NETECH

UPM 2000

Ultrasound Power Meter

User Manual

Manual P/N 1200-User-Manual
Initial Release-3/12/2008

Netech Corporation
110 Toledo St, Farmingdale, NY 11735
http://www.Netech.org 1-800-547-6557

Contents

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Warranty

Netech warrants the UPM 2000 against defects in materials and workmanship for one year from the date of original purchase. The standard warranty is extended for a second year if the instrument is returned to Netech for its recommended yearly recalibration.

During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product shipping prepaid to Netech Corporation. Only serialized products are covered under this warranty.

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than Netech Corporation, or if its serial number is defaced or removed.

Netech reserves the right to discontinue the UPM 2000 at any time, and change its specifications, price, or design without notice and without incurring any obligation. Netech guarantees availability of service parts for 5 years after the manufacture of the unit is discontinued.

The warranty is void if you elect to have the unit serviced and/or calibrated by someone other than Netech Corporation.

The warranty covering your product becomes void when the tamper-resistant Quality Seal is removed or broken without proper factory authorization.

We strongly recommend, therefore, that you send your instrument to Netech Corporation for factory service and calibration, especially during the original warranty period.

The purchaser assumes all liability for any damages or bodily injury, which may result from the use or misuse of the unit by the purchaser, his employees, agents, or customers.

Warranty may be void if shipping procedures are not adhered to.

In no event shall Netech Corporation be liable for consequential damages

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Notices

Copyright

Quality Assurance

Netech is ISO 9001-2000 Certified. This instrument was thoroughly tested and inspected according to Netech's ISO 9001-2000 quality standards and test procedures and found to meet those specifications when it was shipped from the factory.

Certification

Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

Trademarks

Netech and UPM 2000 are trademarks of Netech Corporation. Any other trademark names used in this manual are only for editorial purposes and the benefit of the respective trademark owner with no intention of improperly using that trademark.

Refunds and Credits

Please note that only serialized products and their accessory items (i.e., products and items bearing a distinct serial number tag) are eligible for partial refund and/or credit. Non-serialized parts and accessory items (e.g., cables, carrying cases, auxiliary modules, etc.) are not eligible for return or refund. Only products returned within 90 days from the date of original purchase are eligible for refund/credit.

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In order to receive a partial refund/credit of a product purchase price on a serialized product, the product must not have been damaged by the customer or by the carrier chosen by the customer to return the goods, and the product must be returned complete (meaning with all manuals, cables, accessories, etc.) and in "as new" and resalable condition.

Products not returned within 90 days of purchase, or products, which are not in "as new", and resalable condition, are not eligible for credit return and will be returned to the customer. The Return Procedure (see below) must be followed to assure prompt refund/credit.

Restocking Charges

Products returned within 30 days of original purchase are subject to a minimum restocking fee of 15 %. Products returned in excess of 30 days after purchase, but prior to 90 days, are subject to a minimum restocking fee of 20 %. Additional charges for damage and/or missing parts and accessories will be applied to all returns.

Return Procedure

All items being returned (including all warranty-claim shipments) must be sent freight-prepaid to our factory location. When you return an instrument to Netech Corporation, we recommend using United Parcel Service, Federal Express, or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. Netech Corporation will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling. Use the original carton and packaging material for shipment. If they are not available, contact Netech for replacement packing.

Returns for Refund / Credit

A Return Material Authorization (RMA) number must be obtained from our service or customer service dept, before a product is returned for refund or credit. The RMA number should be clearly marked on the package along with a statement indicating the reason for return.

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Repair and Calibration

Products returned for repair or recalibration must obtain the service form which can be down loaded from our website www.Netech.org/service or contact:

Netech Corporation
Service Dept.
110 Toledo Street
New York, 11735

Tel: 1-631-531-0100
Email: Service@Netech.org

WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. Netech Biomedical Corporation will not be responsible for any injuries sustained due to unauthorized equipment modifications.

Changes or modifications to this unit not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Safety Considerations

Use of this instrument is restricted to qualified personnel who recognize shock hazards and are familiar with safety precautions used when operating electrical equipment. Read the manual carefully before operating the UPM2000.

The following warning symbols may be found on the UPM2000:

Symbol	Description
	**Caution: Risk of electric shock**
	**Caution: Refer to documentation**
	**Power Off (Mains)**
	Power On (Mains)
	**DC/AC**
	**DC**
	**AC**
	**Earth (Ground)**

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Hazard Warnings

∗ Warning! Power Rating. The UPM 2000's mains power input must be connected to an external power transformer that provides voltage and current within the specified rating for the system.

Use of an incompatible power transformer may produce electrical shock and fire hazards. See *Specifications* and *Optional Accessories* in Chapter 2.

∗ Warning! Internal Voltage. Always turn off the power switch and unplug the power cord before cleaning the UPM 2000's outer surface.

∗ Warning! Liquids. Avoid spilling liquids on the analyzer; fluid seepage into internal components creates a potential shock hazard. Do not operate the instrument if internal components are exposed to fluid.

Precautions

The following precautions are provided to help you avoid damaging the system:

∗ Caution: Service. Authorized service personnel should service the UPM 2000. Only qualified technical personnel should perform troubleshooting and service procedures on internal components.

∗ Caution: Environmental Conditions. Do not expose the system to temperature extremes. Ambient temperatures should remain between **10-30°C operating or 5-40°C storage**. System performance may be adversely affected if temperatures fluctuate above or below this range.

∗ Caution: Do Not Immerse. Clean only with a mild detergent, and wipe down with a gentle cloth.

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Based on the testing standards below, this device bears the CE mark.

Electromagnetic Interference and Susceptibility

USA FCC CLASS A

Warning: Changes or modifications to this unit not expressly approved by the manufacturer could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Like all similar equipment, this equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at his/her own expense.

Canadian Department of Communications Class A

This digital apparatus does not exceed Class A limits for radio emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Emissions - CLASS A

The system has been type tested by an independent, accredited testing laboratory and found to meet the requirements of EN 61326-1:1998 for Radiated Emissions and Line Conducted emissions. Verification of compliance was conducted to the limits and methods of the following:

CISPR 16-1:1993 and CISPR 16-2:1996

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Immunity

The system has been type tested by an independent, accredited testing laboratory and found to meet the latest harmonized European emissions and immunity standard requirements of EN 61326 for commercial measurement equipment. Verification of compliance was conducted to the limits and methods of the following:

EN 61326-1 IAW EN 61000-4-2	Electrostatic Discharge
EN 61326-1 IAW EN 61000-4-3	Annex D Radiated & Conducted EM
EN 61326-1 IAW EN 61000-4-4	Electrical Fast Transient/Burst
EN 61326-1 IAW EN 61000-4-5	Surge Immunity
EN 61326-1 IAW EN 61000-4-6	Conducted Disturbances
EN 61326-1 IAW EN 61000-4-11	Voltage Interrupts

EC Directive 73/23/EEC Low Voltage (User Safety)

The system has been type tested by an independent testing laboratory and found to meet the requirements of EC Directive 73/23/EEC for Low Voltage. Verification of compliance was conducted to the limits and methods of the following:

EN 61010-1

"Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General requirements" (including amendments 1 & 2).

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Chapter 1: General Information

1

Inside This Chapter

- Summary of Features
- Ultrasound and its Applications
- Patient Treatment with Therapeutic Ultrasound

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UPM 2000

Summary of Features

Netech's UPM 2000 digital ultrasound power meter provides an accurate means of verifying and calibrating the output of therapeutic ultrasound devices. The instrument measures output through a strain gauge bridge transducer.

After the initial output is verified, the UPM 2000 is used to accurately calibrate the ultrasound unit under test.

In addition, the UPM 2000:

- Has a resolution of 0.1 W and a repeatability of ±-3% of readings ± .2 watts from 0 - 30 W;
- Maintains electrical accuracy of .01 grams throughout range;
- Features a large, backlit, easy to read display that enables the user to quickly and accurately make power measurements;
- Can accommodate a variety of transducer shapes and sizes without interfering with the measurement;
- Has a drain hose and stopper for convenient and controlled drainage of the tank.
- Has a built in draft shield for improved stability in readings.
- Measures total-pulsed or continuous-average power.
- Has a selectable readout in grams or watts.
- Can be battery operated or line-powered 120 VAC for long-term sessions.
- Has an RS232 interface.
- Has a field calibration check.
- Is housed in a sturdy Kydex® case.
- Is portable to meet the needs of service groups and biomedical engineers.
- Comes with a soft carrying case as a standard accessory for ease of transporting and storage.

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Ultrasound and Its Applications

Human perception of sound waves is limited to frequencies of fewer than 20,000 vibrations per second. Higher frequency vibrations — between 0.7 and 3.3 MHz — are used for ultrasound therapy. (Most ultrasound equipment produces an output of between 1 and 3.3 MHz.)

An ultrasound unit produces electrical oscillations at a specified frequency that cause the transducer in the ultrasound applicator to generate sound waves. The resulting ultrasonic radiation is transmitted from the ultrasound applicator, or treatment head, through a coupling medium, to the patient's tissue.

Therapeutic Use of Ultrasound

The therapeutic use of ultrasonic energy is accepted worldwide, and most modern hospitals and clinics have ultrasound devices in their physical therapy departments.

Ultrasound therapy is primarily used in the treatment of sports-related injuries. Another common use is the treatment of circulatory disorders and rheumatic diseases of the musculoskeletal system and peripheral nerves. Ultrasound has been found to be extremely effective in treating body areas with a great deal of scar tissue.

Physiological Effects of Ultrasound Therapy

It is well documented that ultrasound therapy heals because of thermal, mechanical, and chemical effects. *

Thermal effects include *deep tissue heating* at depths to 5 cm or more. The thermal effects of ultrasound differ from diathermy (the use of electrical impulses to produce generalized vasodilation) in that the ultrasound beam heats only a small tissue area that approximates the cross-section of the beam. This heating effect is concentrated in muscles, ligaments, nerves, bones, and where the ultrasound beam crosses from one type of tissue to another.

The mechanical effects are best described as *micro massage,* a deep stirring action within the tissue. The benefit of this action is an increased circulation to the damaged tissue. In addition, ultrasound is capable of separating collagen fibers from one another and of changing the tensile strength of tendons, thereby increasing their extensibility.

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The physiological benefits from ultrasound therapy are numerous. Ultrasound therapy affects the peripheral nerves by chemically changing the conduction velocity (this has been shown clinically *in situ).* Ultrasound alters the diffusion of *Na*+ and *K*+ (sodium and potassium) across red blood cell membranes. Ultrasound can also remove some salt deposits from irritated tissues.

** Physical Agents for Physical Therapists, Second Edition, James E. Griffin and Terence Karselis, Charles C. Thomas Publishing Co., 1992.*

Patient Treatment with Therapeutic Ultrasound

The clinician working with ultrasound can ensure successful ultrasound treatment by assessing:

- the physical condition of the patient,
- the absorption coefficient of the tissue(s),
- the energy output of the ultrasound unit (continuous and pulsed),
- the massivity and location of the affected tissue, and
- the spread pattern of the beam.

The most essential assurance that the clinician can have is the verification that the ultrasound unit is producing the ultrasound energy for which it was designed. The Netech UPM 2000 digital power meter enables the clinician to accurately measure this output energy.

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Chapter 2: Description

2

Inside This Chapter

- Specifications
- Overall Unit Layout
- Front Panel Description
- Back Panel Description
- Standard Accessories
- Optional Accessories

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UPM 2000

UPM 2000 Specifications

• Measurement range	0.1 to 30 Watts
• Input Power Level	0 - 30 W
• Input Frequency	0.5 - 10 MHz
• Resolution	0.1 W
• Accuracy, electrical	+/- .15 W (+/-.01 grams) throughout range
• Repeatability	± 3% of reading ± .2 watts
• Zero Shift	Auto Zero button
• Acceptable Transducer Size	up to 6.7 cm (2.65") diameter
• Operating Temperature	10^0 - 30^0 C (50^0 - 86^0 F)
• Power Requirements	9 V alkaline battery (Duracell® MN1604 or equivalent)
• Battery Life	Maximum of 10 hours

Note: **Unit will auto shut down after approximately 10 minutes of inactivity when on battery power. (A 12-volt DC 300 mA transformer unit is a standard accessory for longer-term test sessions) Refer to page 26.**

λ Dimensions	9″ wide x 14 ½″ deep
λ Height	7 ½″ (10 ¾″ with Clamp Post)
λ Case	Kydex ® Unit Layout

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Overall Unit Layout

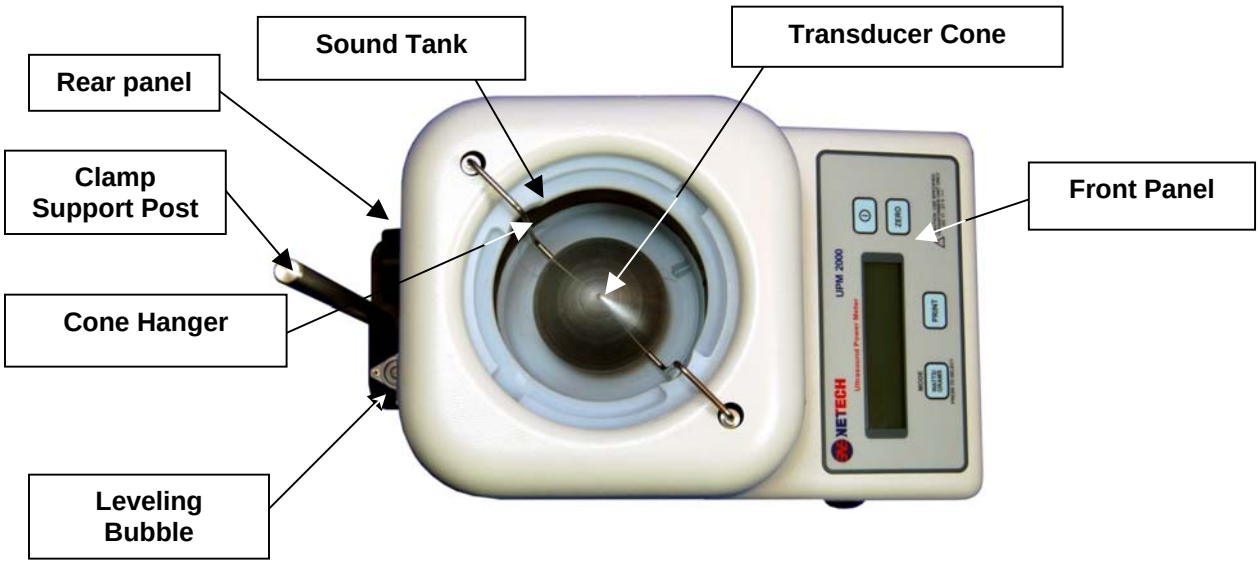

Figure 2-1: UPM 2000 General Layout

The top of the UPM 2000 Ultrasound Power meter is shown in ***Figure 2-1***. It includes the following components.

- Front Panel**: Includes LCD readout and keyboard**.
- Rear Panel: **Includes Battery compartment, RS-232 Connector and Power Transformer Jack.**
- Sound Tank: **To be filled with 600ml ± 50 ml of degassed and de-ionized water for each use.**
- Transducer Cone: **The cone is removable for safe transporting.**
- Leveling Bubble: **Used to help level the unit before turning it on.**
  Leveling Jacks: **Used to adjust the unit to a level position. (***Figure 2-4***)**
- Universal Transducer Clamp Support Post: **A removable vertically mounted bar that the transducer clamp is attached.**

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Front Panel Description

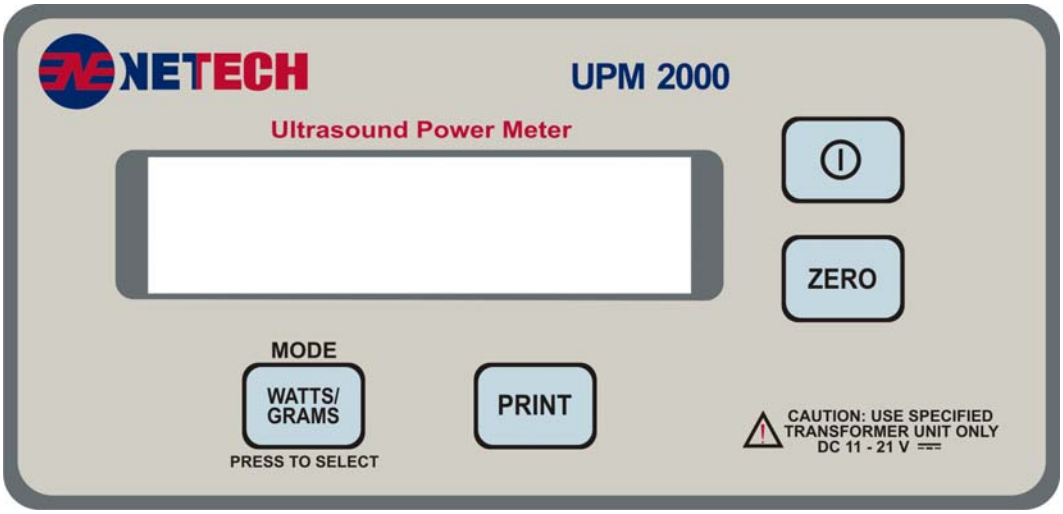

Figure 2-2: UPM 2000 Front Panel Layout

The front panel of the UPM 2000 ultrasound power meter is shown in ***Figure 2-2.*** It includes the following components:

- **LCD Display:** Indicates the meter reading in watts or grams.
- Power On/Off Switch: Turns the power provided by an alkaline battery (or transformer) on and off.
- Auto Zero Button: **Adjusts the LCD display to 00.0 watts or 0.00 grams depending on the mode selected.**
- Mode button: **Switches the mode from watts to grams and back.**
- Print Button**: Sends the text on screen to the RS-232 port for printing or recording**

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Back Panel Description

The back panel of the UPM 2000 is shown in ***Figure 2-3***. It includes the following components:

- **Battery Compartment:** Allows access to the instrument's 9 V dc battery. The hinged plastic battery cover opens to expose the battery compartment during battery replacement. This cover should remain closed during normal operation of the instrument.
- **Wall Transformer Jack:** When using the wall-mounted transformer, simply plug into a receptacle.

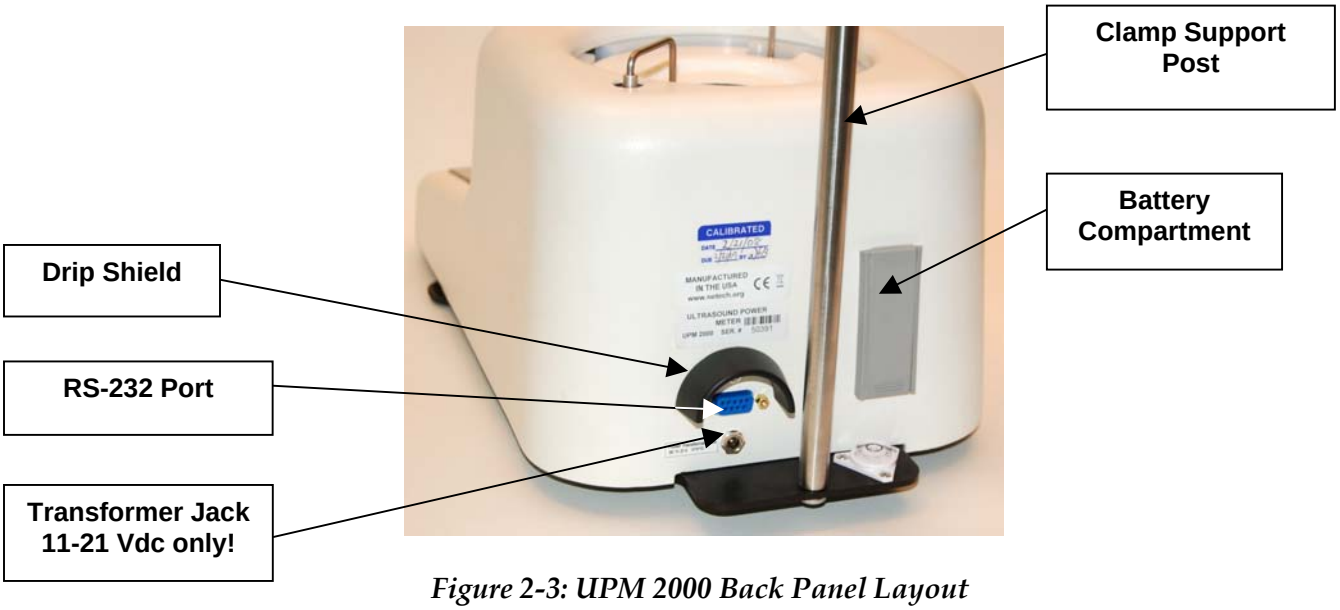

Figure 2-3: UPM 2000 Back Panel Layout

- **RS-232 Port:** To connect to a computer or a printer, use RS 232 cable **PN: 1200-B-232**.
- **Drip Shield**: A drip shield is also provided to minimize the risk of water spillage from getting into the electrical connections. However, care should be exercised to minimize the amount of water spilling down the rear panel.
- **Calibration weight size**: The unit can be calibrated with a 50, 100 or 200 gram weight. A 100 gram test weight is provided.

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Bottom Panel Description

The bottom panel of the UPM 2000 is shown in **Figure 2-4**. It includes the following components:

- **Leveling Jacks:** There are three support legs located on the bottom panel, two of which are threaded to be able to act as leveling jacks for the height adjustment to level the unit.
- **Drain Hose:** The drain tube is stored in a clip on the bottom of the unit. This drain is used to empty the unit when testing is complete. Refer to ***Chapter 3*** for details on usage.

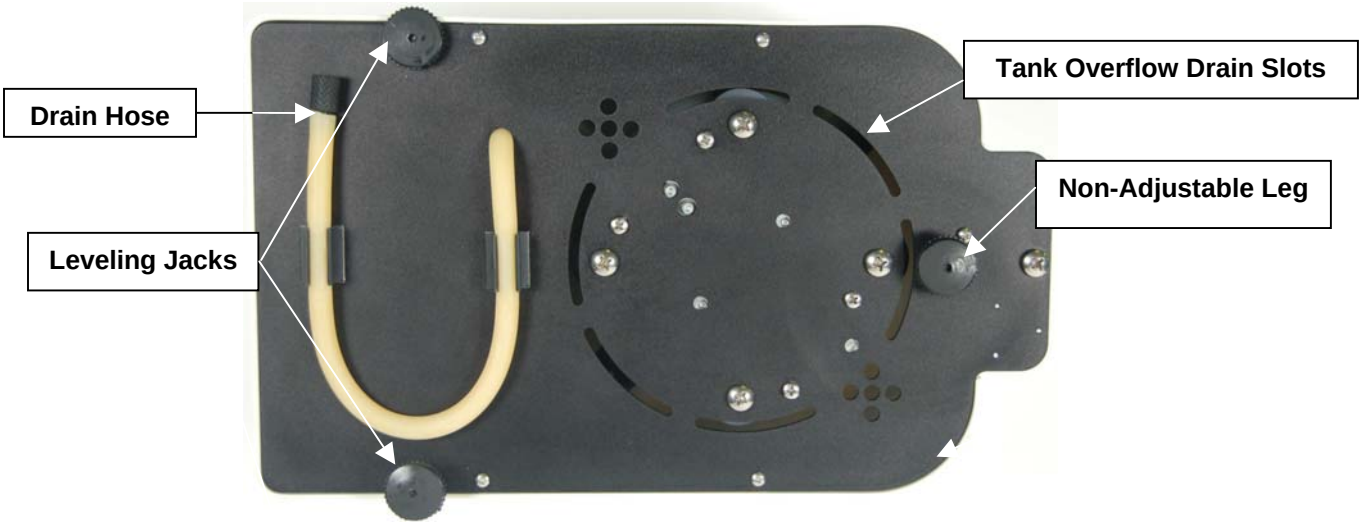

Figure 2-4: UPM 2000 Bottom Panel Layout

- Tank Overflow Drain Slots: In the event that excess water is poured into the sound tank, water will be directed down the sides of the tank and will exit through these slots onto the lab bench, thus preventing water from getting into the electronics.

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Standard Accessories

- Transducer Clamp: **The clamp frees the operator from holding the transducer head in the transducer well during testing.**
- Centering Rings: **Rings used to help ensure that transducers are centered and aimed at the cone properly. This is important for accurate readings.**
- Power Transformer: **An AC wall mounted transformer is provided for extended testing. The installation of this transformer will bypass the battery and allow the unit to stay powered on for extended use.**
- Calibration Check Weight: **A 100 gram OMIL class M1 weight is included. This to be used to ensure the unit is operating properly and is in allowable calibration range.**
- Calibration support ring: **This ring provides a platform for the 100 gram check weight when checking the unit's calibration and performance.**
- Carrying Bag: **A soft bag used for safely transporting and storing the unit.**
- Shipping Container: **This box contains specifically designed foam inserts to ensure safe shipment of the UPM 2000 Power meter. Please save these for future shipment of the unit for service or calibration.**

Note: The Carrying Case is an integral piece of the shipping container. Ship with the carrying case in its original packing. *See Chapter 4- Repackaging and Shipping*.

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Optional Accessories

- Dissolved Oxygen Test Kit: **Tests the dissolved oxygen content of the degassed water. To order this kit, request Netech** PN 1200-O2KIT**.**
- RS-232 Cable: **Used for hooking the unit up to a computer or a serial printer.** PN 1200-B-232
- Transformer Unit:

  Output: 12V⎓ DC 300 mA

  Input:

Description	Part Number
120V~/60 Hz USA 2-Pin UL/CSA	1200-B-AC1
220 V~/50 Hz Euro 2-Pin CE	1200-B-AC2
220 V~/50 Hz UK 3-Pin CE	1200-B-AC3
100 V~/60 Hz Japan 2-Pin	1200-B-AC4
220 V~/50 Hz AUS/NX 2-Pin T-Mark	1200-B-AC5

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Chapter 3: Installation & the Operating Environment

3

Inside This Chapter

- Unpacking and Inspection
- Operation
- UPM 2000 Systems Check
- Beginning Ultrasound Power Measurements
- Using the Universal Transducer Clamp Assembly and Centering Rings
- Ultrasound Unit Testing
- Using the RS232 Port

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Unpacking and Inspection

When you receive the UPM 2000, inspect the shipping carton for damage. If the shipping carton is damaged, unpack the instrument and note any dents and scratches on the UPM 2000. **Immediately notify Netech that the UPM 2000 was damaged in shipping.** Netech will arrange repair or replacement of your instrument without waiting for settlement of the claim against the carrier. **Retain the damaged shipping carton and packing material for the carrier's inspection**.

Be sure to save the box and packing materials. They will be needed when you return the UPM 2000 to Netech for recalibration or future service. (Refer to ***Chapter 4*** for shipping instructions.)

If there is no shipping damage, continue removing the carrying case, with the UPM 2000 in it, from the shipping case. Then check the carrying case for the following accessories that are shipped with every UPM 2000:

- Warranty card (1)
- UPM 2000 Operator's Manual (1)

- Transducer Cone

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UPM 2000

- Cone Hanger

- Clamp Support Post
- Universal Transducer Clamp

- Hook Clamp

- 100 gram calibration check weight

- Calibration weight adapter pedestal

- Centering Rings (3)

- 9 Volt Battery

- Power Transformer

- Carrying Case

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Operation

When operated according to the instructions given in this chapter, the UPM 2000 digital ultrasound power meter will quickly and accurately measure the energy output of ultrasound devices.

Operating Environment

The UPM 2000 **must be allowed to adjust to room temperature** before the unit can be operated. The relative humidity in the room should not exceed 90%.

Refer to ***Chapter 4*** for additional information on safety, storage and shipping requirements for the UPM 2000.

Precautions

When using the UPM 2000 to test ultrasound devices, follow the safety precautions outlined by the ultrasound manufacturer.

- **Do not use any coupling medium other than degassed and distilled water**. Use of improper media can lead to reading variations of up to 10%.
- Do not spill water on the front or rear panel.
- Do not apply more than 30 W of input power to the UPM 2000.
- Do not operate the UPM 2000 for more than 1 hour during testing. Change water after 45 minutes of use.
- Remove and dry the cone when the test is complete.
- Drain the unit completely after each test session.

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Preparing the Distilled and Degassed Water

Distilled and degassed water must be used as the coupling medium to obtain stable and accurate readings with the UPM 2000**. The water must also be allowed to reach room temperature** before pouring into tank in order for unit to stabilize quickly.

Use the following procedure to obtain the best coupling medium:

1. Use a Distiller to distill tap water or purchase distilled water.
2. Boil the distilled water for 30 minutes in a clean glass flask. This will force the oxygen and nitrogen from the water. Bottle the water as soon as possible.
3. Select some small glass bottles with good seals for storing the water. Glass canning jars work well.
4. Siphon the boiling degassed water into the bottles and fill each bottle to the brim. Leave no air space in the bottle.
5. Cap the bottles immediately.
6. Allow the water to cool in the bottles. As the water cools, it will contract and a vacuum will be formed if the bottles have been properly sealed. Allow the water to cool to room temperature.
7. Label and date each bottle. The degassed water should remain good for a long time if the seal is not broken.
8. Test each bottle for oxygen content before it is to be used. The oxygen content should be less than 2 ppm. Dissolved oxygen test kits are available from Netech. **(PN: 1200-B-O2KIT)**.

Note: When the bottle is opened and exposed to air, it can be used during the following 45 minutes. Exposure to air makes this water lose its excellent coupling property; therefore, the bottles should not be opened until tests with the UPM 2000 are ready to begin. Be sure to allow water to come to room temperature before use.

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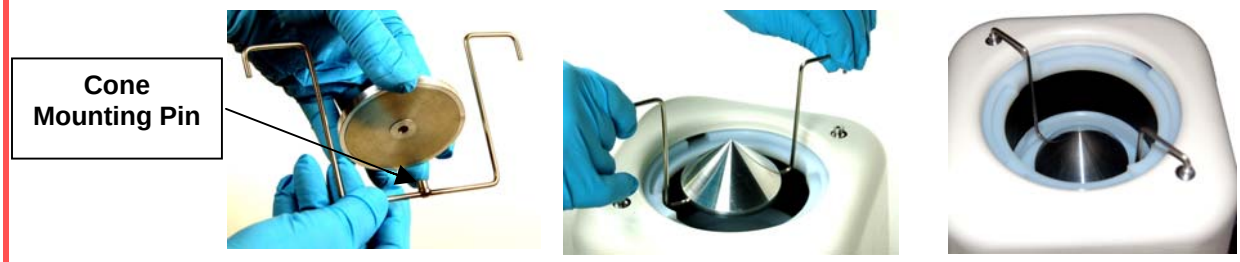
UPM 2000 Systems Check

1. Level the unit using the two adjustable feet in the front of the base of the unit. The unit is level when the bubble is centered. Inspect the transducer cone for

dents and clean if needed**. Do not use a dented cone. Incorrect readings may result.** Inspect the cone hanger to verify that the hanger is not bent or distorted. Check by laying the hanger flat on a table. Make minor adjustments as needed to ensure that the hanger lays flat. Insert the cone hanger into the protruding post holes. Carefully install the cone on the transducer mount pin on the cone hanger as shown below.



2. If a transformer is to be used, plug it into the jack located at the lower left rear of the unit. Then plug the transformer into a wall socket.

Note: There are transformers available for all plug and voltage configurations, which can be ordered separately.

Transformer Unit Power Jack

3. **Allow sufficient time for the UPM 2000 to fully adjust to room temperature**. If the unit is not at room temperature, the transducer will be slowly warming or cooling and will cause the readings to shift.
4. Obtain a bottle of the distilled and degassed water prepared following the procedures discussed earlier in this chapter, *Preparing the Distilled and Degassed Water*. **Be sure that the water is at room temperature before continuing with set up.**

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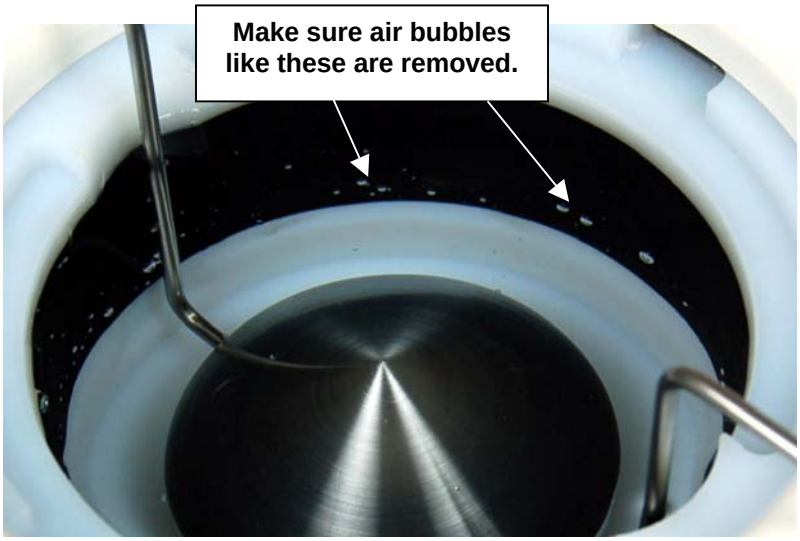
5. Open the bottle of degassed water. When the vacuum seal is broken you should be able to hear it. If you do not hear or feel the vacuum, discard the water.
6. Use a Dissolved Oxygen Test kit to ensure that the oxygen content of the water is less than 2 ppm.

7. Fill the tank with 600 ml ± 50 ml of fresh distilled and degassed water. Do not spill water on the panel of the UPM 2000. Fill until the water reaches slightly above the bottom lip of the well, as shown below.

   Immediately replace the cap on the coupling water bottle.

Note: Be sure the water has been allowed to completely come to room temperature. If the water temperature is lower or higher than the unit and room temperature, it will be difficult, if not impossible, for the unit to achieve a stable zero setting.



8. Insure that there are no air bubbles on or under the transducer cone and stuck to the rubber sound absorber surrounding the cone in the tank. **Air bubbles may induce some reading errors due to buoyancy changes of the transducer cone, erratically bouncing some of the sound beam in the wrong directions or away from the sound absorber.**

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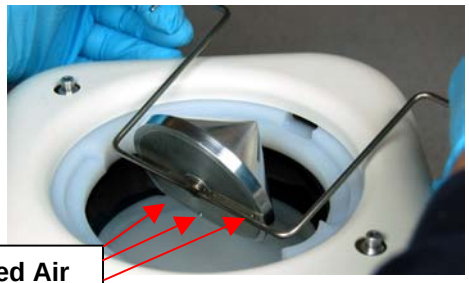
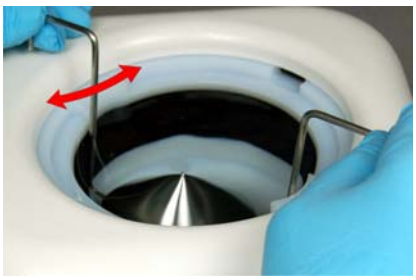
The easiest way to ensure that there are no bubbles under the cone is to lift the cone hanger out of the post mount and tip it to the side. As a final measure, gently swish





the cone side to side before re-seating it on the post mount. This will allow any trapped air to escape and also allow for a visible verification.

9. Turn the unit on and allow 5 minutes for the electronics to warm up and become stable.

Beginning Ultrasound Power Measurements

Measurements

1. Place the transducer in the coupling medium partially submerged so that the head is facing directly downward. Use the centering ring and clamp as needed so that the transducer is exactly centered and is vertical (see section on universal clamp and centering rings below). If the transducer is off center, or not aligned vertically, the reading may be low and out of tolerance. The transducer head should be completely coupled with the distilled and degassed water and there should be no bubbles beneath the radiating head of the transducer.

Note: The coupling water in the transducer well must be changed every 45 minutes or when the readings become unstable. A bottle of opened distilled and degassed water will only be usable for approximately 45 minutes to 1 hour.

2. Turn on the UPM 2000 using the ON switch on the front panel. Ensure that the unit is in the Watts mode (displayed units will read 0).

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3. Allow five minutes for the unit to warm up and stabilize before starting the readings. Once the unit is warmed up, set the digital reading to 00.0 by pressing the AUTO ZERO button. This may take several tries until the unit settles down. Avoid any vibration or movement of the test head, since the unit is VERY sensitive. If the unit cannot be zeroed, refer to the *Troubleshooting* in **Appendix A.**
4. Turn on the ultrasound unit following the manufacturer's instructions. Adjust it to the desired level. Never exceed thirty watts.
5. Read the actual output power in WATTS on the LCD of the UPM 2000.
6. After all of the readings are completed, shut off the ultrasound unit.
7. Remove the water from the transducer well when the measurements are complete. Using the drain tube located in the bottom front, completely drain the well. Remove the drain tube from its storage clip. Holding the tube end over a container, pinch the tube just in front of the stopper with one hand while pulling the stopper out with the other. Remove the stopper and allow the water to drain completely. **It is important to fully drain the unit when testing is complete. This will prevent bacterial growth and other potential water related damage.**
8. Dispose of any water left in the opened bottle of degassed and distilled water. The water will absorb oxygen over time, rendering it ineffective as a coupling medium.

Remove the tube from its clip and raise the tube end. Remove drain cap using a combination of pinching the tube just below the cap and a twisting motion. Once the cap is removed keep the tube pinched until the drain tube is in the container. Move container below the unit until and let the water flow out.

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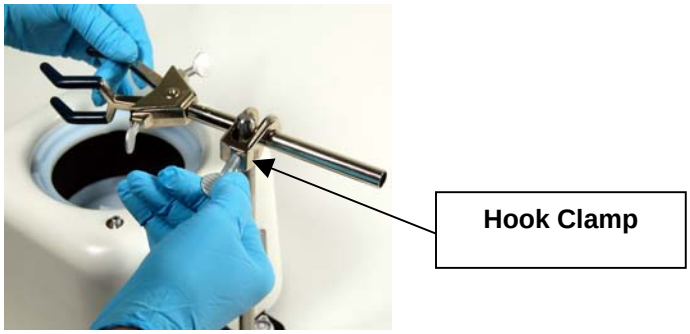
Using the Universal Transducer Clamp Assembly and Centering Rings

The universal transducer clamp assembly frees the operator from holding the transducer treatment (radiating) head in the coupling water and prevents transducer movement, ensuring more accurate and stable readings. The centering rings help to properly center and aim the transducer head in the tank.

1. Screw the clamp support post on the screw stud located at the rear of the unit. Securely tighten by ***hand.*** Do not use pliers to tighten post.

2. Center the transducer clamp assembly over the transducer well, as shown, using the hook clamp to tighten it into place.



3. Place a centering ring, with the hole sized to fit the transducer, on top of the well. The centering ring helps assure that the sound head is properly centered and aimed vertically toward the transducer cone. If there are no centering rings with the proper hole size, one can be cut to the proper size. Just be sure that the enlarged hole is centered in the ring.

4. Loosen the side screw of the clamp assembly so that clamp rotation is easy, and roughly center the clamp opening over the transducer well for vertical transducers without handles (as shown in A), or position it such that it aligns with the transducer handle (as shown in Figure B below).

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Figure A
Clamp orientation transducer without handle

Figure B
Clamp orientation transducer with handle

5. Open the clamp by turning the clamp thumbscrews counterclockwise to fit the desired transducer head or handle.
6. Tighten the clamp screw to effectively grab the transducer head or handle. Make sure that the transducer radiating head (or crystal) remains completely submerged in the coupling water.
7. Re-center the transducer head directly over the middle of the transducer well using the centering ring to assure alignment for accurate readings. Make sure the transducer surface is entirely in the coupling medium. The transducer head should be completely coupled with the distilled and degassed water and there should be no bubbles beneath the radiating head of the transducer. **Any bubbles beneath the transducer head will create a low reading.**

* **Caution**

  Do not ship the power meter with the transducer clamp assembly mounted on the unit, or the cone and hanger still in the unit. Damage to the unit will result and the warranty will be void.

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Ultrasound Unit Testing

Use some form of performance record labels or sheets for record keeping during testing.

Testing Using Discrete Values (Method I)

1. Follow the procedures in this section on operating the UPM 2000. Review the Precautions.
2. Affix a record performance label to the ultrasound unit.

   Set the Ultrasound Unit on discrete values such as 5, 10, 15 or 20.
3. Record these values under Ultrasound Setting on the label.
4. Measure the output on the UPM 2000.
5. Record the UPM 2000 reading under Actual Output in Watts on the performance label.

Testing Using Exact Meter Settings (Method II)

When this method is used, an exact meter setting is obtained for each power desired. This enables the physical therapist to select exactly the ultrasound output that the patient requires.

1. Follow the procedures in this section on UPM 2000 operation. Review the Precautions.
2. Affix a performance label to the ultrasound unit.
3. Adjust the ultrasound unit to read a desired value on the UPM 2000.
4. Record the Ultrasound Setting and the actual UPM 2000 reading on the label.

Using the RS232 Port

The UPM 2000 is equipped with a standard 9-pin female RS-232 port located at the rear of the instrument. A serial printer or a computer may be connected to the UPM 2000 via this port. Printing with the UPM 2000 means that the LCD contents are sent to the printer whenever the Print key on the UPM 2000's front panel is pressed.

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Connecting to a Computer

Using a computer in conjunction with the UPM 2000 requires the following steps:

1. Be certain that the power is off on both the computer and UPM 2000.
2. Attach the UPM 2000 to the computer using a serial interface cable (**PN: 1200-B-232**) or its equivalent.
3. Turn on the computer, and then the UPM 2000.
4. You will need software in order to communicate with the UPM 2000. Terminal emulation software such as *Windows Hyper Terminal*™ or custom software may be used.
5. Configure the software's communications settings for the port you are using to a baud rate of 1200 bps, 7 data bits, odd parity, 1 stop bit, and select "hardware handshaking" if that setting is available. Refer to your computer software's documentation or seek help for the correct procedure.
6. What happens next depends upon the specific software you are using. Refer to its documentation for operating procedures. If you are creating software to interface with the UPM 2000, refer to the protocol information below.

Communications Protocol

Communication with the UPM 2000 is full duplex. There are two commands that may be sent to the UPM 2000 in the form of two byte 7-bit ASCII strings:

Escape P returns the current LCD contents as 22 characters including terminating return and linefeed characters.

Escape T zeroes the UPM 2000 display but returns no characters.

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Chapter 4: Safety, Maintenance & Storage

4

Inside This Chapter

- Recommended Procedures and Precautions
- Calibration Check Procedures
- Maintenance
- Service
- Returning the UPM 2000 for Calibration
- Battery Replacement
- Storage
- Repackaging and Shipping

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Recommended Procedures and Precautions

When using the UPM 2000 to test ultrasound devices, follow the safety precautions specified by the ultrasound manufacturer.

- Do not use any coupling medium other than degassed and distilled water.
- Do not spill water on the front or rear panel.
- Do not apply more than 30 W of input power to the UPM 2000.
- Do not operate the UPM 2000 for more than 1 hour during testing. Change the water between extended tests.

Calibration Check Procedures

UPM 2000 calibration can be verified using the 100 gram weight supplied with the unit to insure that the unit is in good working order. **This procedure is NOT intended to substitute for a regular calibration.** The weight supplied is an OMIL class M1 weight that will weigh between 99.7 and 100.3 grams.

1. The unit should be off at the beginning of this procedure. Remove the cone. Place the calibration weight adaptor pedestal on the cone-mounting pin. This provides stable platform upon which the 100 gram check weight will be placed.

Calibration Weight Adapter Pedestal

100 Gram Weight

2. Turn the unit on and allow it to warm up for 5 minutes.
3. Press the MODE button until the unit displays in grams.
4. Zero the display.
5. Place the calibration check weight on the pedestal. Allow the reading to settle down for 30 seconds to 1 minute. Take the reading.

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6. Remove the calibration check weight. It is normal for the unit to take 30 seconds to 1 minute to completely return to zero.
7. If the reading is 98.3 to 101.8 grams, the unit is in good working order. If the unit is outside of this range, the unit should be returned for repair and/or calibration.

Maintenance

Maintenance of the UPM 2000 power meter is straightforward, requiring little more than keeping it clean. It is important to keep dust and dirt out of the transducer tank. Rinsing the tank with clean water before use, along with proper storage in the carrying case, is all that is required. It is also important that the cone and hanger be removed and stored in the carrying case after use.

Do not use ***any type*** of cleaner in the tank or on the transducer cone. The use of a light detergent and non-abrasive cleaning pad is acceptable on the exterior of the unit.

Service

The mechanical assembly of the UPM 2000 contains no parts that can be serviced by the user. The unit should be returned to Netech Biomedical for repair or calibration. The alignment and adjustment parameters are critical to the performance of the UPM 2000 and can be performed only at the factory or designated distributor.

For service, pack the UPM 2000 according to the *Repackaging and Shipping* instructions in this chapter. **Failure to do so may void warranty.**

Call Netech Customer Service at 1-800-547-6547 (U.S.) or 1-631-531-0100 (International) for shipping instructions.

Returning the UPM 2000 for Recalibration

The UPM 2000 should be recalibrated annually. The instrument should be returned to Netech. Call Netech Customer Service at 1-800-547-6547 (U.S.) or 1-631-531-0100 (International) to obtain a Return Authorization Number and shipping instructions.

For recalibration, pack the UPM 2000 according to the *Repackaging and Shipping* procedures outlined in this chapter. **Failure to do so may void warranty**.

Battery Replacement

When the display blinks several times and turns off shortly after it is turned on, the battery is low and should be replaced. Be aware that when the unit is running on battery, it will shut down within 8-10 minutes automatically, when not being actively used. If the battery is low, it will shut down within seconds of turning on. The alkaline battery (9 V Duracell MN 1604 or equivalent) must be replaced or alternatively a wall mounted transformer unit may be used. To replace the battery, open the hinged plastic battery cover on the instrument's back panel to expose the battery compartment. Replace the battery, and close the battery cover.

Storage

The UPM 2000 ***must*** be stored in an upright position on a flat surface that is relatively free of vibration. The unit should be stored in the carrying bag supplied with the unit. The storage environment should be free of dust and other foreign particles.

The UPM 2000 must have the cone removed and be fully drained for storage. Permanent damage may result if this is not done.

The UPM 2000 can be stored under the following environmental conditions:

Temperature:	5° -40° C (41.3° -106.4° F)
Humidity:	up to 90% relative humidity

The UPM 2000 should be protected from temperature extremes that can cause condensation within the unit and should be stored away from corrosive fumes and vapors.

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Repackaging and Shipping

When the UPM 2000 is shipped to Netech for service or repair, the unit **must** be shipped in the original packing and carrying case; other forms of commercially available packing are not recommended and can void the warranty.

If the original packing has been damaged or lost, contact Netech for replacement packing.

Repackage the instrument according to the following procedures:

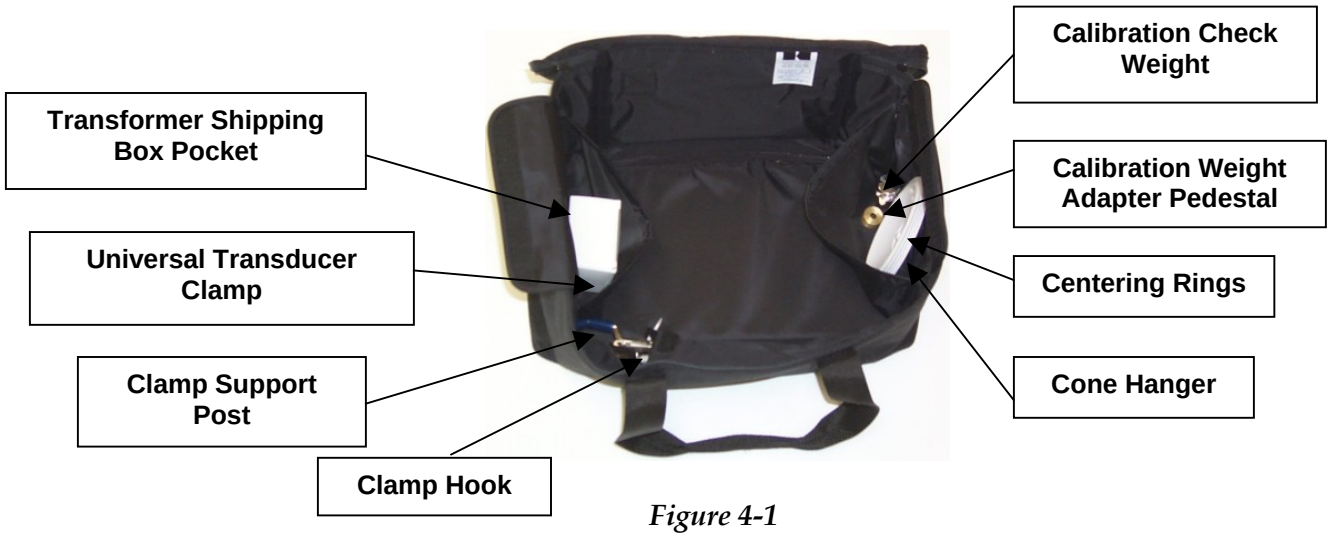

Figure 4-1

- Unplug the wall transformer from the unit, if used. Store it in its box in the left pocket, as shown in ***Figure 4-1***.
- Remove the universal transducer clamp from the clamp support post. Store in front pocket of carrying bag along with the hook clamp.
- Remove all the centering rings from the tank. Remove the cone hanger from the tank. Store the centering rings and cone hanger in right side pocket of the carrying bag.
- Unscrew the transducer clamp support bar. Store it in front pocket of the carrying bag.

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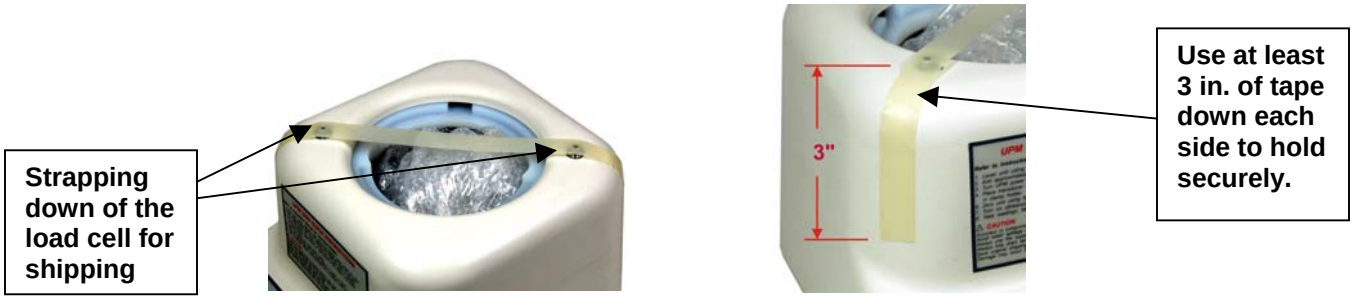
- Wrap the cone in bubble wrap and store it in the tank.



- **Use masking tape or equivalent to secure the load cell for shipping. Failure to due so will void the warranty and cause damage to the unit.**
- Place the UPM 2000 into the carrying bag.
- Make sure all accessories are in their individual compartments and the cover flaps are closed in the carrying bag with the exception of the Transducer Cone.

Figure 4-2

- Place the gray foam padding insert around the UPM 2000 unit in the carrying bag as shown in ***Figure 4-2.***
- Zip the canvas bag cover closed.

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- Pack the UPM 2000 in its original packing material and shipping box. **FAILURE TO USE THE ORIGINAL PACKAGING MATERIAL MAY RESULT IN DAMAGE TO THE UNIT AND VOID THE WARRANTY!**

Proper placement of the foam inserts when re-using the original packaging

Before the UPM 2000 is returned to Netech, make sure you have addressed each item in the following checklist:

- ✓ Obtain a **Return Authorization Number** from Netech's Service Department (1-800-547-6547 U.S.; 1-631-531-0100 International).
- ✓ Write the RMA number on, or near, the shipping label.
- ✓ Include a statement of what is required of the Netech Service Department. State whether the unit requires calibration, cleaning, or repair.
  - Include a tag that specifies the Return Authorization Number, the full model number and the serial number.
  - Provide Netech with a contact name, telephone number, and email (if applicable), should there be any questions.
  - Insure the UPM 2000 for its full value.
  - Mark the shipping box clearly as **FRAGILE**.
  - Mark the shipping box clearly with arrows indicating **THIS END UP.**

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Appendix A: Troubleshooting Guide

A

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The UPM 2000 will display an error code if improper use or an abnormal condition is detected. Consult the following table for possible error codes, the probable cause, and corrective action.

Error Code	Description	Corrective Action
uL	Indicates that an under-load is sensed. This error usually occurs when neither the cone nor the calibration weight adapter pedestal is in place on the load cell.	Replace the cone, or if calibrating, place the calibration weight adapter on the cone-mounting pin. The condition may also indicate defective electronics or load cell. If the condition cannot be cleared, return the unit to the factory for service.
oL	Indicates that there may be an excessive force applied to the load cell.	Remove excessive load from the load cell immediately. If this condition occurs without any weight on the load cell, this indicates either defective electronics or a damaged load cell. Turn the unit off and back on again to see if the error clears. If the error repeats, the unit must be returned to the factory for service. If this error occurs during a calibration check with the 100 gram check weight but the unit seems to read normally without the weight on, this indicates that the unit needs to be recalibrated. The onboard processor only allows readings up to 5% over 200 grams. The processor will display the **oL** error code for any readings above this range.
E-02	Usually the result of the unit being exposed to excessive vibration, draft, or unstable environments during calibration.	Move to a more stable work surface and/or improve environmental conditions. Before initiating the calibration process, wait until a stable zero is displayed.
E-10	Indicates that an attempt was made to zero the display with a value stored in memory. This error code will appear if the AUTO ZERO key is pressed momentarily while there is a measurement stored in memory.	The memory function is not relevant to the UPM 2000; however, memory must be cleared. Press and hold the ON button until a beep is heard, then press the ZERO/PRINT button momentarily. This action will clear memory and the display and will restore normal function.

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Error Code	Description	Corrective Action
E-11	Indicates an attempt to store a measured value when the displayed value is zero. This error code will appear momentarily if the ON button is pressed after the instrument is turned on.	In its original application as a balance, a secondary function of the ON button was to add the current measurement to the value stored in memory. This is not applicable to the UPM 2000 and may be ignored. Turn the UPM 2000 off, then on to restore normal function.
E-54	Appears on the display when the unit is powered on if the electronics are no longer within factory-set parameters. Probable causes include: ✓ An object was dropped onto the load cell. ✓ The Unit was dropped. ✓ The load cell was damaged while the cone was being removed from or placed on the cone-mounting pin.	Return the unit to the factory service center.
SYS.Err	**This symbol displayed in the upper left corner of the display indicates a serious problem. Possible causes include:** ✓ Something is causing the load cell to function out of specification. ✓ Rough or improper handling of the unit. ✓ Liquids or other materials spilled onto the electronics.	**Return the unit to the factory service center for evaluation and repair.**

Communication failures between the UPM 2000 and a printer or a PC are usually caused by the serial cable or incorrect parameter settings. Troubleshoot as follows:

1. Verify that the correct serial cable is being used. The correct cable is Netech PN: 1200-B-232 or equivalent 9-pin "straight-through" male-female cable.
2. If attempting to communicate with a PC, verify that the serial cable is connected to the desired port and that the port settings are **1200, 7, N, 1**.
3. If attempting to interface with a printer, check the printer's settings.

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Other Problems

Unit does not return to 0.0 +/- .1 watts after taking readings.

Allow at least 10 seconds for the reading to return to zero. There is a lag in the readings due to potting on the strain gauges.

There is a possibility that air bubbles have collected under the cone causing a slight change in the buoyancy. Gently spin the cone to help dislodge them and lightly tap the sides of the unit while tipping the unit on edge until all air bubbles appear to be removed.

If allowing 10 seconds more does not allow reading to return to zero, then the unit and water have probably not fully temperature equalized. Allow the unit to sit while turned on for at least 10 more minutes then re-zero the unit and try again. Repeat the 10-minute settling time if zero drift persists.

Readings do not stabilize and slowly decrease.

This condition usually indicates that the water has absorbed too much air and should be replaced with fresh water. When too much air is in the water, air bubbles tend to build up in the sound beam and bounce some of the sound away from the cone, thus lowering the reading.

Unit fails to power up or battery drains quickly.

Verify there is a fresh 9V Battery in the Unit. If the Battery fails to hold up for approx. 10 hours' operation this indicates a problem with the electronics; return the unit to Netech Biomedical, for Factory Service. Remember, when on battery power, the unit will automatically shut off after 8-10 minutes to save battery power if not in use.

Use the recommended power transformer to power the unit. If the unit still fails to power up or the transformer runs hot, this indicates a problem with the electronics. Return the unit to Netech Biomedical for Factory Service.

Numbers appear to the left of the display.

Should a digit (such as 1, 5, 6, or 7) followed by a decimal point show up toward the left side of the display (possibly followed by one or two other digits followed by decimal points, you have inadvertently entered into Service Menu Codes, and your unit's calibration and communications setups could be affected. Call Netech Biomedical Service Center 631-531-0100 for how to get out of the Service Menu Codes without affecting the operation of your UPM 2000 and voiding the warranty.

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