to the tissue placement, a feature that is very useful in controlling stimulus intensity.

While in the dissection dish, the upper vascular tissue hook (the triangle-shaped hook) is passed through the lumen. Using forceps, the tissue is then transported to the selected tissue bath and put on the hook hanging from the force transducer. The lower tissue hook (the L-shaped hook) is also placed through the lumen of the vessel. Lower the micrometer positioner to submerge the tissue in the buffer. Follow "Blood vessel" protocol (page 8) to prepare the vascular tissues.

• Stimulation

The stimulation tissue holders have a built-in stimulation circuit and external electrodes which are located closely to the tissue under study. The electrodes can be fixed (*Figure 14*) or flexible (*Figures15 & 16*). The position of the flexible wire electrodes can be adjusted to provide

maximum stimulation effect.

The electrical contact of the tissue holder is connected (using shielded cables provided) to a BNC adapter mounted on the upper support bar. Stimulus pulses generated by any one of WPI's stimulus isolators can be conveniently connected (via a BNC cable) to the adapter.

Parts List

Part #	Description	Quantity
2851	BNC Cable, 6 ft	4
3560	Plug, 0.375-in. diameter	4
4983	Silicone Tubing, 1/4 ID x 7/16 OD	35 ft
5459	Ringstand Clamp, 10-35mm Jaw	1
7465	Pinch Clamp, Polypropylene	10
7467	Leveling Feet	6
13651	Level Circular	1
14016	Bath Holder	4
14022	Barbed Hose Fitting 1/4ID-1/8NPT	4
14030	Weight, Scale, 5G SS	1
14055	Manifold, 4-Valve W/6 F Ports	1
14073	Right-Angle Frame Clamp	4
14120	Clips, Vessel, 30 g Pressure	1
47216	Bridge Block, T-Slot	1
47217	Baseplate	1
47218	Support Bar, Upper	1
47220	Chamber Assembly, 1.0 Ltr Areation	1
47225	Aeration Tubing	10
47227	Reservoir Tubing	2
47228	Filling Tubing	10
47232	BNC Adaptor	4
47240	Aeration Manifold	1
47700	Micrometer Positioner	4
47800	BNC Stimulation Adapter Assembly	4
400199	PVC Tubing, clear 0375 ID 0500 OD	30 ft
501903	Frog Heart Clips, Fine Tip, 5	2
502193	Parallel Frame Clamp	10
503012	Triangular Hook for Rings, M	10
503014	Holder for Vessel Segments, 2	5
503075	Stainless Steel Post, D12 MM, L600MM M8	4
503077	Stainless Steel Post, D12 MM, L800MM M8	1
503088	Thumbscrew, M5X20MM	10
800709	Luer Male 1/8", Locking Nut	10
801049	Elbow, Nylon, 3/8 Barb	2
801050	T-fitting, threaded, Nylon, 1/8NPT-3/8 Barb	5
801051	T-fitting, barbed, Nylon, 3/8	3

Additional Options

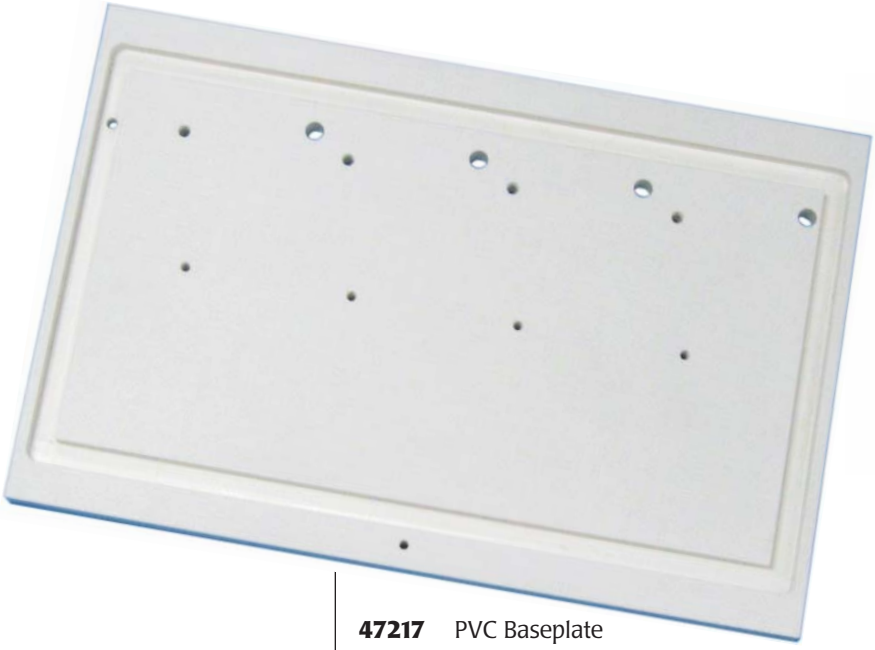
Force Transducer	
FORT10g	Force scale force 10 gram
FORT25	Full scale force 25 gram
FORT100	Full scale force 100 gram
FORT250	Full scale force 250 gram
FORT1000	Full scale force 1000 g
Organ Bath	
47262	Tissue Bath, 2 mL
47263	Tissue Bath, 5 mL
47264	Tissue Bath, 10 mL
47265	Tissue Bath, 25 mL
47266	Tissue Bath, 50 mL
Tissue Holder	
47310	Vascular holder
47050	Vascular holder with stimulation
47250	Atria holder with stimulation
47060	Blank holder with stimulation
47330	Mini vessel holder
47120	Mini vessel holder with stimulation, size 1
47130	Mini vessel holder with stimulation, size 2
47350	Mini strip-tissue holder
47360	Mini strip-tissue holder with stimulation

Data Acquisition System	
TBM4M	4 channel transducer amplifier
BRIDGE8	8 channel transducer amplifier
DBA8000	8 channel digital bridge amplifier
Stimulator and Isolator	
A300	5 channel stimulator
A310	Signal generator
A360	Stimulus isolator
A365	Stimulus isolator
A385	Stimulus isolator
Water circulator	
500787	Haake DC10-P5/U Circulating Bath (115V, 22lb)
500788	Haake DC10-P5/U Circulating Bath (230V, 22lb)
500789	Haake DC10-P5/U Circulating Bath (100V, 22lb)

Accessories

WPI provides following accessory for the convenience to replace existing components. See WPI's catalogue or website (http://www.wpiinc.com) for a complete list of accessories, options and updates. If you need special items, please contact WPI for custom design or modification.

Item	Description
14120	30 g pressure vessel clips, 5 pack
15911	10 g pressure vessel clips, 5 pack
15904	Tissue Bath Surgical Tool Kit (7 pieces)
501903	Heart Muscle Clip, 0.6 mm tips, 5 pack
501904	Heart Muscle Clip, 1x3 mm flat tips, 5 pack
47126-12	Triangular Hook for rings, size S, 12 pack
503012-12	Triangular Hook for rings, size M, 12 pack
503013-12	Triangular Hook for rings, size L, 12 pack
503014	Holder for Vessel Segments, 5 pack

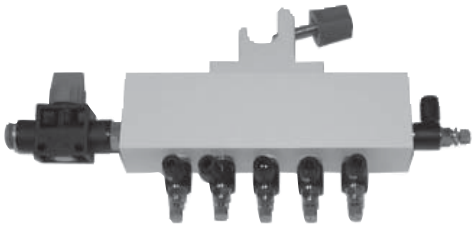


47217 PVC Baseplate

503083 Reservoir Platform

47216 Bridge Block

47218 Upper Cross Bar



47240 Aeration Manifold

47220 1 Liter Reservoir

503075 60 cm Stainless Steel Rod (four)
503077 80 cm Stainless Steel Rod (one)

14016 Bath Holder (4)

5459 Ringstand Clamp

14073 Right-angle Frame Clamp (4)

502193 Parallel Frame Clamp (10)

503088 M5 Thumbscrew (10)

14030 5 g weight

13651 Bubble Level

47232 BNC Adapter (4)

3560 Screw Hole Plug (4)

7467 Levelling Feet for Baseplate (6)

47700 Micrometer Bracket Assembly (4)

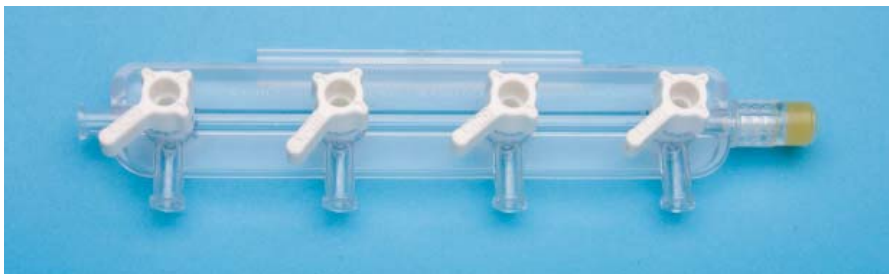
14022 Barbed Fitting (4)

801051 T-Fitting (3)

801050 T-fitting, threaded (5)

801049 Elbow (2)

7465 Pinch Clamp (10)



14055 Liquid Luer Manifold

47227 Reservoir Tubing (2)

47228 Filling Tubing (10)

47225 Aeration Tubing (10)

400199 PVC Tubing, 30 ft (9.1 m)

4983 Silicone Tubing, 35 ft (10.7 m)

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 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. 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.

• WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.

• Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.

• Goods returned for repair must be reasonably clean and free of hazardous materials.

• A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.

• Equipment which was built as a special order cannot be returned.

• Always refer to the RMA# when contacting WPI to obtain a status of your returned item.

• For any other issues regarding a claim or return, please contact the RMA department

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

Warning: This equipment is not designed or intended for use on humans.

World Precision Instruments, Inc.
International Trade Center, 175 Sarasota Center Blvd., Sarasota FL 34240-9258
Tel: 941-371-1003 • Fax: 941-377-5428 • E-mail: sales@wpiinc.com
UK: Astonbury Farm Business Centre • Aston, Stevenage, Hertfordshire SG2 7EG • Tel: 01438-880025 • Fax: 01438-880026 • E-mail: wpiuk@wpi-europe.com
Germany: Liegnitzer Str. 15, D-10999 Berlin • Tel: 030-6188845 • Fax: 030-6188670 • E-mail: wpide@wpi-europe.com

Contents