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SHUR*/Wave*™

Microwave Tissue Processor

Catalog # SW-120 and SW-220

Operator's Manual

Version 1.5c – December 13, 2011

Be certain to read this manual thoroughly
before proceeding with unpacking and installation.

WELCOME

Thank you for selecting the **SHUR**/*Wave*™ Laboratory Microwave. **SHUR**/*Wave*™ was carefully designed to be easy to use, safe to operate and capable of producing consistent, quality results. The embedded Personal Computer affords you the flexibility and reproducibility required by the modern laboratory. The ventilation system and built-in software safety features protect you, the operator. Internal electronic sensors protect the instrument, and sophisticated temperature monitoring and advanced electronics provide safety for your specimens. The ability to optimize each step of every program will allow you to create programs that yield excellent reproducible results time after time.

The employees of TBS thank you for your support. Feel free to call TBS customer service at 919-384-9393 or e-mail us for support at service@trianglebiomedical.com.

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INTERNATIONAL SAFETY SYMBOLS

Caution – General Danger

Caution – High Voltage

Protective Earth (Ground) Terminal

No Food or Drink Allowed

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SHUR/*Wave*™ – *110-120 ONLY*

Instruments manufactured for this voltage range do not have built in fuses. Instead these units are protected with a built in circuit breaker. When the breaker trips the ON/OFF switch to the off position, the only operation required to reset the breaker is to wait three (3) minutes and then reset the switch.

General Warnings

Safety Precautions

- Properly functioning instruments will not present a microwave exposure risk, however, improper use of the instrument or use in a manner inconsistent with the procedures set forth in this manual should be considered dangerous and must be avoided.

- NEVER operate the **SHUR**/*Wave*™ when it is empty. If there is an insufficient load, the microwaves will not be absorbed and will be redirected through the waveguide back to the magnetron. When running a small load, place a container of room temperature water inside the cavity to protect the magnetron from damage.

- Use the same universal safety precautions for infectious specimens and hazardous materials that you would enforce elsewhere in the lab.

- DO NOT USE SEALED CONTAINERS in the **SHUR**/*Wave*™. Lids must either be vented or be loosely placed on the container. Use only manufacturer's supplied lids.

- **SHUR**/*Wave*™ should never be used to heat food or drink.

- The electrical cord and plug should be checked routinely for evidence of fraying or cracking to prevent electrical shock.

- ONLY AUTHORIZED PERSONNEL should service this instrument. Do not attempt to tamper with or make any adjustments or repairs to the door or other components. Do not remove the cover unless specifically directed by an authorized service agent.

- Do not cover or block any air vents or openings on the instrument.

Microwave Chamber

- Do not remove the plastic tray from the ceiling of the chamber.

- The interior of the microwave must be cleaned after each use.

- Clean up any spills or splatters immediately.

- Use water and non-abrasive cleaners and disinfectants. Do not use abrasive cleaners or steel wool.

Access Door

- Safety interlocks and automatic switches prevent the production of microwaves if the door is opened. Do not operate the **SHUR**/*Wave*™ if the door does not close properly or if it is damaged in any way.

- The door has a seal that will prevent microwave leakage. Check to see that the door seals and closes evenly.
- Do not hold the instrument by the door when lifting or repositioning on a cabinet.
- It is good practice to stand back from the microwave while it is in operation to protect against the unlikely event of microwave leakage and exposure to harmful materials.
- A third party compliant microwave leakage detector should be used to identify any microwave leakage from the instrument. It is advisable to test periodically for leakage. The American National Standards Institute (ANSI) and the International Radiation Protection Association (IRPA) set guidelines for limits.

Temperature Probe

- Temperature is measured using a flexible thermocouple temperature probe, combined with a built-in feedback control system. This probe must be inserted into the sample container through any of the center holes in the cover and must be submerged into the bulk of the reagent at least 2 inches (measured from its tip). Never place the probe nearby the perimeter of the sample container and never use it without the top lid cover.
- Do not place a mercury thermometer inside the microwave while it is in operation.

The Ventilation System

- During normal operation the instrument maximum power consumption could reach 1,700 Watts, which is equivalent to 5, 800 BTU/hr. The built-in ventilation system on the **SHUR**/*Wave*™ can be ducted into the facility's exhaust system or a laboratory hood using 4" flexible tubing. The ventilation system evacuates the chamber, eliminating the chance of exposure to hazardous fumes when the door is opened or during operation. The exhaust specifications are:

    - Air Flow: 103 CFM or 175 M^3/hour
    - Static Pressure: 9.1 mmH_2O
    - Processing Chamber heat generation: 2,220 BTU/hr. maximum
    - Internal Instrument heat generation: 3,580 BTU/hr.
    - Total heat generation: 5,800 BTU/hr. maximum

- Be certain to seek qualified advice as to the size of fan (airflow static pressure and CFM) that is necessary to obtain the required distance and never dump hazardous gases into the atmosphere without checking with regulatory bodies as to allowed levels of contaminants.
- If the airflow in the chamber is not sufficient, a vent interlock failure screen will appear and the system will shut down until the airflow is increased. Check the exhaust system regularly for possible debris or blockage.

Containers and Solutions

- Use microwave-transparent containers, such as polystyrene, plastic or tempered glass (Pyrex). ***WARNING:*** NOT ALL PLASTIC AND GLASS MATERIAL IS SUITABLE FOR MICROWAVE USE. Some plastics contain materials that are affected by microwave energy. Some glass may contain high levels of metal (especially lead). ***BEST RULE:*** Do

not use containers that are not specifically designed for microwave use, also known as "microwavable."

- Use thermal mitts to remove hot objects from the cavity. Liquids heated in the microwave have the same properties as if they were heated with a conventional method. There is danger of burns from direct contact with processed liquid and from the possible steam produced. It is advisable to wait for several seconds after the microwave has completed a step before opening the door and removing the container.
- Heated solutions are extremely volatile and the fumes from hazardous solutions can have serious or sometimes deadly effects. When removing heated toxic solutions, be sure they are loosely covered before removing them from the chamber. Do not carry heated toxic solutions in a way that the fumes could enter the breathing zone of you or your coworkers.

- All lids must be loose-fitting and vented.
- Do not use the instrument without having a vented lid placed over the sample container.
- Do not use other lids than those provided by the manufacturer – many materials may look suitable, but may not be appropriate for microwave use.
- Exercise care when heating flammable solvents. Be certain to follow your laboratory's standard handling procedures for flammable solvents and other dangerous materials.
- Do not microwave formalin unless you understand and follow OSHA's Formaldehyde Standard. Protocols must be documented in a Chemical Hygiene Plan under OSHA's Laboratory Standard. Lethal concentrations (100ppm) will be generated and will remain as long as the solution is hot.
- NEVER use chloroform, acetone, xylene, and picric acid.

Disclaimer

This instrument is for use in laboratories by trained personnel only. **SHUR**/*Wave*™ should only be used in accordance with the cautions and instructions contained in this manual. The manufacturer declines all responsibility for possible damages to persons and/or objects due to improper operation of this instrument.

Specifications

Software version at the date of publication: 1v9h
Dual magnetron system rated to 1200 watts (maximum)
Dual waveguides and stirrers
PID (Proportional-Integral-Differential) temperature control
Controlled by an embedded personal computer (ePC)
Color touch screen interface with adjustable tilt
Graphical temperature vs. time readout
Defined power calculation program and control
Dual range timer for working in minutes/seconds or hours/minutes
Built-in FDD (Floppy Disk Drive) for loading program updates and exporting results and logs
Stainless steel interior with ceramic floor
Ventilated chamber with standard 4" duct port
Equipped with magnetron pre-warming technology
Infinitely variable power with continuous or pulsed power operation
Ramp-up rate calculator
Adjustable air bubble agitation

Accurate and reliable temperature probe
Dual air/fluid ports
Safety interlock door mechanisms
Over temperature sensor logic (computer controlled)
Over temperature sensor cut-off on chamber walls (analog)
Installation Category II, Pollution Degree II

Dimensions		
Outside	(17 x 21 x 21) in	(43 x 53 x 53) cm
Chamber	(13 x 12 x 07) in	(33 x 31 x 17) cm
Weight		
SHUR/*Wave*™	77 lbs	35 kg
SHUR/*Wave*™ with shipping crate	177 lbs	80 kg

Power Requirements	
SW -100	100VAC, 20A, 50/60Hz
SW -120	120VAC, 20A, 50/60Hz
SW -230	220-240VAC, 15A, 50/60Hz

Chapter 1 – Installation

Unpacking the Instrument

- Do not use the door handle to lift or move the **SHUR**/*Wave*™.
- Do not use the 4” ventilation port to lift or move the **SHUR**/*Wave*™.

Unlock the locks on the outside of the crate, carefully lift the top straight up and then set it aside. To remove the **SHUR**/*Wave*™ from the packaging, position a person on each side of the instrument (not front and back). The **SHUR**/*Wave*™ should be held by the bottom framework and lifted straight up. Remove any packing material on the exterior as well as from the chamber.

Environmental Requirements

The **SHUR**/*Wave*™ is considered to be a Pollution Degree II device under the UL 61010-1 standard and other international electrical safety standards. Ambient room temperature where the **SHUR**/*Wave*™ is operated should be between 20°C and 40°C, with a maximum relative humidity of 80% at up to 31°C, decreasing linearly to 50% at 40°C.

- Do not set up the **SHUR**/*Wave*™ under air or heating vents or windows.

Electrical Requirements

WARNING: **SHUR**/*Wave*™ MUST BE GROUNDED!

- Do not remove the ground prong from the plug or bend the prongs to fit into a receptacle other than the one configured for your instrument.
- Do not use a two-prong adapter.

SHUR/*Wave*™ is considered to be an Installation Category II instrument under the UL 31010-1 standard and other international electrical safety standards. **SHUR**/*Wave*™ must be connected directly to a dedicated electrical outlet with at least a 20 Amp, 120V circuit, using the plug supplied with the instrument. Use of an extension cord or using a shared line could cause problems with wattage output. The wattage output will vary depending on the power that is delivered to the facility and any activity from other instruments. For accuracy and reproducibility, the wattage output of the microwave should be calculated and recorded routinely. Microwaves draw a large amount of power and can cause line fluctuations that may affect the operation of other lab instruments.

Fuse Rating

SHUR/*Wave*™ uses two Littelfuse FLQ Midget series fuses (or UL/CSA Listed equivalents) of the following ratings:

SHUR/*Wave*™ – 230VAC – 20A, 500V ($^{13}/_{32}$” x 1 ½”) time-delay fuse (Littelfuse FLQ-10)

Ventilation Requirements

WARNING: DO NOT USE TOXIC REAGENTS IN THE **SHUR**/*Wave*™ UNLESS IT IS PROPERLY VENTILATED TO REMOVE THE FUMES FROM THE WORK AREA AND REGULATIONS ALLOW THE EXHAUSTING OF FUMES. KEEP HOT TOXIC REAGENTS UNDER A HOOD. DO NOT ALLOW TOXIC FUMES TO ENTER THE BREATHING ZONE.

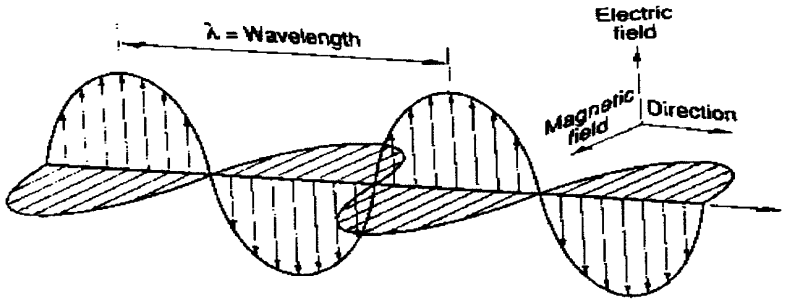
Connect the **SHUR**/*Wave*™ to an appropriate laboratory ventilation system or connect no more than 10 feet of 4” dryer tubing to the vent elbow and place the other end into a laboratory hood, or vent to the atmosphere if regulations permit. Be certain to follow all guidelines specific to your laboratory and all regulatory requirements related to venting specific fumes into the atmosphere.

Chapter 2 – Introduction

This section of the operator's manual is offered to help you understand microwave technology, how the **SHUR**/*Wave*™ works and how it can be used to run your laboratory more efficiently.

Introduction to Microwave Technology

A microwave is a wave of electromagnetic energy and a form of non-ionizing radiation. The wave consists of growing and collapsing electric and magnetic fields that are oriented at right angles to one another. The electric field moves up and down while the magnetic field moves back and forth. The relationship between the fields stays the same as the wave moves in a direction perpendicular to both of them. Their length from crest to crest is the *wavelength*, their height is the *amplitude* and the amount of time between them is their *frequency*. Like other forms of radiant energy, such as radio waves, infrared light, visible light, and x-rays, microwaves are created by accelerated electrical charges. Microwaves are used to carry information in satellite communication and cellular phones; radar bounces microwaves from objects to determine their position and speed; *and microwave ovens use microwaves to add thermal energy to polar molecules in order to accelerate reactions.*



All EM waves travel through a vacuum at the speed of light (about 186,282 miles/second), but the speed is reduced by various amounts whenever a wave travels through matter. EM waves will either *travel through* a substance, be *absorbed* by the substance or be *reflected* from it. If the wave travels through a substance, that substance is considered to be "microwave-transparent." Examples of such substances include solid paraffin, Styrofoam and most plastics. If a substance, such as water, absorbs the energy, then the amplitude of the waves decreases and the depth of penetration is decreased. The stainless steel walls of the microwave chamber reflect microwaves, causing them to form a standing wave pattern (waves coming from opposite directions which are reflected each time that they hit the walls).

Microwave equipment has a standard frequency of 2.45 GHz. At that frequency, the wavelength of a microwave in air is 12.2 cm, but that figure is greatly reduced as the wave enters a substance. The ability of microwaves to penetrate various reagents and tissue specimens is dependent on temperature and on the "permittivity" (the permissive nature) of the material. Several histology microwave technique books provide tables that give penetration depth measurement guidelines for specific substances.

Electromagnetic (EM) radiation exhibits particle-like properties. The energy carried is viewed as packets (or "quanta") of energy called photons. The energy of a photon is related to the frequency of the radiation. A photon has no mass, but it transfers its energy in a way that is

similar to what happens when one object strikes another. Each object usually undergoes a change in direction, momentum and energy.

How the Microwave Works

In microwave instruments, microwaves are produced by a magnetron that consists of an anode and a cathode. The anode is a hollow cylinder of iron containing an even number of “vanes” (walls) that extend inward and surround the centralized cathode, or filament. The vanes create trapezoidal-shaped areas that act as resonant cavities. Alternate cavities are connected so that each cavity is surrounded by cavities of the opposite charge.

The process begins when low voltage is applied to the filament (cathode), causing it to heat and increasing molecular activity. Electrons “boil off” and create a cloud of electrons that hover over the cathode, waiting for momentum. A high-voltage transformer converts typical voltage (115V in the U.S.) to approximately 4000V, which is what is needed for the magnetron to convert the high voltage into electromagnetic energy. The negative high voltage is applied to the cathode, creating a corresponding positive high voltage charge on the anode. As the negatively charged electrons accelerate toward the anode, they are exposed to a strong magnetic field created by two permanent magnets. This field forces the electrons into a circular rotation around the cathode, which eventually expands and reaches the anode. The electrons accelerate to a frequency of 2.45 GHz. (2,450,000,000 cycles per second). Because of the size and geometry of the tube, the system “resonates” (like an organ pipe) and produces microwaves.

An antenna (a probe or loop) is connected to the anode and extends into one of the tuned cavities. It radiates some of the energy from the cavities into a metal channel, or waveguide**,** which leads away from the magnetron into the chamber. The energy is extracted slowly enough that the filament and the high voltage power supply can replace it and the operation can continue indefinitely. Up to 30% to 50% of the energy not used to heat the load in the chamber is dissipated as heat in the anode block of the magnetron. Fans provide adequate cooling to prevent damage.

The SHUR/NAVE™ Microwave Tissue Processor

The chamber of the **SHUR**/*Wave*™ is a closed waveguide that acts as a resonant cavity, much like the pipe of a pipe organ. A resonant cavity is designed so that its dimensions are an exact multiple of the confined waves (microwaves in this case). The waves reflect from the walls and their peaks and valleys line up perfectly with the incoming wave, reinforcing it and causing “hot spots” where the peaks are. The peaks remain in the same place over time, and so are called “standing waves,” even though energy is actually flowing back and forth within the cavity, carried by the wave. Unlike a pipe organ, a microwave cavity has several possible resonant modes, where the standing wave peaks can occur in different places. In the **SHUR**/*Wave*™, there are two magnetron microwave sources, each with its own waveguide. One magnetron is positioned at the top and one at the bottom of the chamber. As the microwaves exit each waveguide, they pass through a rotating mode stirrer (a metal antenna) that forces changes in the resonant mode and therefore the positions of the wave peaks. This improves uniformity and reduces areas of high and low microwave intensity that could cause hot and cold spots. Using two microwave sources simultaneously reduces this non-uniformity to a minimum.

The chamber door is actually one wall of the resonant cavity. Behind its window is a steel mesh that has openings too small for the microwaves to pass through. The doors' safety interlocks immediately shut down the production of microwaves by the magnetron when the door seal is broken.

The microwave-transparent ceramic floor offers some protection to the magnetrons, as do the stainless steel walls that deflect the waves and absorb some of the energy, building up an electrical charge. Since the walls and the fan are grounded, the charge is carried away.

The Ventilation System is particularly important because of the use of potentially hazardous reagents and specimens. Fans provide air exchanges in the chamber and vents allow the evacuated air to flow into a hood or a permanently installed ventilation system. The ventilation fans are active during all processing steps, and at any time the chamber door is open.

An embedded personal computer (ePC) controls the **SHUR**/*Wave*™ according to user-defined (programs) application-driven modes of operation. Since knowing the wattage output is critical when reproducing results, the **SHUR**/*Wave*™ calculates and displays the current wattage during a simple one-step program procedure *(Power Test).*

Up to 30 programs, each with up to 12 steps, can be named, stored and used. Each program step contains parameters for the *Step Number, Reagent/Solution Name, Duration* (in either minutes/seconds or hours/minutes), *Set Temperature*, *Power Percentage (% Power),* and *Proportional Band (PB).* Additionally, each step has settings to enable or disable *Agitation (AG)* and *Stop Step (ST)* features, and each program can be set to run for *Time at Temperature (TAT)* or *Total Time (TT)*, and can use either *Continuous Power* or *Pulsed Power* modes.

When the **SHUR**/*Wave*™ operates for *Total Time (TT),* this means that the timer begins immediately and runs for the set time period. When operating for *Time at Temperature (TAT),* the set time does not begin to elapse until the desired temperature is reached.

When using the *Continuous Power* mode, the magnetrons constantly produce microwaves but the output power of the magnetrons is automatically adjusted by the ePC in order to maintain the desired temperature. In the *Pulsed Power* mode, the magnetrons operate at a predetermined user-selected wattage output and are pulsed into the chamber in cycles. The cycle time, which includes the amount of time the magnetron is running and not running, can be as short as one second or less. Temperature control in this mode is as accurate as it is in the continuous mode.

Temperature control is one of the most important features on the **SHUR**/*Wave*™. It is achieved by using a Proportional-Integral-Differential (PID) control, which is a closed-loop temperature control system. The PID uses algorithms to guide the ePC in computing the output power required to reach and maintain a desired temperature. Another feature of the **SHUR**/*Wave*™ is the ability to set a PB for individual solutions. This setting defines the safe temperature range in which the ePC can maintain the temperature without causing damage to the specimen. Full power is used to ramp up to the lowest temperature setting in the proportional band. Within this band the power is proportioned, using less power to avoid over-shooting the upper safe limit setting and increasing the power when the temperature approaches the lower limit. Since various reagents respond differently to microwave exposure, the ability to set the proportional band for each step ensures specimen safety.

Agitating solutions, especially aqueous solutions, is important for maintaining even temperatures. Solutions in large containers can develop thermal layers that yield inconsistent results. The **SHUR**/*Wave*™ has agitation that can be used for up to four containers (or for

certain steps, not used at all) which prevents thermal layering and provides even distribution and exposure.

Applications

The **SHUR**/*Wave*™ can be used for applications other than routine tissue processing, such as:

- Fixation
- Staining
- Heat-induced epitope retrieval
- Immunohistochemistry
- Decalcification

Chapter 3 – Overview of the *SHUR*NAVE™

This section of the manual is intended to familiarize users with the parts of the **SHUR**/*Wave*™.

Operator Interface

Door Handle

(CAUTION: Do not lift the **SHUR**/*Wave*™ by this handle!)

Dimensions

Outside	(17 x 21 x 21) in	(43 x 53 x 53) cm
Chamber	(13 x 12 x 07) in	(33 x 31 x 17) cm

Chamber Light

Chamber Tray

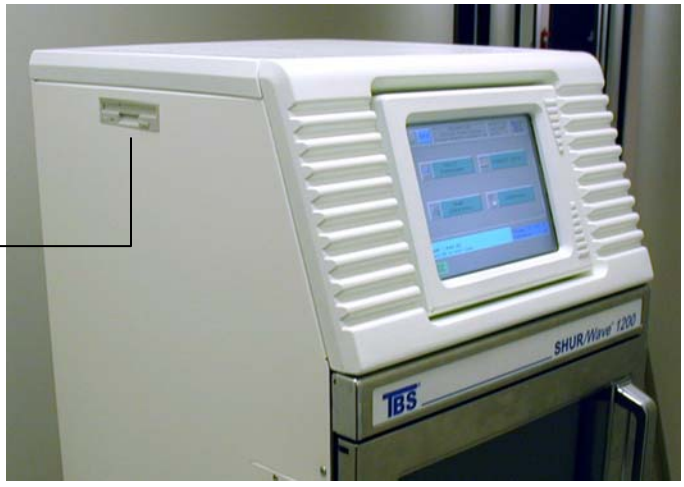
Door Interlock Guides

Ceramic Floor

Agitator Tube

Protective Mesh


Chamber Light Bulb Access Panel and Temperature Probe

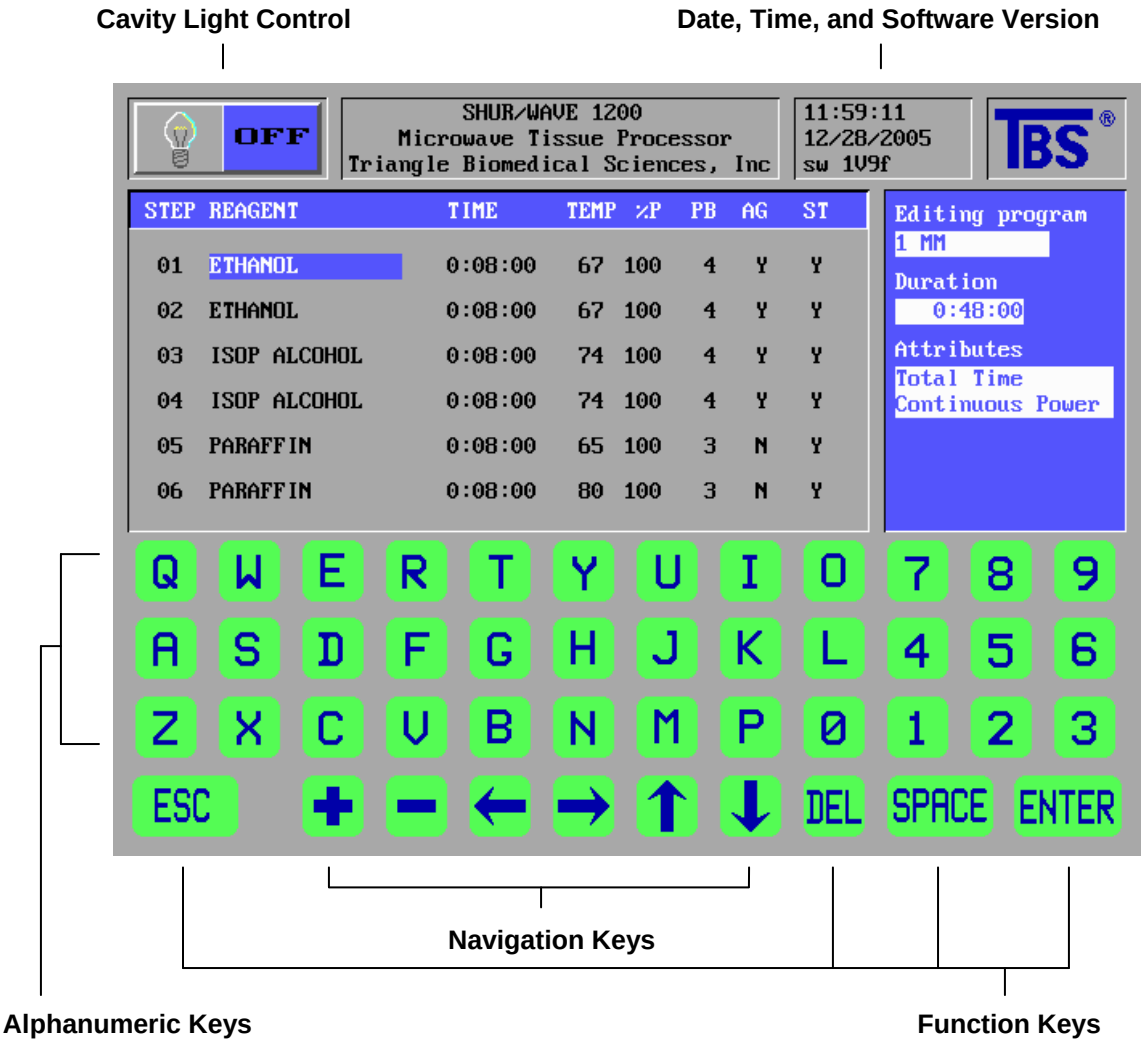

1.44Mb FDD
SHUR/Wave 1200
TBS


4” (102mm) Ventilation Duct
Mains Fuses (2)
Power Cord
Air/Fluid Ports

Chapter 4 – Operation

User Interface

All system operations are controlled through the use of a built-in touch-screen. The **SHUR**/*Wave*™ pre-fetches and fills all required fields, where possible, for the user's convenience.



Graphical Conventions

The **SHUR**/*Wave*™ control software provides interactive video screens to prompt the user in the selection of operational settings and to guide the operator in its usage. Where appropriate, most user selections produce positive video or audio feedback. The four main operating modes consistently provide a succession of video screens with a unique color scheme and icon for each mode. Inputs required of the operator are always highlighted using a light green background and/or a cursor. System parameters, information and execution steps are highlighted using a gray background. The system provides two visual information areas consistently: *Cavity Light Control* (upper left corner), which may be pressed to toggle the oven light on and off; and *Date, Time, and Software Version* (upper right corner).

Control and Navigation Keys

With the exception of the *Language Selection Screen*, all other screens provide large, easily accessible navigation and control keys. Only the necessary keys appear on each screen and they are always found at the bottom of the screen. These keys are: **ESC** (escape), **+** (plus), **-** (minus), ⇦ (left arrow), ⇨ (right arrow), ⇧ (up arrow), ⇩ (down arrow), **DEL** (delete), **SPACE**, and **ENTER**.

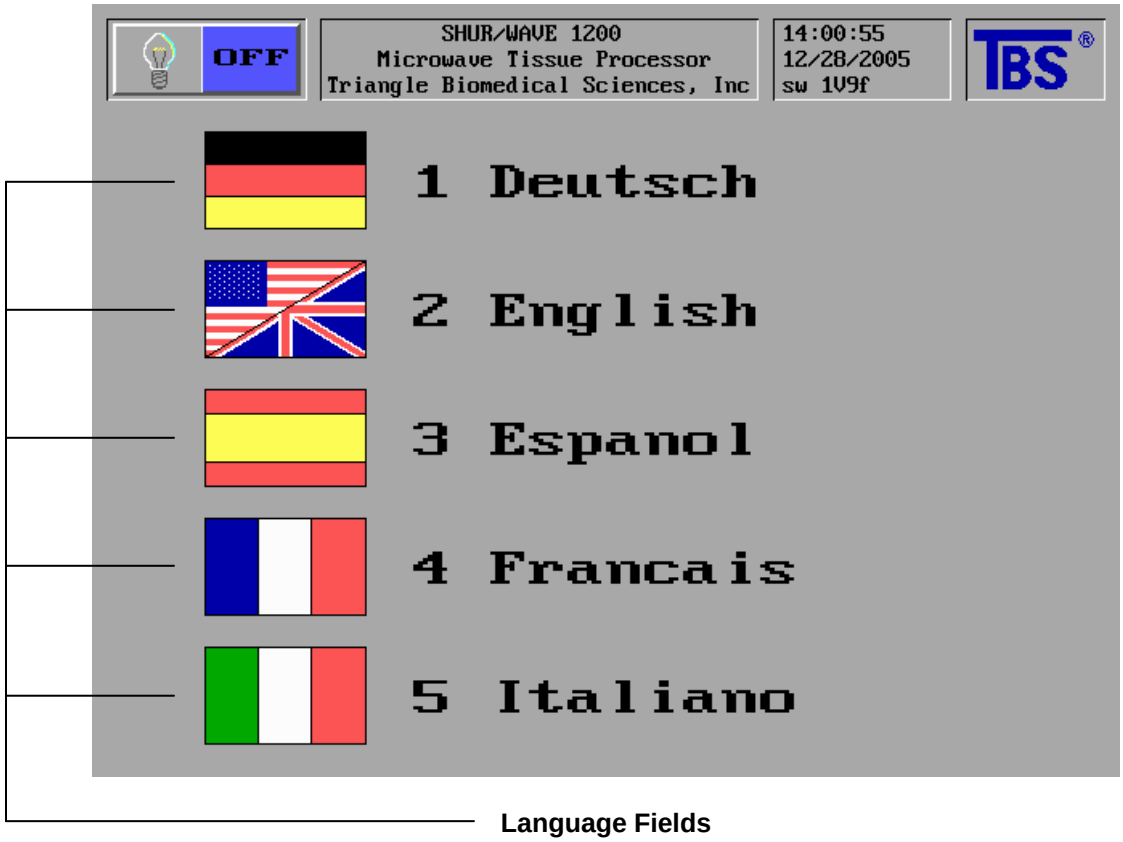
Alphanumeric Keys and Fields

When the system requires alphanumeric input data (for example, when entering program names or program duration values), the appropriate alphanumeric keys are made available to the user (letters **A** through **Z** and numbers **0** through **9**).

Language Selection

When the instrument is first powered, the screen will display the system's boot progress, beginning with the BIOS startup, RAM check, recognition of installed devices, and DOS boot, afterwards loading and starting the **SHUR**/*Wave*™ control software. After a successful boot procedure, the system will display the following screen, giving the user the opportunity to choose the preferred operating language by selecting it on the screen.

Language Selection Screen

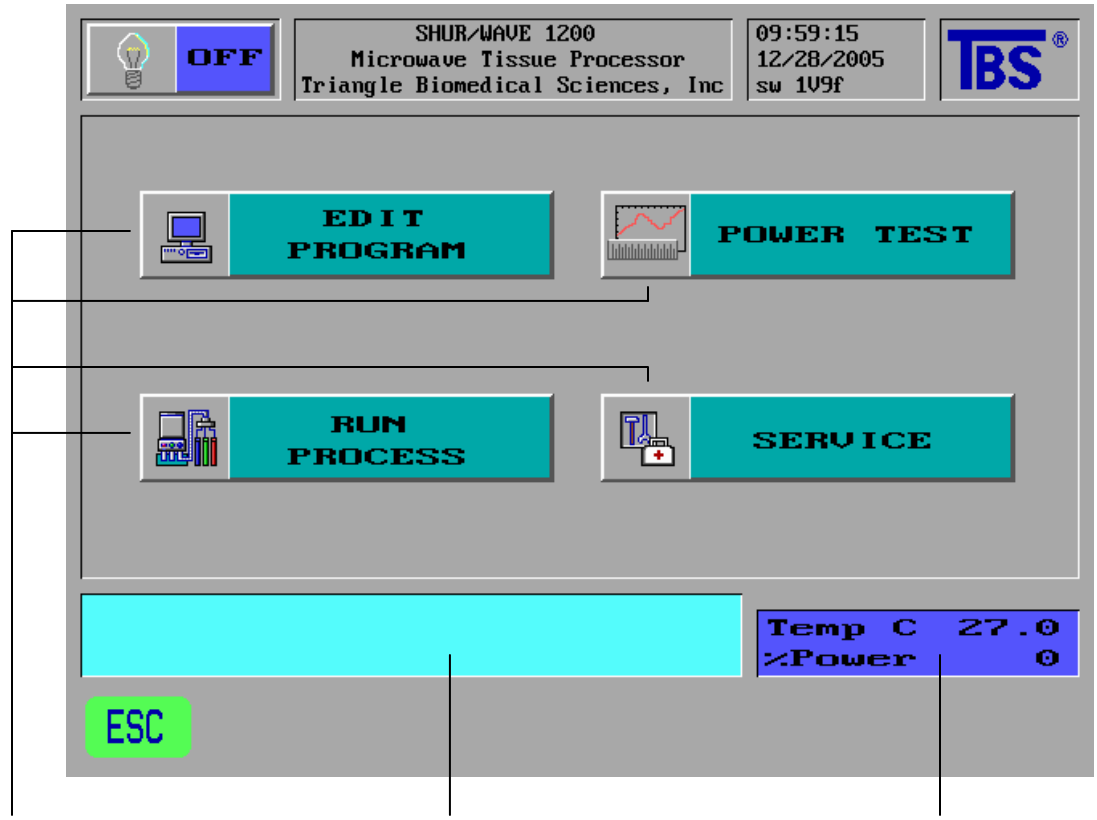


- *Language Fields*
  Touch one of these fields to select the desired language.

Mode Selection

Once the desired language is chosen, the *Mode Selection Screen* (or *Main Screen*) will appear. This screen is designed to effectively communicate instrument status, to provide a pathway to the various operating modes, to inform the user of the most significant parameters and alarms, and to allow software navigation using the touch-screen.

Mode Selection Screen (Main)



Operating Mode Keys **Message Center** **System Information**

- *Operating Mode Keys*
  Press one of these keys (**EDIT PROGRAM**, **RUN PROCESS**, **POWER TEST**, or **SERVICE**) to switch to the desired operating mode.

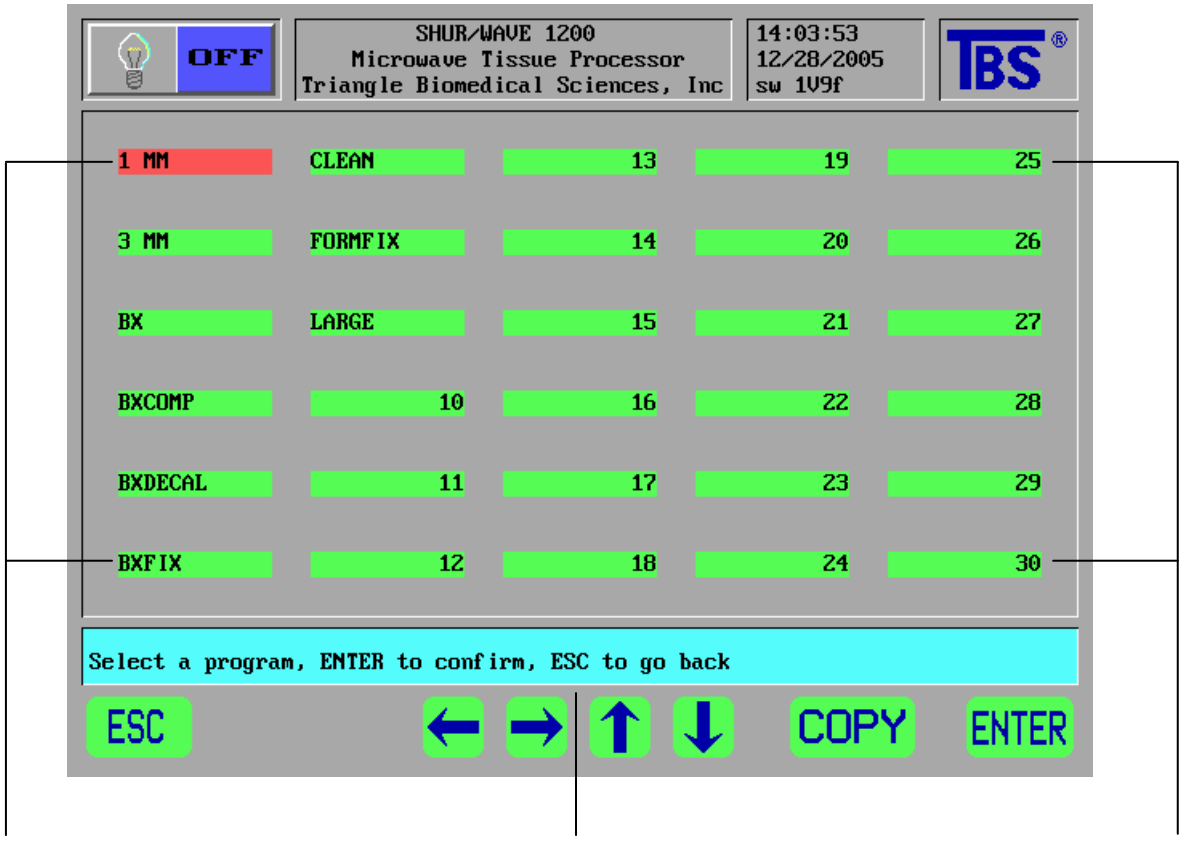
- *Message Center*
  This window displays relevant information, activity details, error conditions, alarms, and other warnings. When an error condition or alarm is encountered, it must be cleared (by pressing **ESC**) before normal operation may resume. After **ESC** is pressed, an audible tone occurs, and the alarm is reset. ***NOTE:*** When first powering up the instrument, an error code will be displayed since the power was obviously interrupted before packaging and shipping.

- *System Information*
  This window displays the current temperature of the solution (as reported by the temperature probe) and the current % Power (%P) being applied into the chamber.

Edit Program

When the **EDIT PROGRAM** key on the *Main Screen* is pressed, a new screen appears, requesting a password. The password is **TBSUSA**. Enter this password, and the *Select Program Screen* is displayed. The last program that was used will be highlighted.

Select Program Screen



Existing Program Fields **Dialog Message Bar** **Blank Program Fields**

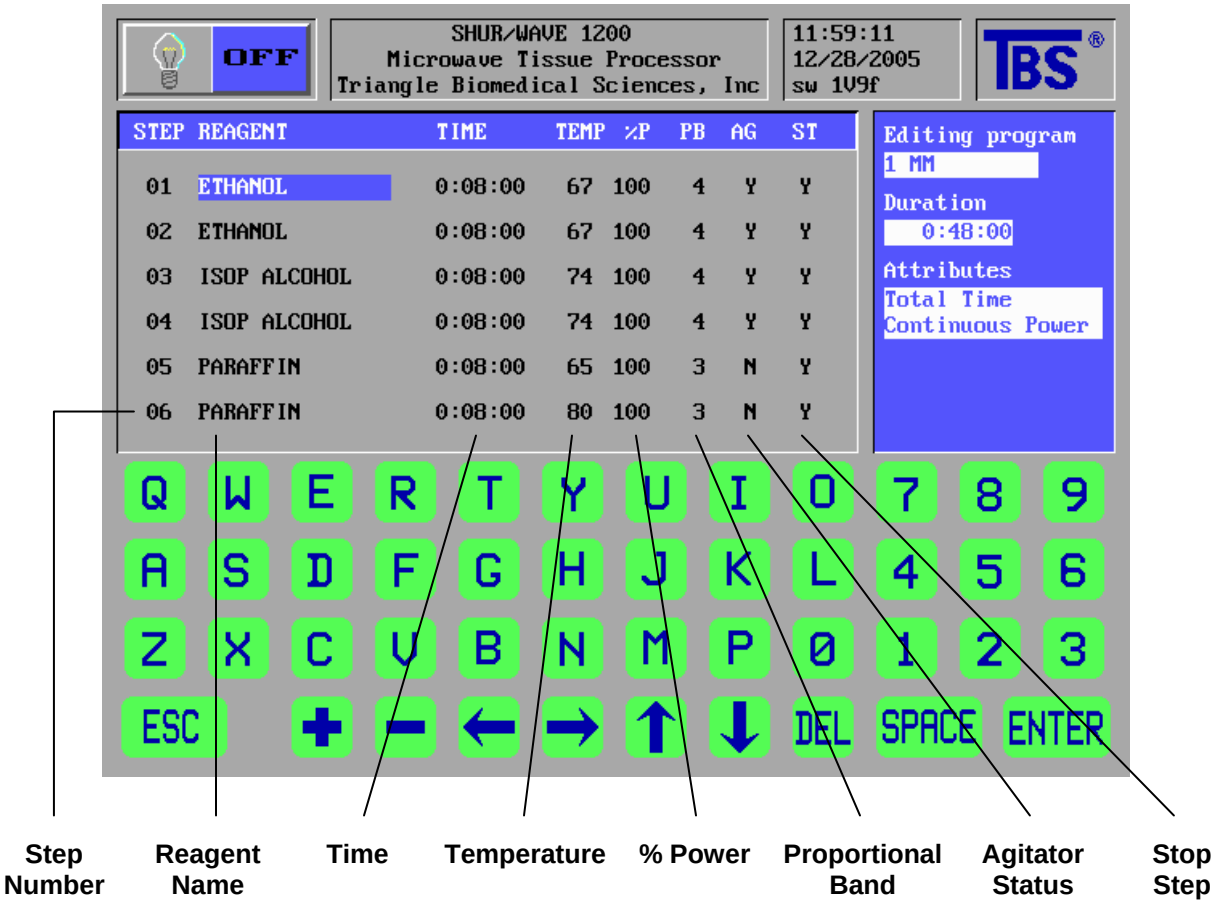
- To start editing or creating a new program, touch that program's field. You may also use the arrow keys to move to the program's field and press the **ENTER** key to select it.
- To copy a program, highlight the desired source program with the arrow keys, and then touch the **COPY** key. Next, highlight the desired destination program's field and touch the **COPY** key again. Press the **ENTER** key to confirm or the **ESC** key to abort. Once the program has been copied, you may edit the program parameters (as described below) before saving the program to its new slot.
- To return to the *Main Screen*, press the **ESC** key.

Working with Program Parameters

After the user selects a program field at the *Select Program Screen*, the *Edit Program Screen* appears.

- If a blank program field has been chosen, a new program will be created with all parameters set to zero or left blank, to be filled in by the user.
- If an existing program field has been chosen, the parameters for that program will be loaded so that the user may edit them.

Edit Program Screen



- *Step Number*
  A maximum of 12 steps is possible per program. Steps 1 through 6 are displayed initially on this screen. Steps 7 through 12 are displayed on a second screen when the user moves the cursor beyond step 6. All steps will be displayed on one screen, however, during program operation.

- *Reagent Name*
  Here the user may enter a reagent name for each step. To add or edit a name, highlight the desired name field using the arrow keys, and enter the name using the alphanumeric keys. To backspace, use the **DEL** key. Note that any previously entered name in that field will be overwritten as a new name is typed. When you are done entering a name, use the arrow keys to move to a different field.

- *Time*
  This represents the time to be spent executing a particular step, in the format H:MM:SS (hours, minutes, seconds). To add or edit a time, highlight the desired time field using the arrow keys, and enter the time using the numeric keys. For example, a time of 20 seconds is entered as **2**, **0**. A time of 20 minutes and 30 seconds is entered as **2**, **0**, **3**, **0**. A time of 2 hours is entered as **2**, **0**, **0**, **0**, **0**. (Note that values higher than 60 for seconds and minutes will be converted automatically to the correct notation. Therefore, entering **6**, **1** – 61 seconds – results in a time of 00:01:01, and entering **6**, **1**, **6**, **1** – 61 minutes and 61 seconds – results in a time of 01:02:01. However, entering **6**, **1**, **6** will still naturally yield a time of 00:06:16.) Be aware that entering a time of zero for a given step will cause the program to skip that step, and note that the last step with a time of zero ends the program. When you are done entering a time, use the arrow keys to move to a different field.

- *Temperature*
  This represents the target temperature for each step. The minimum temperature allowed is 25 degrees Celsius and the maximum is 150 degrees Celsius. To add or edit a temperature, highlight the desired field with the arrow keys and enter the temperature using the numeric keys. The DEL key can be used to undo the last entered digit. The + (plus) and – (minus) keys may also be used to increment or decrement the current temperature value.

- *% Power (%P)*
  This setting should be set keeping in mind that the percentage selected will determine the amount of power used by the **SHUR**/*Wave*™ to operate during the entire program step. If the *Pulsed Power* operating mode is set, the percentage of power will be divided by the percentage selected in this mode modifier. In other words, if 50% power is selected for a given step, the magnetrons will operate 50% of the time and the power will be pulsed accordingly, resulting in 50% of the normal wattage available. In *Continuous Power* mode, using the % Power method is an excellent way to set a desired wattage output. After automatically calculating the wattage output, a percentage of the output figure can be used to accurately set the desired wattage. ***NOTE:*** For more information on *Continuous Power* and *Pulsed Power* modes, see Chapter 2.

- *Proportional Band (PB)*
  The proportional band defines the temperature range over which the microwave's temperature control algorithm is active. Until the temperature is within this range, the microwave operates at full "% Power" (if below set temperature), or zero power (if above set temperature). Within the proportional band's temperature range, microwave power is regulated as required to acquire and maintain the set temperature, without under- or over-shooting. Solutions increase in temperature at different rates when exposed to microwave energy. Setting a proportional bandwidth for individual solutions informs the system of the acceptable temperature range for safe operation for that solution. The set temperature is considered to be the midpoint of the bandwidth. Bandwidth values can range from +/-1degC (the default) to +/-5degC. Solutions that are more responsive to microwave energy, such as alcohols, can tolerate a wider bandwidth setting than less responsive solutions, such as paraffin. A bandwidth of 4 is a good starting place for alcohols, and a setting of 3 usually works well for paraffin. (See note 5 below.)

  <u>VERY IMPORTANT TO UNDERSTAND:</u>

  1. The PB (Proportional Band) is a parameter that provides a fine control to the PID (Proportional-Integral-Derivative) control, which is responsible for the power applied to the magnetrons while the temperature is within the proportional band.
  2. In **SHUR**/*Wave*'s PID implementation, a low PB value translates into aggressive control while a high number provides smoother results.
  3. Paraffin is relatively transparent to microwave energy (as compared to water, alcohols, etc.) Due to this transparency, it is common to observe cyclic temperature peaks (especially if the target

temperature is 80°C), which are a result of microwave energy directly heating the temperature probe, which in turn heats the paraffin around it. In some instances, this may result in "over-temp" alarms.

4. There are other parameters that affect the overall control system, specifically the TAP (Total Available Power) — in other words, how much electrical energy is really available to the system from the AC power line. Typical numbers may range from 860 to 1,120 Watts. Installations that provide a solid, strong power supply could allow the maximum 1,200 Watts.
5. For installations that have a total available power (TAP) of 1,100 Watts and above, "aggressive" PB values between 1 and 3 may result in over-temp alarms during paraffin steps. In these cases, increasing the PB to a value of 4 or even 5 may reduce the cyclic temperature swings, and eliminate the over-temp alarms.
6. Installations that have a TAP between 950 and 1,050 Watts are most likely to work fine with a PB number set to 3.
7. Installations where the TAP is below 950 may even need to adjust the PB to 2.
8. Another important element to consider is that there may be some variance from Paraffin to Paraffin or some contamination (mix level with residues, etc.) which may actually impact the overall behavior of the Paraffin step(s). The total volume of Paraffin, the volume of samples and their spatial distribution, the location of the container within the microwave chamber and the actual location of the probe will also have an effect on the control process.
9. Please note that changing the PB to a value of 4 when there is not enough TAP or other previously described conditions may limit the system's ability to reach the desired step temperature.
10. Furthermore, many times there is no need to change the PB settings. Instead, changing the step temperature from 80°C to 76°C may solve the problem.

Of course, none of the TAP numbers above are set in stone. That's why we ***strongly*** recommend that anyone experiencing trouble with the Paraffin steps should contact TBS so that all related questions can be cleared and a proper solution be given.

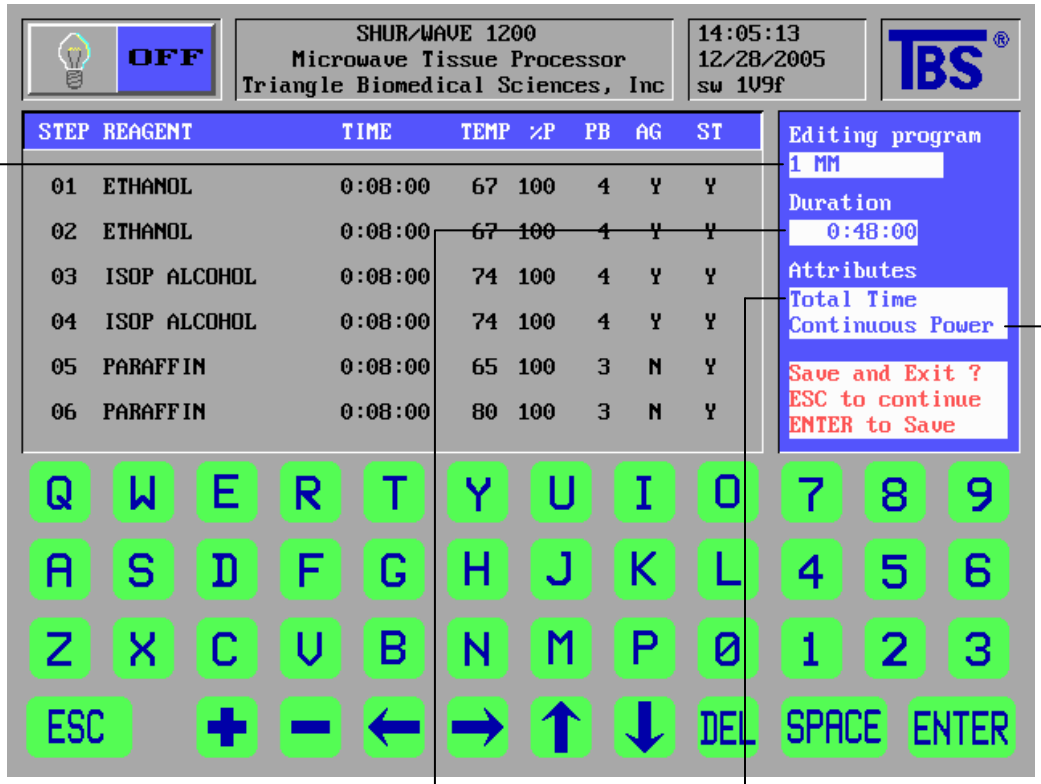
- *Agitator Status (AG)*
  This field determines whether the unit's agitator pump is turned on (*Y*) or off (*N*) for a given step. The setting can be toggled by pressing the **+** (plus) or **-** (minus) key, or set directly with the Y or N keys.

- *Stop Step (ST)*
  When set to *Y* (Yes), this setting causes the program to pause after each step and sound an alarm, awaiting confirmation from the user. This is useful for changing or adding reagents or samples between steps. When set to *N* (No), the program will execute the next step without user intervention.

Editing General Program Attributes

To edit the program's name and set operating modes for both timing and power, press the **ENTER** key at any time while on the *Edit Program Screen*.

Edit Program Screen



Program Name **Program Duration** **Timer Mode** **Power Mode**

- *Program Name*
  Use this field to enter a name for the program using the alphanumeric keys. To backspace, use the **DEL** key. When you are done entering a name, press **ENTER** to move on to the *Attributes* fields.

- *Program Duration*
  This field displays the combined running time of all the steps in the program (e.g., six steps at two minutes each would yield a 12-minute program). This field cannot be edited directly. To change a program's total running time, the user must edit the running times for each individual step.

- *Timer Mode*
  This *Attributes* field displays the timer mode being utilized by the program. It can be toggled by pressing the **+** (plus) or **-** (minus) key to choose between *Time at Temperature (TAT)* and *Total Time*

(TT). When operating under *Time at Temperature*, the **SHUR**/*Wave*™ will ramp up to the set temperature before the timer begins to count down the set time. When using *Total Time*, the timer begins when the step is started and runs for the set time without first achieving the set temperature. When you are done selecting a timer mode, press **ENTER** to move on to the *Power Mode* field.

- *Power Mode*
  This *Attributes* field displays the power mode being utilized by the program. It can be toggled by pressing the **+** (plus) or **-** (minus) key to choose between *Continuous Power* (in which the magnetrons operate continuously) and *Pulsed Power* (which pulses the power in cycles). See Chapter 2 for more details. When you are done selecting a mode, press **ENTER** to finish.

Saving Changes to a Program

After editing or reviewing the program's attributes (name, timer mode and power mode), you will be asked for confirmation on saving the settings you've chosen.

- To save the program, press **ENTER**. The program will be saved and you will be taken back to the *Main Screen*.

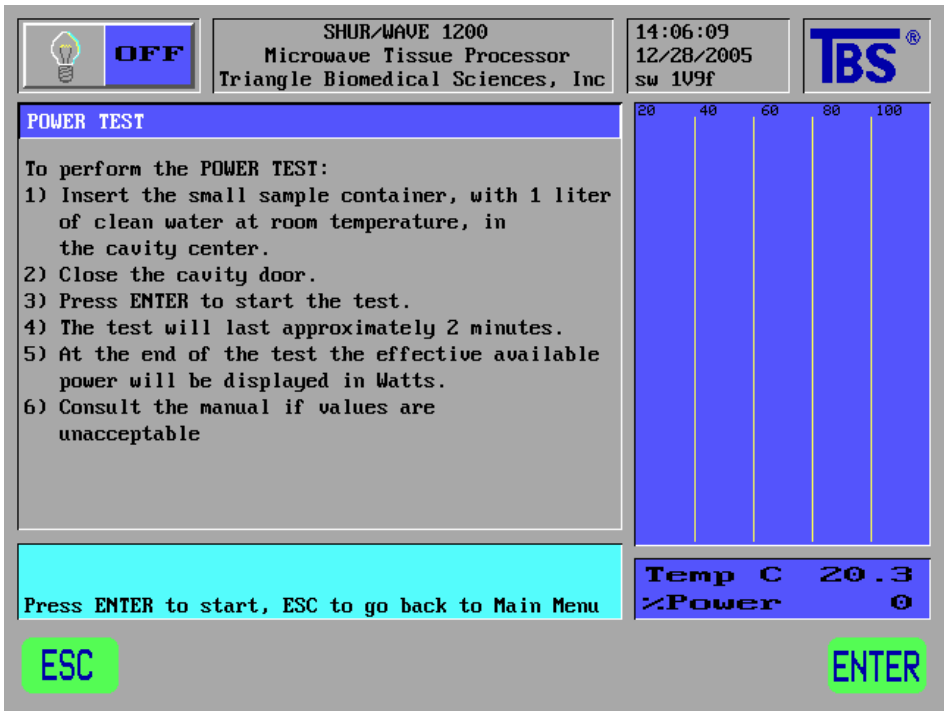
- To cancel saving and continue making changes to the program or to exit without saving changes, press **ESC**.

Power Test

It is important to understand that the local AC line power conditions can (and will) affect the overall performance of any microwave. A weak AC line supply will limit the maximum available power output of the instrument. A power test run function is available to compensate for such unique conditions. If the results are not within an acceptable range, power calibration will be recommended.

The *Power Test Screen* is displayed after the **POWER TEST** key on the *Main Screen* is pressed. This screen allows the operator to determine the exact wattage output of the instrument, given the available power from the AC line. This information is useful for technique standardization, quality assurance recording, monitoring typical fluctuations in available power within the facility and monitoring any trends in the performance of the magnetrons.

Power Test Screen (Instructions)



The test takes two minutes to perform. It is recommended that the power be calculated and recorded using this test before each run for quality assurance purposes.

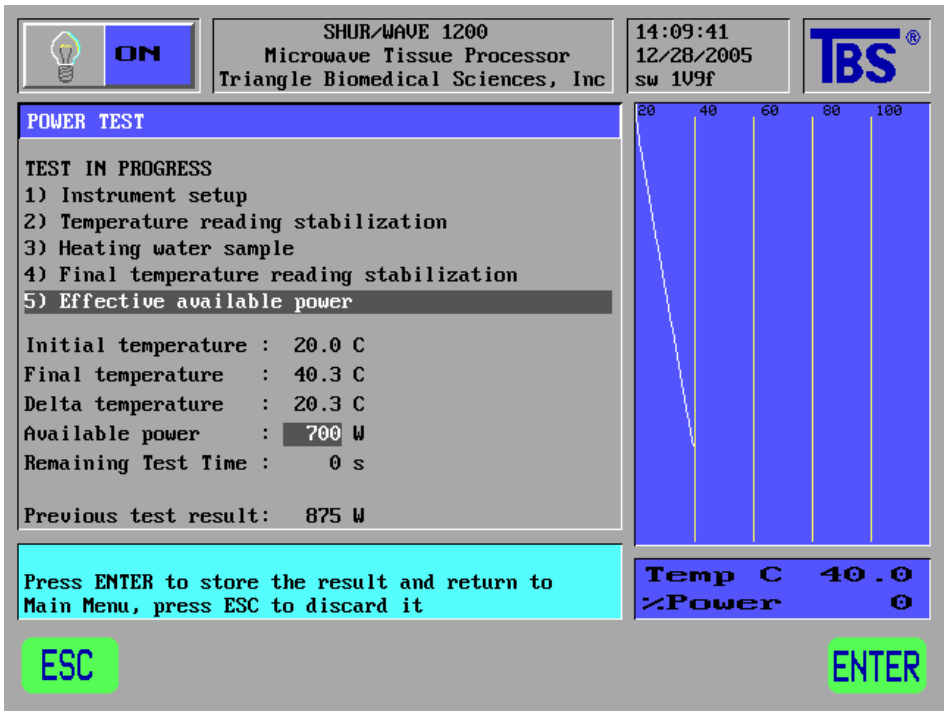
Pre-test Procedure

- Follow the instructions in the main window and the *Message Center*.
- Fill a small microwavable sample container with exactly 1 liter of clean, *room temperature* water.
- The sample container should have a capacity of 1.25 to 1.50 liters. A container with a low profile is easier to insert into the chamber.
- Place the sample container in the center of the oven cavity.
- Insert the temperature probe into the center of the container and about halfway into the water. The temperature of the water will be displayed in the lower right corner of the screen in degrees Celsius.
- Close the oven door.
- To begin the power test, press the **ENTER** key.
- To return to the *Main Screen*, press the **ESC** key.

Test Results

After the test is complete, the *Power Test Screen* presents the results. This information includes the starting and ending temperatures, the output in watts and, as a comparison to the current conditions, the previous test result. As stated before, it is recommended that the wattage output of the instrument be determined and recorded before each run.

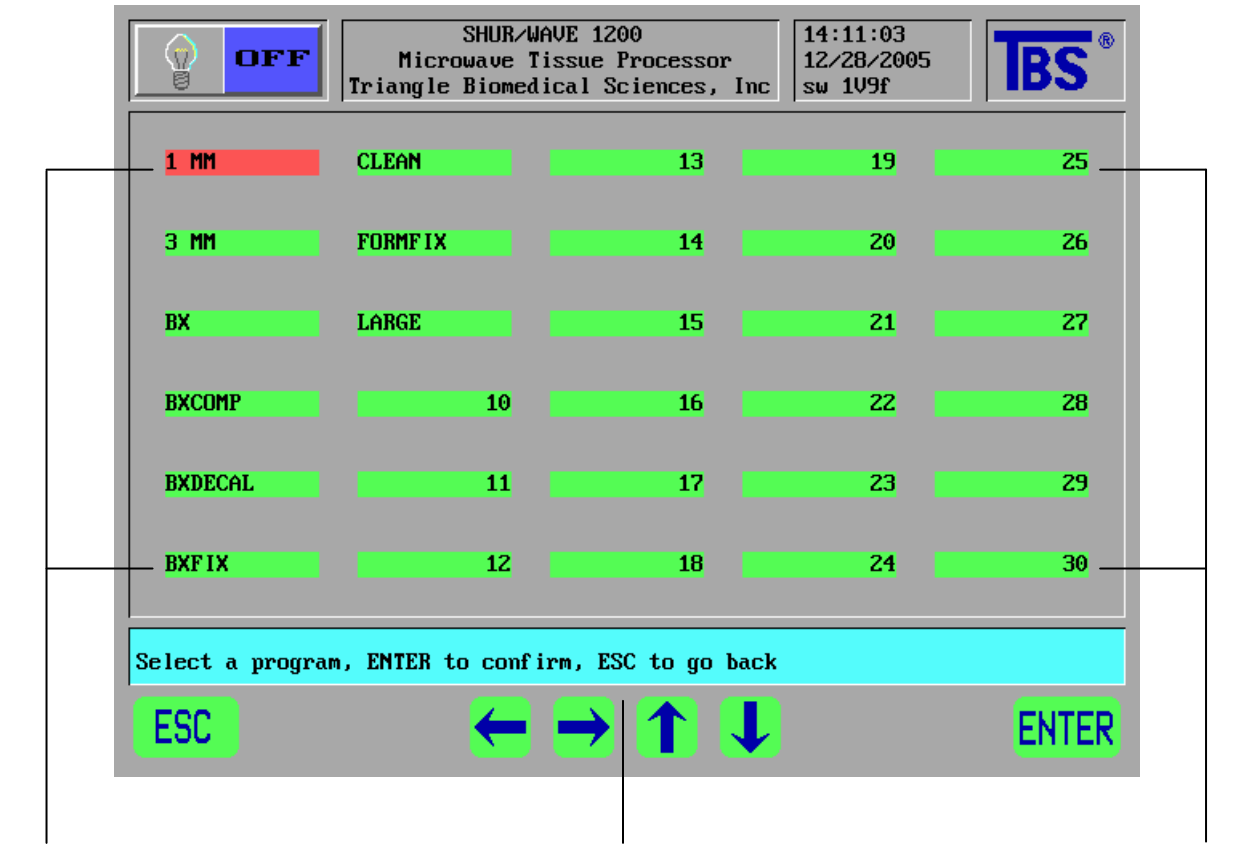
Power Test Screen (Results)



Run Process

When the **RUN PROCESS** key on the *Main Screen* is pressed, a new screen appears, requesting a password. The password is **TBSUSA**. Enter this password. The system will then prompt you to enter a user name or code (no longer than 10 characters). This user name can be anything. Its purpose is to identify the person who is running the program, which the system will record in the operational log (e.g., the Effective Available Power file). Enter a user name or code, and press the **ENTER** key. The *Select Program Screen* is then displayed.

Select Program Screen



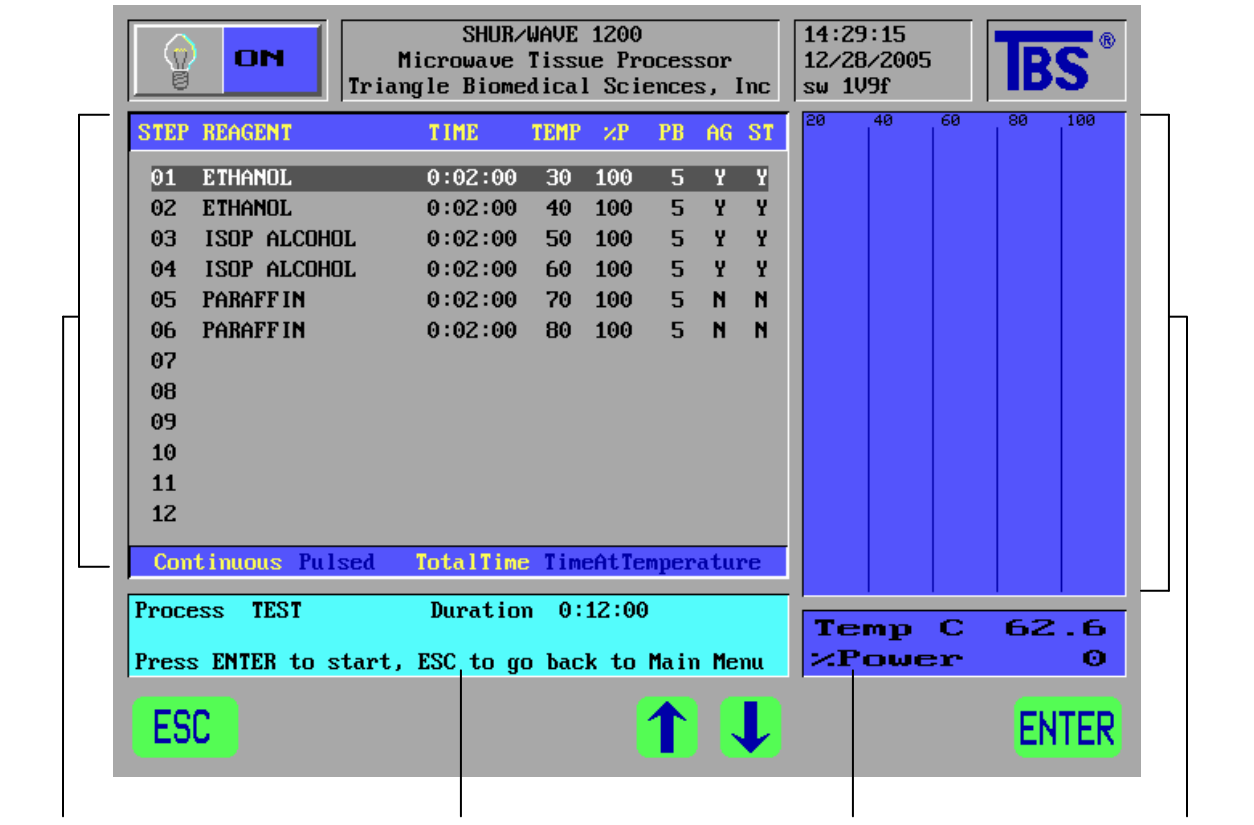
- To select a program to run, use the arrow keys to move the cursor highlight to the program's field and press the **ENTER** key to select it.
- To return to the *Main Screen*, press the **ESC** key.

Running a Program

After the user selects a program field at the *Select Program Screen*, the *Run Process Screen* appears.

- To start the program, press the **ENTER** key.
- To return to the *Main Screen*, press the **ESC** key.
- To suspend a process after it has been started, press the **ESC** key. The program will be paused. It can then be canceled completely by pressing **ESC** again, or resumed by pressing **ENTER**.
- Opening the door will also suspend the process and will immediately discontinue the production of microwaves by the magnetrons.

Run Process Screen (Program Start)



Step Parameters **Message Center** **System Information** **Graph Window**

- *Step Parameters*
  Similar to the *Edit Program Screen*, the *Run Process Screen* displays the following information: *Step Number, Reagent Name, Time, Temperature, % Power (%P), Proportional Band (PB), Agitator Status (AG),* and *Stirring Status (ST)* for each step; as well as the program's power mode (*Continuous* or *Pulsed*) and timer mode (*Total Time* or *Time at Temperature*) as highlighted (yellow) text. ***NOTE:*** To start the program at a specific step, use the arrow keys to highlight the desired step, and press **ENTER** to start the process.

- *Message Center*
  This window displays relevant information, including the program name, program duration, possible error conditions, alarms and user prompts. ***NOTE:*** When an error condition or alarm is encountered, it must be cleared (by pressing **ESC**) before normal operation may resume.

- *System Information*
  This window displays the current temperature of the solution (as reported by the temperature probe) and the current % Power (%P).

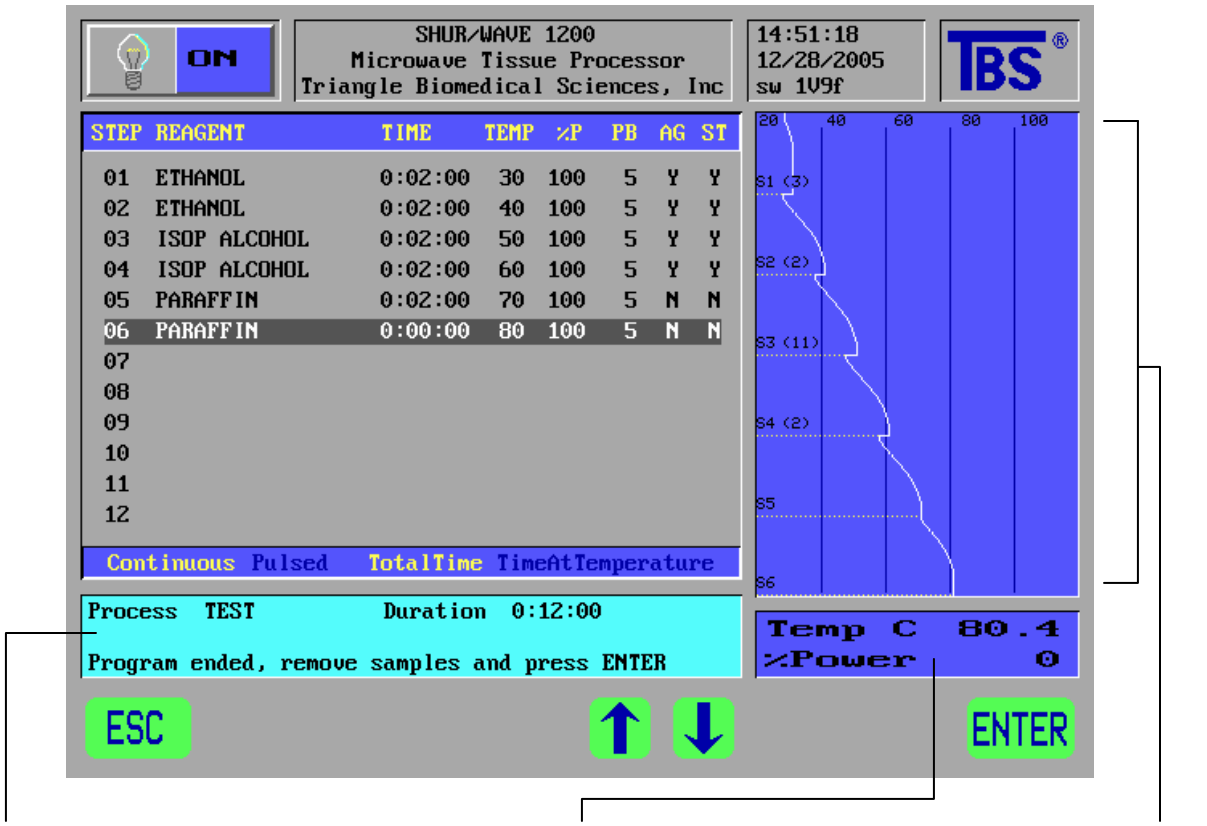
- *Graph Window*
  This area displays a graph of the process data as the program is run. Temperatures are graphed along the x-axis, while time is graphed along the y-axis. The graph also records any error codes that have occurred during program operation.

Process Results

While a program is running, the current step will be highlighted on the *Run Process Screen.* A graph of temperature changes over time will be drawn in the *Graph Window* on the right side of the screen.

When a program is finished, the **SHUR**/*Wave*™ will notify the user. All samples should be removed from the cavity chamber. The user may then press the **ENTER** key to return to the *Main Screen*.

Run Process Screen (Program End)



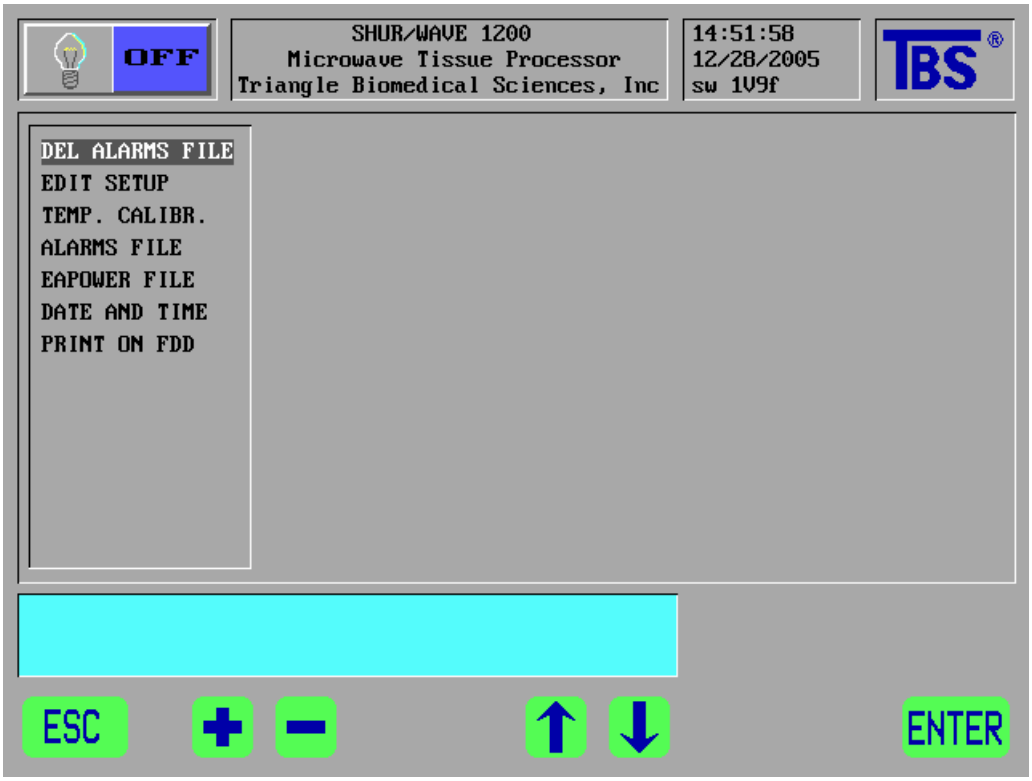
Message Center **System Information** **Graph Window**

- *Graph Window*
  At the end of a completed process run, this area will contain a graph of temperature changes throughout the entire process. Note that the end of each step is marked by a horizontal line and a step label (i.e., *S1*, *S2*, *S3*, and so on). The graph will also display error codes, if any, that occurred during program operation.

Service

When the **SERVICE** key on the *Main Screen* is pressed, a new screen appears, requesting a password. The password is **TBSUSA**. Enter this password, and the *Service Screen* is displayed. This screen allows the user to change unit settings and perform system tasks.

Service Screen



- To choose a function from the menu on the left side of the screen, use the arrow keys to highlight your choice and press the **ENTER** key to proceed.

Delete Alarms File

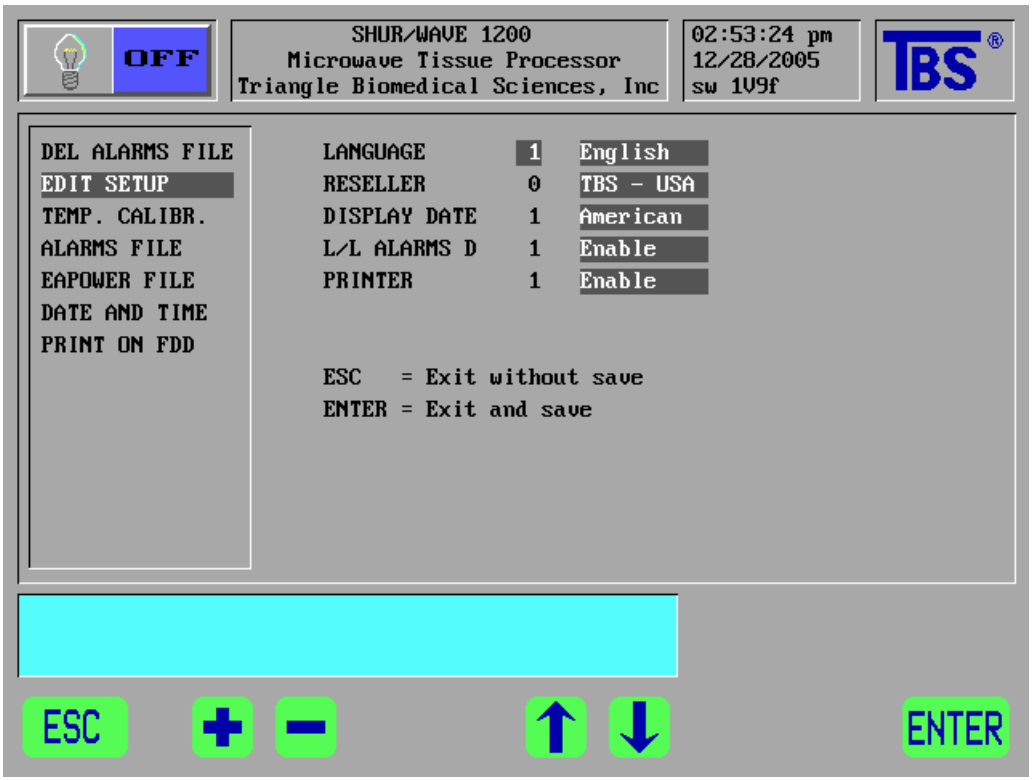
This option allows the user to reset the alarms file, clearing the log of all previous alarm events. After selecting this option, you will be prompted for a password. The password is **+** (plus) ⇧ (up arrow) **–** (minus) ⇩ (down arrow). After entering the password, an audible alert will confirm that the unit's alarms file has been cleared.

Edit Setup

This option allows the user to review and change setup parameters for the **SHUR**/*Wave*™ including display language, reseller, date format, alarm settings, audio feedback and printer usage.

- To make changes, use the arrow keys to highlight a setting and the **+** (plus) and **-** (minus) keys to toggle between values.
- To save changes and exit, press the **ENTER** key.
- To discard changes and exit without saving, press the **ESC** key.

Service Screen (Edit Setup)



- *Language*
  This option allows the user to change the display language for menu items, dialog text and other messages and alerts.

- *Reseller*
  This field indicates the original vendor of the instrument if the information was entered.

- *Display Date*
  This option allows the user to toggle between American (MM/DD/YYYY) and European (DD/MM/YYYY) formats for displaying the current date.

- *L/L Alarms D*
  This option enables or disables lower system alarms. (See *Alarm List* under Chapter 9.)

- *EOP Beeping*
  This option enables or disables the unit's audio feedback at the end of each program.

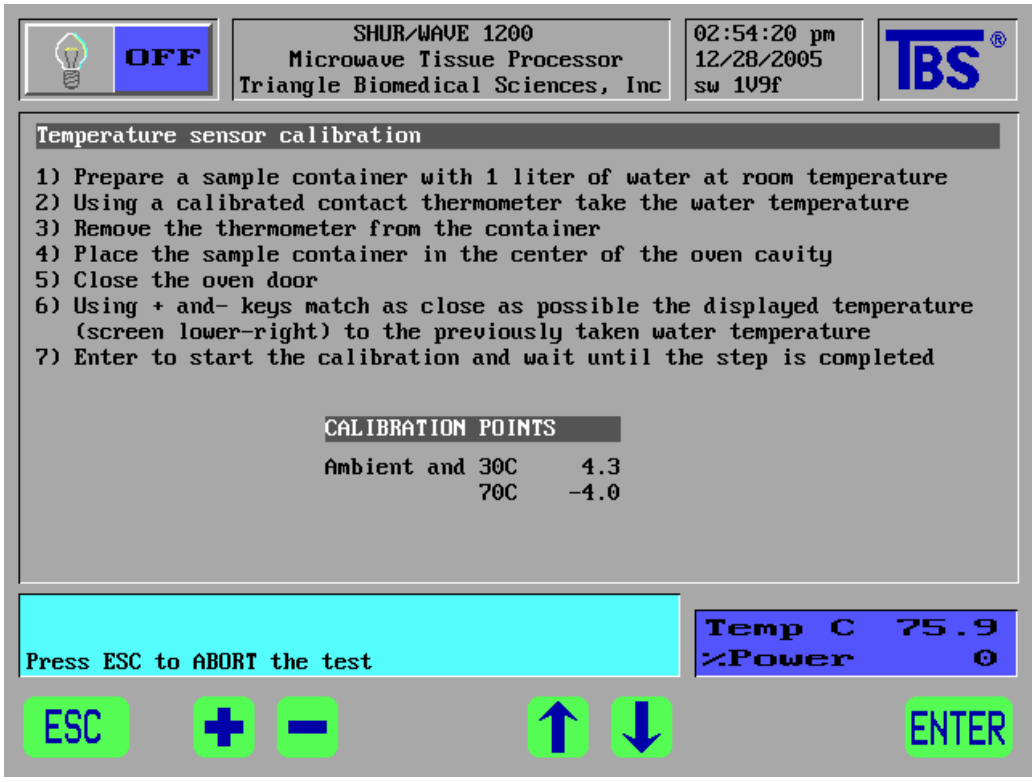
- *Printer*
  This option enables or disables printing of alarms and system events.

Temperature Calibration

This option brings up the *Temperature Calibration Screen* and allows the user to test and calibrate the unit's temperature sensor. Since this setting affects all other operations, the user is required to enter a

password before continuing. Once the correct password has been entered, a series of calibration instructions will be displayed. ***NOTE:*** You may abort the test at any time by pressing **ESC**.

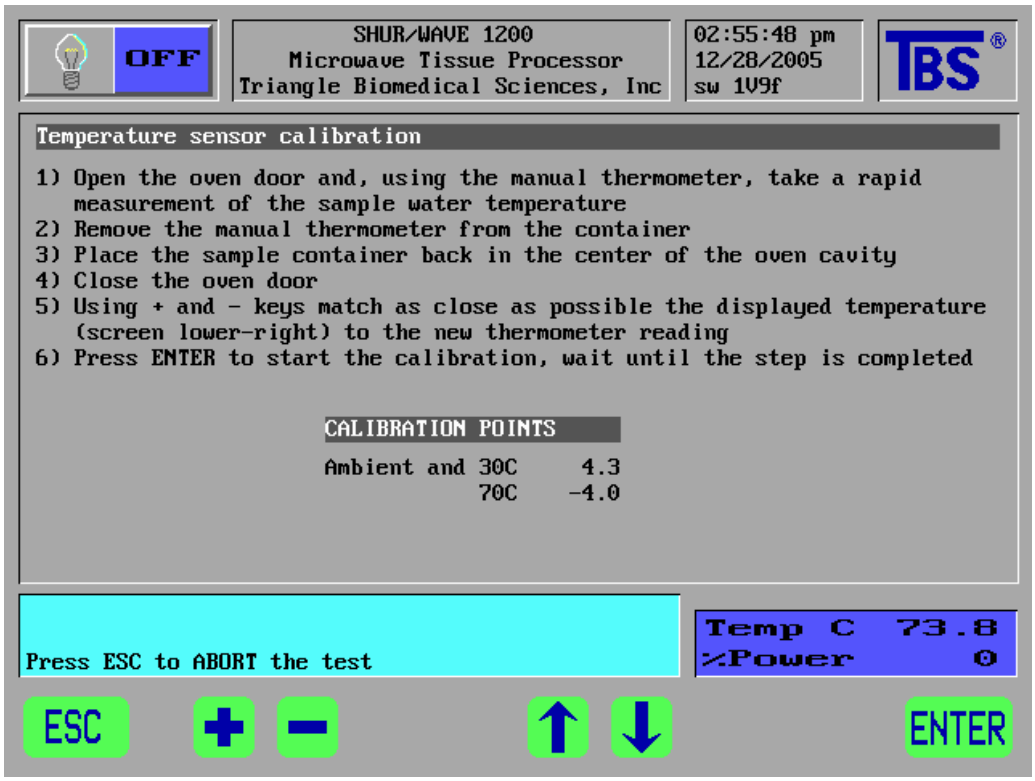
Temperature Calibration Screen (Pre-test Instructions)



- Fill a small microwavable sample container with exactly 1 liter of clean, *room temperature* water.
- Using a calibrated contact thermometer, take the water temperature.
- Remove the thermometer from the container.
- Place the sample container in the center of the oven cavity.
- Insert the temperature probe into the center of the container about halfway into the water. The temperature of the water will be displayed in the lower right corner of the screen in degrees Celsius.
- Place the agitator tube into the container to properly agitate and mix the solution.
- Close the oven door.
- Using the **+** (plus) and **-** (minus) keys, match as closely as possible the temperature displayed at the lower right of the screen to the previously taken water temperature.
- Press the **ENTER** key to start the calibration and wait until the step is completed.

When the first step is completed, the screen will display additional instructions for the next step. This will occur for all the remaining steps in the calibration process.

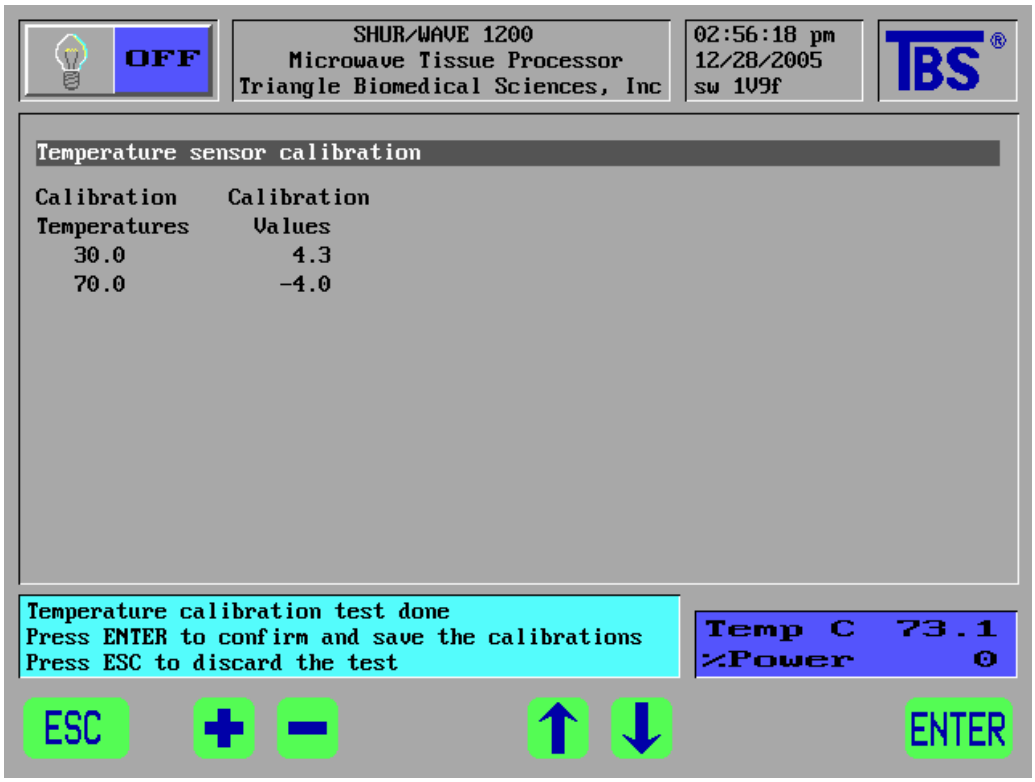
Temperature Calibration Screen (Mid-test Instructions)



- Open the oven door and, using the manual thermometer, take an accurate measurement of the sample water temperature.
- Remove the thermometer from the container.
- Place the sample container back in the center of the oven cavity.
- Insert the temperature probe back into the center of the container about halfway into the water. The temperature of the water will be displayed again in the lower right corner of the screen.
- Place the agitator tube into the container to properly agitate and mix the solution.
- Close the oven door.
- Using the **+** (plus) and **-** (minus) keys, match as closely as possible the temperature displayed at the lower right of the screen to the previously taken water temperature.
- Press the **ENTER** key to continue the calibration.

After all of the steps have been completed, the results will be displayed on the screen. Saving the results will affect the outcome of all procedures run after the calibration so be certain that all manual measurements during the calibration were accurate. You may run additional temperature calibration tests at any time to correct for suspected inaccuracies. ***NOTE:*** Program parameters will not be affected by the temperature calibration process.

Temperature Calibration Screen (Results)



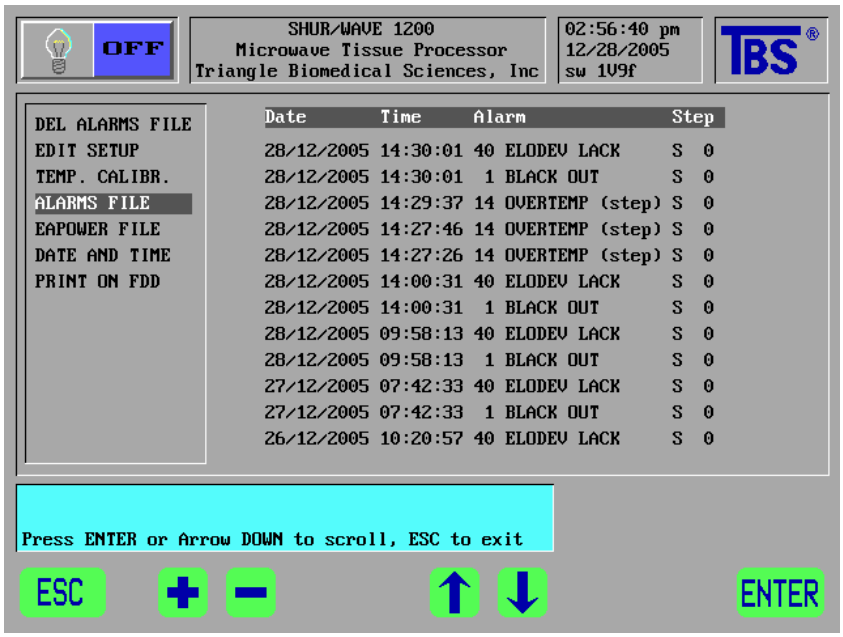
- To confirm and save the calibration information, press the **ENTER** key.
- To discard the calibration information, press the **ESC** key.

Alarms File

This option displays the alarms file, which allows the user to review a list of all recorded alarm messages, indexed by date and time.

- To view more alarm messages, scroll down by pressing either the down arrow or the **ENTER** key.
- To exit and return to the main *Service Screen* menu, press the **ESC** key.
- To delete the alarms file, choose the *Delete Alarms File* option from the main *Service Screen* menu (see above).

Service Screen (Alarms File)

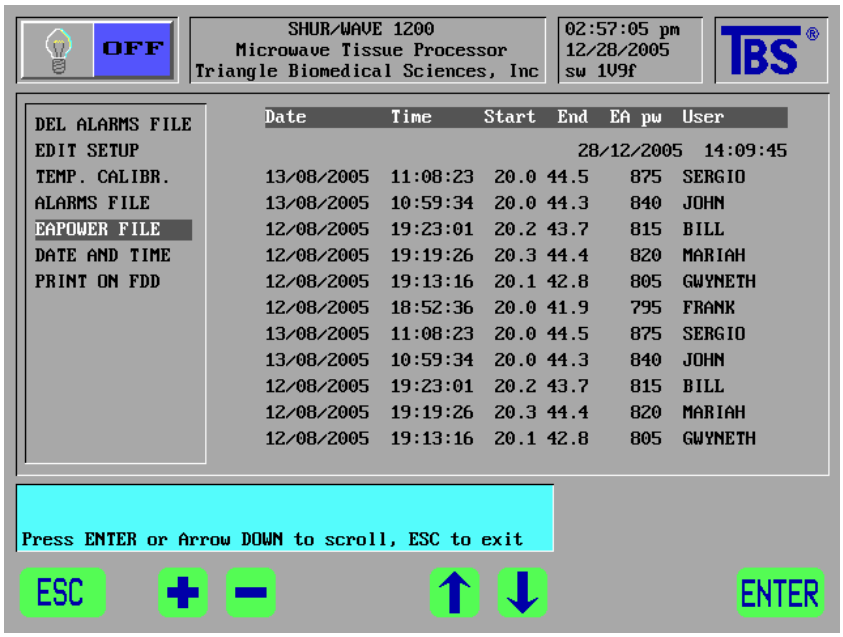


EAPower File

This option displays the effective available power file, which allows the user to review a list of recently executed processes and the effective available power for each, indexed by date and time.

- To view more log entries, scroll down by pressing either the down arrow or the **ENTER** key.
- To exit and return to the main *Service Screen* menu, press the **ESC** key.

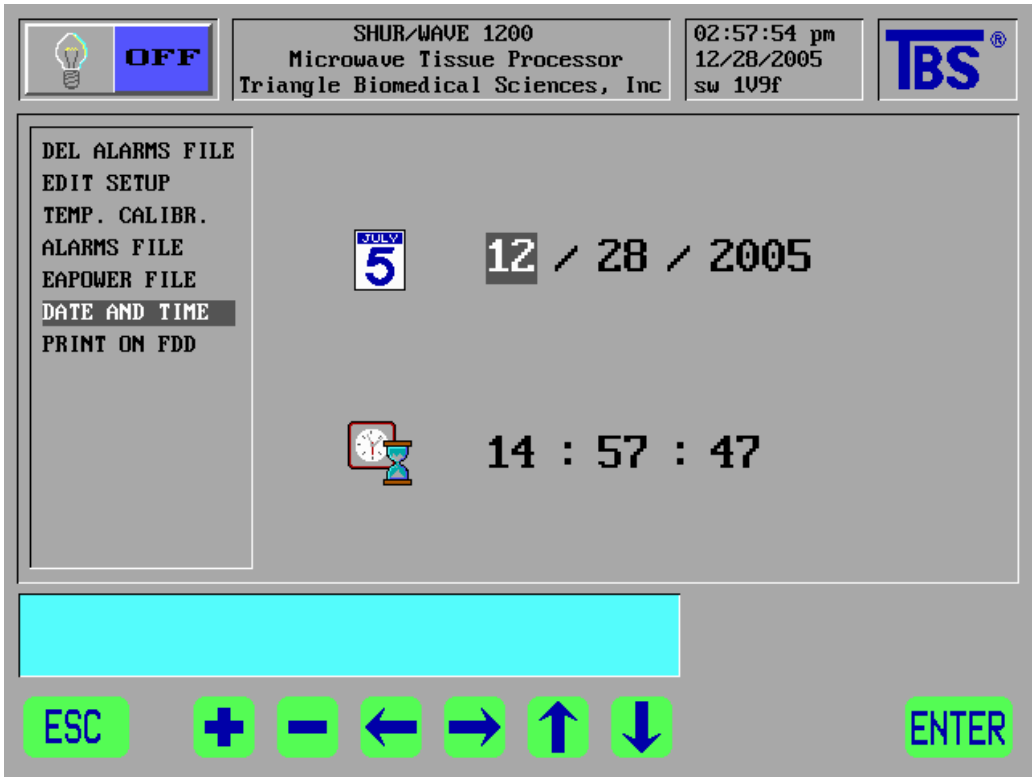
Service Screen (EAPower File)



Date and Time

This option allows the user to set the correct date and time for the **SHUR**/*Wave*™.

Service Screen (Date and Time)



- Use the arrow keys to move between date and time fields.
- Use the **+** (plus) and **-** (minus) keys to change the values in a particular field.
- To save the new date and time settings, press the **ENTER** key.
- To cancel without saving, press the **ESC** key.

Print on FDD

This option allows the user to save data including process information, alarms, effective available power and current setup parameters. The user will need to insert a blank 3.5” 1.44MB floppy disk in the unit’s floppy disk drive (FDD) before proceeding.

- To save the data on a blank disk or overwrite existing data on a disk, make sure that there is a 3.5” 1.44MB floppy disk in the drive and then press the **ENTER** key. The following data will be saved: the last process executed, instrument setup information (calibration settings, etc.), the alarms file, the effective available power file and program information for processes 1 through 30.
- To cancel without saving or to abort the disk-writing process after it has begun, press the **ESC** key.

Chapter 5 – Care and Maintenance

General Cleaning

Interior

Keeping the **SHUR**/*Wave*™ chamber clean is of the greatest importance. Clean the chamber immediately if a spill occurs.

- The stainless steel walls and ceramic floor of the chamber may be cleaned with mild soap and water or, if necessary, a non-corrosive solvent. Do not use abrasive cleansers or pads. Solidified paraffin can be removed by delicately scraping with a plastic spatula.
- The window of the door should be washed with very mild soap and water on a soft cloth. Never use window cleaner. Harsh soap or cleaners can scratch the glass.
- The splatter shield at the top of the chamber should also be cleaned with mild soap and water. If it must be removed for a more thorough cleaning, depress the snap in/snap out side stoppers located on both sides and pull down just enough to disconnect. While holding the shield steady, disconnect the air bubbler tubing on the left front side. Gently guide the shield out of the chamber over the temperature probe. Be certain to reinsert the splatter shield before the next run. ***WARNING:*** DO NOT RUN THE INSTRUMENT WITHOUT THE SPLATTER SHIELD.
- Routinely inspect and clean the air vent area in the left rear portion of the chamber to be certain that it is free of debris.

Exterior

- Unplug the instrument from the wall before cleaning.
- The outside surface should be cleaned with soap and water and then dried with a soft cloth. Make certain that water does not get into the rear openings of the instrument.
- Clean the air vent in the front lower portion of the instrument. Remove the vent cover by pulling the Pop Pin on the right side straight out. Slide the vent cover to the right to lift it off the post on the left side. Wash with soap and water. Replace by aligning the vent cover with the post, holding the Pop Pin out and inserting the back of the pin in its hole. Press the pin to secure the vent cover in place. ***WARNING:*** DO NOT RUN THE INSTRUMENT WITHOUT THE VENT COVER.

Routine Maintenance/Service

NOTE: Always unplug the instrument before doing any service related procedure. Only the following items are user-serviceable and do not require an authorized service representative. Any other service related issue must be presented to TBS technical service. Do not remove the cover of the instrument.

Replacing the Light Bulb

Unplug the instrument from the electrical outlet. Locate the cover plate that provides access to the light bulb on the left side of the exterior cabinet. Remove the screw and cover plate. Only replace the spent bulb with a new bulb that is correct for the instrument's voltage, as shown in the spare parts list. Replace the cover plate before plugging the instrument into the electrical outlet.

NOTE: The original bulb comes with a small amount of sealant or tape that prevents the bulb from moving during shipment. It is not necessary to reapply the protective sealant.

Replacing the Fuses

SHUR/*Wave*™ – ***220-240V ONLY***
Unplug the instrument from the electrical outlet. Turn the **SHUR**/*Wave*™ so that the fuses' holder can be located. Be careful not to lift or turn the instrument when holding the door. Remove the right side panel of the instrument to access fuses and replace them with the same type and rating for the instrument's voltage and amperage, as shown in the spare parts list.

Chapter 6 – Parts List

SHUR/Wave™ Catalog Numbers

TBS is continually upgrading SHUR/Wave's processing rack assembly in order to provide the customer the most convenient and efficient accessories available.
Please contact TBS for a listing of the most recent update of racks and reagents.

Chapter 7 – Loading the Cassette Racks

There are two sizes of Teflon racks that can be utilized in the **SHUR**/*Wave*™. Each rack has a central stem that supports the cassette holders and a top disc that is used to stabilize the cassettes. The small rack stem, which is 110mm in height, will hold two loaded cassette holders that are 130mm in diameter and have a capacity of 18 cassettes on each level. The small top disc is 90mm in diameter. The large rack stem, which is 134mm in height, will hold three loaded cassette holders that are 160mm in diameter and have a capacity of 32 cassettes on each level. The large top disc is 120mm in diameter. The rack stems may only be used with cassette holders of the appropriate size.

The racks fit into plastic or glass containers that are specifically selected to conserve processing reagents and to accommodate either the small or large Teflon lids. The lids have holes that allow insertion of the temperature probe and prevent vapor buildup within the container that could cause an explosion. A Teflon lid should be used during steps requiring volatile liquids to prevent excessive evaporation, but not during paraffin steps when it is important to evaporate out any remaining alcohol.

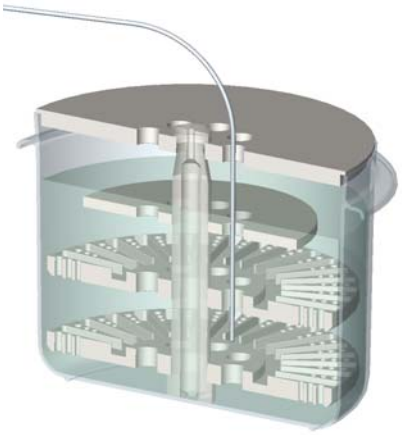


Fig. 1

Please make certain that the temperature probe is inserted thought any of the holes in the top disc and well submerged into the paraffin, not touching any cassette, racks or rack support.

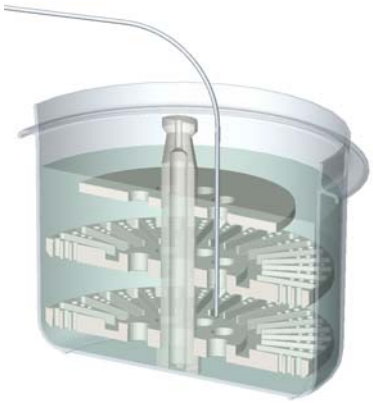
***NOTE:* Do not utilize any container lid that seals and has no ventilation holes during microwave exposure of solutions. Any such lid should only be used to store cooled solutions to minimize spillage during transport and storage in the lab.**

To load the racks, place a cassette holder on a rack stem and then place the cassettes in the cutout spaces, distributing them evenly around the circular cassette holder. Orient them so that the specimen identification number is facing outward and can be easily read. If more than one level is needed, stack the next cassette holder on top of the loaded cassettes. When loading of the cassettes is complete, place the top disc (smaller diameter Teflon plate with holes) on top of the last level of cassettes. This will hold the cassettes down when the racks are being gently submerged into a solution. ***NOTE:* Do not tip the rack when it is outside the container. Maintain a vertical orientation when handling the rack or cassettes may fall out. Always transport a full rack inside a container.**

Solution may be added at this point. It is recommended that the solution be added to the container while the cassette rack is in place, using the appropriate safety equipment and assuring proper ventilation of the work area. If the rack is transferred to a full container, allow it to drain on an absorbent material and then submerge it *gently* in order to maintain proper orientation of the cassettes. ***NOTE:* Make certain that the cassettes are completely covered by the solution (1" above the cassette top is recommended.)**

The **SHUR**/*Wave*™ has an internal pump that provides optional air bubble agitation on any step. The air enters the chamber through tubing into an adjustable air valve, allowing the airflow to be regulated to the users' preference. A reducing coupler connects the larger tubing from the air valve to the smaller tubing on the rack stem connector. The air is forced down the center of the hollow rack stem, providing air bubble agitation within the solution from the bottom of the rack. The agitation facilitates fluid mixing and reduces thermal layering of the solutions. When air bubble agitation is desired, connect and disconnect the tubing at the reducing coupler.

NOTE: **If the Teflon top lid is used, feed the tubing through the center hole in the lid before connecting to the reducing coupler (see *Fig 1* above), but if this cover is not used, make sure that the temperature probe is inserted thought any of the holes in the top disc and well submerged into the paraffin, not touching any cassette, racks, or rack support.**



Once the air bubble agitation tubing is connected, the temperature probe, which moves freely on a ball joint, should be gently moved forward and inserted into the container. If the Teflon lid is being used, insert the probe into one of the holes that surround the hole reserved for the air bubble agitation connector.

Gently move the container and probe into the center of the chamber. Position the probe so that it is inserted approximately halfway into the solution and passes through the hole in the top disc.

NOTE: **Make certain that the probe tip is not touching the rack stem, the cassette holder, a cassette, or the inside wall of the container.**

Chapter 8 – Sample Programs

Processing Schedules (Small Rack Container)

Program	Reagent	Time (Min/Sec)	Temp	% Power	Prop Band	Comments
1MM *(for processing 1mm thick specimens)*						**Continuous Power**
	Ethanol	8:00	65°C	100	4	Use lid and agitation
	Eth/Iso (50/50)	7:00	67°C	100	4	Use lid and agitation
	Isop Alcohol	7:00	74°C	100	4	Use lid and agitation
	Paraffin	6:00	65°C	100	3	No lid, no agitation
	Paraffin	8:00	76°C	100	4*	No lid, no agitation
3MM *(for processing 3mm thick specimens)*						**Continuous Power**
	Ethanol	10:00	65°C	100	4	Use lid and agitation
	Ethanol	10:00	67°C	100	4	Use lid and agitation
	Isop Alcohol	10:00	74°C	100	4	Use lid and agitation
	Isop Alcohol	10:00	74°C	100	4	Use lid and agitation
	Paraffin	10:00	65°C	100	3	No lid, no agitation
	Paraffin	8:00	76°C	100*	4	No lid, no agitation
BX *(for processing biopsy specimens)*						**Continuous Power**
	Ethanol	5:00	67°C	100	4	Use lid and agitation
	Isop Alcohol	3:00	74°C	100	4	Use lid and agitation
	Paraffin	2:00	65°C	100	3	No lid, no agitation
	Paraffin	5:00	76°C	100*	4	No lid, no agitation
BXCOMP *(for fixation and processing of biopsy specimens)*						**Pulsed Power**
	Formalin	7:00	37°C	25	4	Use lid and agitation
	Formalin	2:30	37°C	65	4	Use fresh soln, lid and agitation
	Ethanol	5:00	67°C	100	4	Use lid and agitation
	Isop Alcohol	3:00	74°C	100	4	Use lid and agitation
	Paraffin	2:00	65°C	100	3	No lid, no agitation
	Paraffin	5:00	76°C	100*	4	No lid, no agitation
BXDECAL *(for decalcification of bone marrow biopsies)*						**Pulsed Power**
	RDO	3:00	37°C	65	4	
	Check results when complete. May require additional run.					
BXFIX *(for fixation of biopsy specimens*						**Pulsed Power**
	Formalin	7:00	37°C	25	4	Use lid and agitation
	Formalin	2:30	37°C	65	4	Use fresh soln, lid and agitation
CLEAN *(for cleaning racks/containers after a run ending in paraffin)*						**Continuous Power**
	Isop Alcohol	5:00	74°C	100	4	Use lid and agitation
FORMFIX *(for fixation of large specimens & easy detection of lymph nodes)*						**Pulsed Power**
	Formalin	45:00	37°C	25	4	Use lid and agitation
	Formalin	10:00	37°C	65	4	Use fresh soln, lid and agitation
LARGE *(for processing specimens larger than 3mm thick)*						**Continuous Power**
	Ethanol	10:00	67°C	100	4	Use lid and agitation
	Ethanol	10:00	67°C	100	4	Use lid and agitation
	Ethanol	10:00	67°C	100	4	Use lid and agitation
	Isop Alcohol	10:00	74°C	100	4	Use lid and agitation
	Isop Alcohol	10:00	74°C	100	4	Use lid and agitation
	Isop Alcohol	10:00	74°C	100	4	Use lid and agitation
	Paraffin	10:00	65°C	100	3	No lid, no agitation
	Paraffin	10:00	76°C	100*	4	No lid, no agitation

* Depending on the Effective Available Power (given by the Power Test at your site). If it is below 950 Watts, please adjust this value to 2; if it is between 950 and 1,050 Watts adjust this value to 3; if it is greater than 1,050 Watts please adjust this value to 4. Please read Proportional Band (PB) section on pages 17-18.

Chapter 9 – Troubleshooting and Alarms

Troubleshooting Guide

Problem	Remedy
Large temperature fluctuations	Check if probe is touching anything and make proper correction if necessary
Temperature stops just under the set temperature and clock doesn't start to count down	Decrease the proportional band (PB) value

Alarm List

Error Code	Error Name	Description
0	NO_ALARM	No error.
1	BLACK_OUT	The unit has recently experienced a power loss.
7	FILE_NOT_FOUND	The *init.dat* file is missing. Please call the Product Service Department.
8	LOWTEMP	A low temperature has been detected at the end of a step. This means that at the end of the programmed set time (when set in *Total Time* mode), the actual temperature did not enter the range of the set temperature.
13	OVERTEMP	The temperature in the cavity has exceeded 130 degrees Celsius. Stop the process immediately, unplug the unit, and call the Product Service Department.
14	PROC_OVERTEMP	A high temperature has been detected during a program step. This means that at the end of the programmed set time (when set in *Total Time* mode), the actual temperature exceeded the set temperature by at least 11 degrees.
15	TSC_OUT	The unit's temperature sensor is faulty. Please call the Product Service Department.
16	VENT_OUT	The unit's cavity ventilation fan is faulty. Please call the Product Service Department.
17	DOOR_OPEN	The door has been opened while running a program.
18	FILE_NOT_FOUND	One or more data files are missing. Please call the Product Service Department.
30	COM_FRAME	There is a serial frame communication error. Please call the Product Service Department.
31	COM_PARITY	There is a serial parity communication error. Please call the Product Service Department.
32	COM_OVERRUN	There is a serial buffer overrun error. Please call the Product Service Department.
33	COM_TIMEOUT	There is a serial timeout communication error. Please call the Product Service Department.
40	ELODEV_LACK	The touch screen hardware is not responding. Please call the Product Service Department.