"Innovation through collaboration"

Providing Instrumentation and Apparatus for Cellular Research, Intraoperative Recording, and Microneurography; Micro-electrodes, Micropipettes, and Needles to the Neuroscience Community for 30 years.

OTS-4000

Tissue Slicer

microTargeting™

neurocraft™

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L005-18B

Table of Contents

OTS-4000 Tissue Slicer

1. Operation Manual

1.1 Features

- Slice thickness set in 10-micron increments on thumbwheels; pushbutton advance; digital display of status
- New ultra light blade oscillation mechanism mounted on heavily reinforced chassis minimizes vibration
- Linear cutting blade motion to 4000 CPM
- Blade mechanism above bath simplifies maintenance
- Easy to clean, removable tray
- Motorized variable speed blade advance; momentary or continuous modes
- Auto-sectioning controls permit consecutive sections to be cut automatically
- Pure white, high intensity halogen lamp with dual fiber optic light pipes and focusing lens
- X2 Magnifying lens (4" D) included
- Available with integral refrigeration system (250 ml/minute cold tap water flow required)

1.2 Description

The new OTS-4000 Tissue Slicer has been designed to meet the highest standards for precision and accuracy. By dramatically decreasing the weight of the blade mechanism and then mounting it on a massive reinforced chassis, we have been able to maximize stability. As a result, we believe our OTS-4000 will match the performance of units costing twice as much.

We have included the convenience and operational features from our popular OTS-3000:

Thumbwheel selection of slice thickness.

Automatic control circuitry so that consecutive sections can be cut easily, rapidly.

Fiber optic lights and magnifying lens mounted on flexible goosenecks and clear front tray panel to give maximum sample exposure.

Removable, easy to clean tray.

The optional Refrigeration Unit is built into the OTS-4000 cabinet (at time of purchase or later as a retrofit). As a result, the entire unit occupies less than 12" (30cm) on the lab

bench. (A tap water flow input of 250 ml/minute is required during refrigeration system operation.)

The OTS-4000 is delivered complete, ready to use, including blades, a 2.5" tray, pedestal, sample vise and blocks. A wider tray (3.5") is available which is convenient where frozen medium is used to cool the bath. It includes a wider pedestal and a small sample holder which displaces a minimum solution volume.

1.3 Technical Summary

1.3.1 Specifications

Blade height adjustment: 35mm travel adjustable in 10 micron increments set on digital thumbwheel switches.

Slice thickness: adjustable from 10 to 990 microns in 10 micron increments

Blade speed: continuously adjustable from 60 - 4000 cycles per minute

Oscillation Amplitude: linear, 1.2mm traverse (other ranges, optional)

Blade angle adjustment: adjustable from 5 to 30 degrees

Blade advance, travel: 31mm total

Blade advance, forward speed: continuously adjustable from 0 - 3mm per second**;** **reverse speed:** 3.4mm per second

Specimen Size: 25(w) x 25(d) x 15(h) mm maximum volume.

Lamp: 20-watt halogen white lamp with fiber optic light pipes and focusing lens on 18" (46cm) gooseneck.

Magnifier: 4" (10cm) diameter, X2 lens mounted on 12" (30cm) gooseneck, 9" working distance

Temperature Range: (80-15-1-02 only) 0 degrees C to ambient; temperature displayed on 3-digit LED to .1 degree C

Dimensions: 10.5"w x 16"d x 7.5"h (27 x 40 x 18cm), 30lb. (13kg).
Working space requirements: 12"w x 18"d x 10"h (30 x 45 x 25cm).

Power requirements: 115/230VAC, selectable, 50-60Hz, fused at 1Amp max current (500 mA for 230 VAC operation). See Section 2.1.4 for instructions on selecting line voltage.

1.3.2 Controls / Connectors

Controls, Front Panel

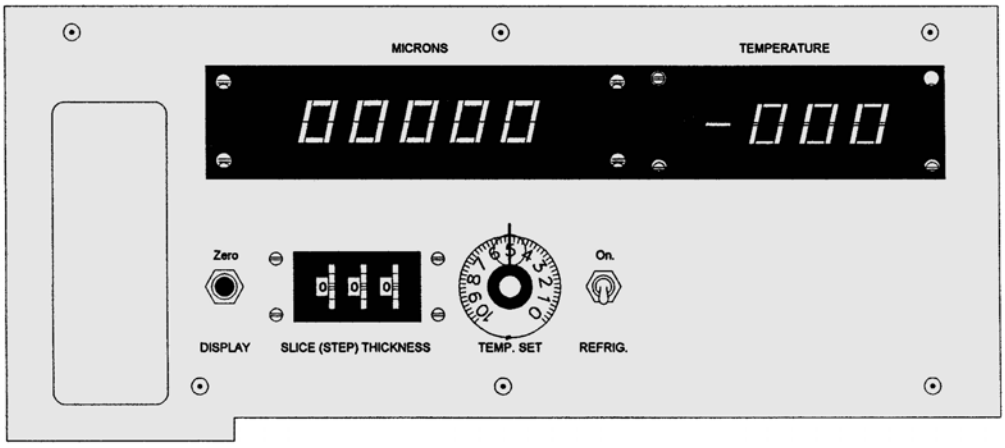
Blade advance - direction: 2-position toggle switch for selecting advance or return blade direction

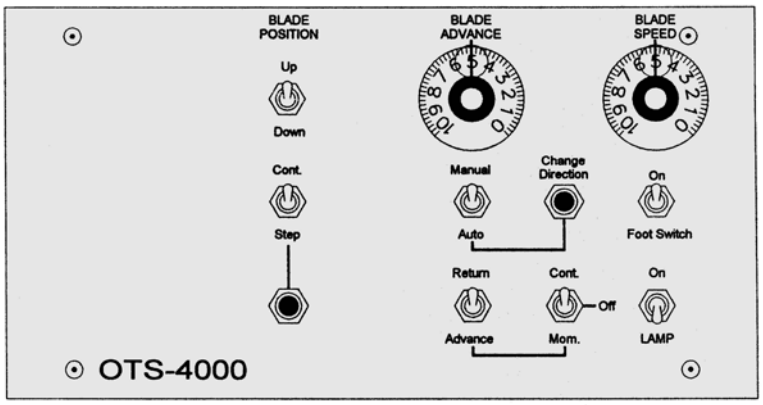
Blade advance, mode: 3-position toggle switch (center off) for selecting continuous advance at the selected rate or momentary advance when "spring-back" toggle is depressed.

Manual/Auto, mode: 2-position toggle switch. In the manual position, the blade drive stops at the end of its forward or reverse travel. In the auto mode, (which must be selected when the blade is not at its maximum forward or reverse position), the blade will automatically reverse direction at its maximum forward position (or when the change direction push button is activated), return to the maximum reverse position, activate a slice thickness increment, and then begin a forward cutting sequence.

NOTE: The blade advance switch must be in the continuous position for the blade to move during the auto-section sequence. However, if bunching of tissue is noted, the control can be switched to the stop or momentary position to allow the cutting to even out. Then, the switch can be set to continuous and the auto sequence continued.

Change Direction: Push button (for use in the auto mode) which reverses the blade direction when the blade is moving. This control permits the operator to save the time that would be used to complete a forward cycle after the section is cut.





Blade advance: 1-turn potentiometer with calibrated dial for selecting rate of blade advance (blade return rate is always 3.4mm per second)

Blade height, direction: 2-position toggle switch for selecting up or down motion

Blade height: 2-position switch for selecting continuous steps or single steps

Blade height, step: pushbutton switch for initiating single step equal to slice thickness selected on thumbwheel switches

Blade height reference: Pushbutton switch to zero the 5-digit LED display

Slice thickness: 2-digit thumbwheel switches for selecting slice thickness in 10-micron increments (least significant digit on 3-digit bank is fixed at 0)

Blade speed: 1-turn potentiometer with calibrated dial for selecting blade speed

Blade motion: 2-position toggle switch for selecting motion continuously on or activated through Foot Switch on 6-ft (2m) cord

Lamp: 2-position toggle switch for activating halogen lamp (power switch must also be activated)

Refrigeration: (80-15-5-02 only): 2 position toggle switch for activating the refrigeration controller.

Temperature Set: (80-15-5-02 only): 1 - Turn potentiometer with calibrated dial for selecting the temperature at which the bath is to be regulated.

Controls / Connectors, Rear Panel

Power: entry module containing:
Fuse drawer holding two fuses.
Line voltage selector
Rocker switch for activating power.
Three prong IEC connector for attaching the line cord.

(See Section 2.1.4 for details on voltage selection and fusing.)

Foot Switch: 1/4" phone jack for Foot Switch cable connector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-239

1.4 Inventory Check

1.4.1 Included Items

Your OTS-4000 is provided with the following items, which may be wrapped separately in packaging:

- OTS-4000
- Footswitch with 6' cable
- Dual fiber optic tube with focusing lens
- Slicer blades, Pk 25
- 4" magnifying lens with gooseneck
- 2.5" wide tray
- Pedestal for 2.5” tray
- Vise for 2.5” tray
- Pk/3 mounting blocks
- Power cord with alternate line voltage fuses attached
- Instruction Manual
- 1/16" Hex key for adjusting blade angle

1.4.2 Replacement / Accessory Items

80-11-6	Slice Blades Pk/25
80-12-1	Glass Blade Holder
80-12-2	Mounting Blocks, Pk/3
80-12-2-02	Vise for Standard Tray complete
80-12-5	Large (3.5” wide) Tray complete, Including Fixed Stage and Adjustable Pedestals
80-15-2	Standard (2.5" wide) Tray only
80-15-2-02	2.5” Pedestal for Standard Tray, complete Assembly
80-15-3	Large Tray only
80-15-3-02	3.5” Pedestal for Large Tray, complete Assembly
80-15-3-03	Fixed Stage Pedestal for Large Tray, complete Assembly
80-12-3	Surface for Standard Tray Pedestal
80-12-4	Replacement Halogen Lamp
80-12-3-02	Surface for Large Tray Pedestal

Note: all other OTS-4000 components as detailed in the assembly drawings in section 3 are available by contacting our sales department.

1.5 Illustrative Procedure

The procedure below illustrates slicing fresh brain tissue for electrophysiological recording.

1. Activate power and position the blade in the maximum UP and blade advance in the maximum RETURN position.

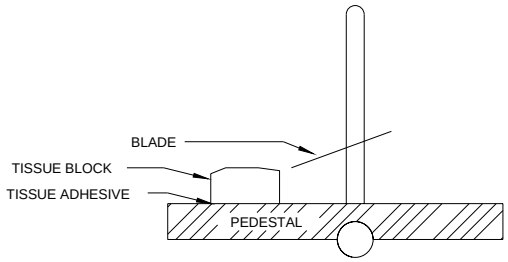
2. Prepare the surface of the sample pedestal by scraping with a previously used slicer blade followed by a light sanding with fine emery paper; clean with alcohol and blot absolutely dry.

3. Prepare a volume of Ringers or other medium oxygenated with 95% O. Put a small amount in a beaker immersed in an ice bath.

4. Position a new slicer blade in the blade arm slot and tighten securely. Clean both sides of the blade with soft tissue soaked in acetone or alcohol to remove any grease or oil.

5. Fill the tray with oxygenated medium. If the refrigeration section (80-15-5-02 only) is used, connect the inlet port to a suitable tap water supply. See Section 2.2.5 for more details.

6. Rapidly excise the tissue and cut the structure of interest into a block leaving a minimum of excess tissue, especially connective tissue. During the trimming process, bathe the tissue continuously with an eyedropper filled with the cooled medium. Turn the side of the tissue to be bonded up, and gently blot as dry as possible. Place a thin layer of tissue adhesive on the pedestal; too thick a layer of adhesive will ride up along the sides of the tissue and interfere with the slicing. Position the pedestal in the tray, being certain that the tissue is covered by a millimeter or two of medium.



7. Set the blade height direction switch DOWN and the mode switch to CONTINUOUS. This will cause the blade to begin a slow descent. Switch the mode to STEP when the blade approaches the correct height for a preliminary slice through the top of the tissue block.

   Note: To achieve a 20μm slice, set the Blade Advance to 5, Blade Speed to 5, Blade Angle to 15° and have an approximate water temperature of 21°.

   Set the auto section to manual, the blade advance to ADVANCE and the BLADE ADVANCE CONTROL to 2. Depress the mode switch to MOM, to cause the blade to advance towards the tissue.

   Activate the halogen lamp and position the magnifier as the blade and tissue are brought closer.

8. The correct blade advance and blade speed rates are determined by the temperature and consistency of the specimen as well as the slice thickness required. When beginning a new preparation, it is important to make several test passes to determine the optimum rate for the tissue under the experimental conditions.

   Set the BLADE SPEED CONTROL to about 2 and depress the foot switch to cause the blade to oscillate. The momentary blade advance mode is useful; if the tissue begins to bundle up; the advance can be quickly stopped allowing the tissue to recover.

9. After the first cut, return the blade to a point behind the tissue block. Set the thumbwheels to the required slice thickness, e.g. 300 microns. Zero the display counters by depressing the zero pushbutton. Push the STEP pushbutton which will cause the blade to move downward by the selected step thickness.

10. Activate the foot switch and advance the blade. The slice may float off the blade or remain adhered to it. Use a 000 sable brush or a small piece of filter paper to remove the slice; store it in a small beaker of cooled media until all slices are prepared.

11. Return the blade to a position with the blade behind the tissue block, depress the STEP pushbutton to lower the blade for the next slice and begin another sequence by setting the blade direction to advance.

    If several sections are to be cut, Auto Sequencing can be initiated by setting the auto-section switch to Auto. Please refer to section 1.3.2 CONTROLS/CONNECTORS for additional information on this feature.

12. When all slices are prepared, return the blade to the maximum RETURN position and the blade height to the maximum UP position. Turn off the halogen lamp and swing the magnifying lens to the right.

    Remove the blade from the blade holder and wipe dry with a soft tissue. Save the blade for clean up of the pedestal or the gross trimming of the tissue, but do not reuse blades when preparing slices. Thoroughly rinse the tray with tap water followed by a distilled water rinse. It is not advisable to wash the tray using a detergent or acid wash as contaminants may remain and interfere with future experiments.

2 Reference Manual

2.1 Reference Information

2.1.3 Inspection

FHC modules are factory checked and calibrated but should be carefully inspected before activating power.

If any exterior damage to the shipping carton is noted, the instrument should be inspected for obvious physical damage.

Components included with the OTS-4000 are listed in section 1.4.1.

2.1.4 Power Connections

Before operation, the power entry module on the rear panel must be configured for the line voltage that will be used to power the OTS-4000. The instrument has been provided set up for the line voltage determined from the shipping address. PLEASE check the window in the power entry module to be sure this is correct.

CAUTION: Failure to perform this procedure correctly may result in damage to, or improper operation of, the instrument.

The extra fuses required for changing the line voltage are packaged and attached to the power cord.

For operation at 110-120 volts (For example, in North America):

1. Insert the voltage selector insert into the top socket within the recess above the power switch of the power module so that "115" legend is visible when the insert is in installed. (The legend will be rotated 90 degrees). Press firmly into position.

2. Insert two (2) fuses, each marked 1A into the fuse drawer. (Discard the two fuses marked 500mA; they are intended for 230-volt operation).

3. Insert the fuse drawer into the power module. ("115" should appear in the fuse drawer window.)

4. Insert the power cord into the receptacle on the power module.

For operation at 220-240 volts (For example, in Australia or Europe):

1. Insert the voltage selector insert into the top socket within the recess above the power switch of the power module so that "230" legend is visible when the insert is installed. (The legend will be rotated 90 degrees). Press firmly into position.

2. Insert two (2) fuses, each marked 500mA into the fuse drawer. (Discard the two fuses marked 1A; they are intended for 115 volts operation).

3. Insert the fuse drawer into the power module. ("230" should appear in the fuse drawer window).

4. Insert the power cord into the receptacle on the power module.

2.1.5 Warranty

All FHC products are unconditionally guaranteed against defects in workmanship for one year from date of shipment as long as they have been exposed to normal and proper use. Even though the one year warranty may have expired, please contact our Service Department before attempting any repairs or alterations. Many of these repairs will still be performed at the factory at no charge to the customer.

2.1.6 Policies

1. TECHNICAL SUPPORT: It is our policy to provide our customers with the most comprehensive technical support in the industry. If any questions arise or problems occur, we encourage you to call or write and we promise to promptly and comprehensively respond to your requirements.

2. TRADE-UP POLICY: It is our policy to offer customers trade-up ability as new and/or expanded capabilities for their instruments are announced. In many cases, full credit will be given. In general, we will allow 100% credit for two years and depreciate 20% per year thereafter. Please contact our Marketing Department for information relating to your particular situation.

2.1.7 Service

Should service be required, please contact our Service Department for return instructions (207-666-8190). Carefully pack the instrument before returning.

Please include a note indicating:

1. The model number and purchase date of the instrument.
2. The person to contact if questions arise.
3. The "symptoms" indicating that repair is necessary.

If the instrument is not covered by the warranty, a quotation will be forwarded to the sender detailing the repairs necessary and charges, before repair is begun.

2.2 Installation

2.2.1 Initial Assembly

Set the OTS-4000 cabinet on a solid, level bench top.

Insert the fitting at the end of the fiber optic light pipes into the lamp mount on the cabinet back panel until it snaps into position. The focusing lens slips over the ferule end and is adjustable by moving it up and down on the ferule.

The magnifying lens gooseneck slips over the mounting stud on the top of the cabinet.

Insert the foot switch cable connector into the socket on the cabinet back panel.

Section 2.1.4 describes the procedure for configuring the slicer for the proper line voltage.

Section 2.2.5 describes connection of the refrigeration components.

2.2.2 Mounting / Removing Tray

The OTS-4000 specimen tray includes a lock-on slot to more solidly mount it to the platform while still allowing some adjustment in the positioning of the tray relative to the blade.

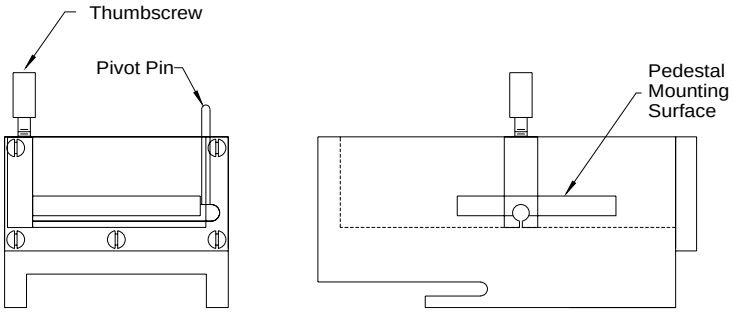
To mount the tray on the platform, move the blade to its uppermost position, fully returned. Slide the tray forward until the thumbscrew threads slide into the slot on the left side of the tray. Tighten the thumbscrew.

The OTS-4000 is provided with three sample mounting fixtures which mount in round grooves in the sample tray side wall.

The Fixed stage pedestal is removed by loosening the thumbscrew about half a turn, and lifting up.

To remove the adjustable pedestal from the tray loosen the thumbscrew on the top of the post about half a turn and, grasping the thumbscrew and the pivot pin, lift the assembly vertically out of the slots as shown below.

After mounting the sample, reverse the above operation. Use the pivot pin to set the angle of the sample relative to the blade. A gentle tightening of the thumbscrew is all that is required to securely hold the assembly in position.



2.2.3 Light Bulb Replacement

Remove the fiber optic pipe from the lamp mount (on the cabinet back panel) by firmly pulling the light pipe from the lamp mount. Allow the lamp mount housing to cool.

Remove the lamp mount housing by unscrewing the two screws (one on each side of the housing). Gently, pull the housing forward exposing the back of the bulb. Work off the connector. The bulb is held in position by an O-ring, which can be removed using forceps.

> NOTE: NEVER handle high intensity lamps in such a way as to touch the bulb with bare hands leaving oils on its surface. This dramatically reduces bulb life! Inadvertently touched bulbs should be cleaned with denatured alcohol and a lint free cloth.

Replace the bulb (please refer to section 1.4.2 for FHC catalog number of the bulb. Position the housing back in the cabinet and screw in the two mounting screws. Replace the fiber optic pipe.

2.3 Blade Holder Information

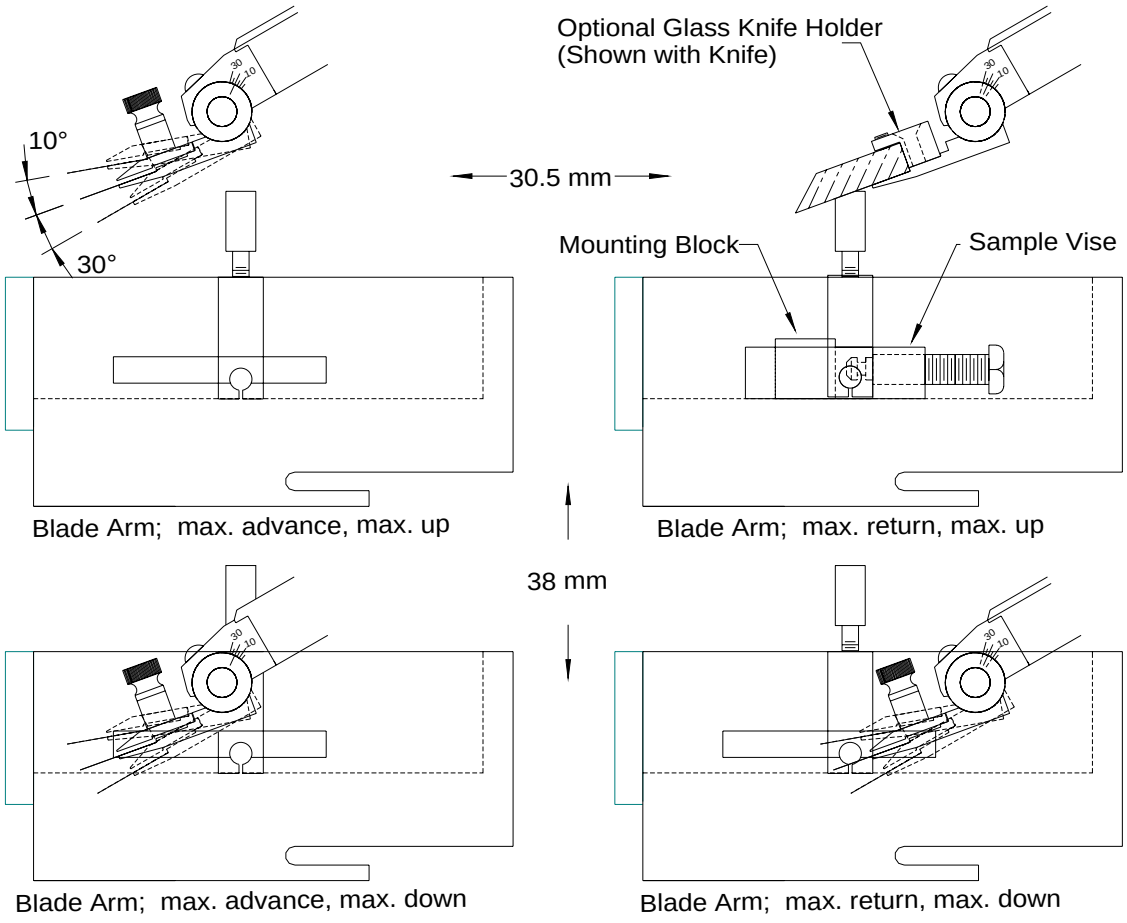
Your OTS-4000 Blade holder is provided with a clamp type holder; loosening the thumbscrew will allow various sized blades to be mounted between the top clamp and base plate. The diagram below shows the external positions of the blade arm relative to the tray.

The angle of the blade can be adjusted between 10° and 30° by loosening the black Allen lead screw directly behind the thumbscrew and rotating the white cylinder to which the blade holder is attached.

PLEASE NOTE: using blades other than those provided with your unit may change the relative position of the blade to sample.

An optional glass knife holder is also available (Catalog # 80-12-1). Designed to accept knife thicknesses to .25in., the holder is easily installed. Remove the thumbscrew and top clamp plate from the standard blade holder; replace with the knife holder bracket oriented as shown in the drawing below. Use the 4-40 flat head stainless steel screw provided with the holder to secure.

A .050" hex key is also provided to tighten the nylon tipped set screws onto the glass knife.



2.2.5 Refrigeration Control (80-15-5-02 only)

The cooling unit built into the tray utilizes a thermoelectric device which, when electric current flows through it, draws heat from one side to the other. The cooling side of the device contacts the stainless steel bottom of the tray; water from cold water tap is circulated against the other side of the device drawing off the heat.

IMPORTANT NOTE: Water from cold water tap should always be circulated through the cooling unit when power is activated or inefficient cooling and damage to the thermoelectric device will result.

1. Connect the plastic tubing provided to the stainless steel tubing inlet and outlet ports that emerge from the side of the Tray. Either port can be used for inlet.
2. Connect the other end of one piece of the tubing to a cold water tap and circulate water from the cold water tap through the unit at a rate of 250-300ml/min.

NOTE:

A. The exact flow rate is not critical so long as it exceeds 250ml/min.

B. Be certain no air pockets are trapped in the Cooling Unit. It is helpful to elevate a portion of the outlet tube above the level of the tray to prevent such an air pocket.

3. Position the tray on the OTS-4000 and connect the output cable from the Cooling Unit to connector on the back panel.

4. Fill the tray to within 5-6mm of the top with buffer or saline solution.

5. With the water from the cold water tap water running, turn the REFRIG. switch on and set the temperature control knob to the required bath temperature, e.g. 2

6. A temperature differential of 4-5 between the top and bottom of the solution in the tray will result if the solution is not stirred. During cutting, the blade oscillations will assure stirring. Before the sample is introduced and the unit is "cooling down", sufficient stirring can be accomplished by simply setting the blade speed to 5 or 6 and effecting oscillation with the blade positioned above the solution.

7. It is recommended that buffer or other solution be refrigerated between uses. This will reduce "cooling down time" to less than 5 minutes.

8. Regulation of + or - .5 degree C. at the thermistor is expected.

3 Technical Manual

3.0 General Documentation Information

It is our policy to provide comprehensive product documentation with our instruments. Section 3 of our instruction information includes not only technical descriptions and calibration procedures but parts lists, schematics and parts layouts. We also maintain a service record file on each product, information that is available to any instrument owner if in the future he should experience problems.

Section 3.4 includes our master parts list which details the assemblies for the instrument and individual parts list for each assembly. These parts lists include our FHC part or assembly numbers, a general description of the part, and quantities.

Parts layouts are provided for all relevant assemblies. These layouts include component values and circuit numbers unique to the assembly. In those cases where the density of the assembly is too high a separate drawing with circuit numbers is included.

Complete schematics are also provided for each instrument. Schematics include all components of an instrument and as such, one schematic may include two or more assemblies, e.g. front panel and captive circuit board assemblies. Whenever possible assemblies are separated or designated on schematics. Schematics, in addition to listing component values include circuit numbers. Because circuit numbers are unique to each assembly, the same circuit number e.g. C10 may be used twice on a schematic referring in one place to a 10 pF capacitor on a front panel switch and in another to a .47mF PCB mounted capacitor. However, functional considerations should remove any ambiguity.

Schematics are referenced by the instrument catalog number followed by a code which lists the total number of pages which constitute the complete instrument schematic i.e. 1/2, 2/2.

Assemblies are referenced by the assembly number followed by the number of pages code i.e. 1.2, 2.2. In those situations in which a printed circuit board is wired to another assembly, for example a front panel, the identifying interconnections, wire colors, etc. are included with the front panel assembly.

3.1 Specific Packaging Disassembly Information

Disassembly for service or calibration (not required on a routine basis).

Access to the circuitry and mechanics of the OTS-4000 Tissue Slicer is through removal of the case as follows:

1. Move the blade mechanism to its full reverse, maximum up position.

2. Disconnect (unplug) the power cord from the rear of the slicer.

3. Remove the tray. Set the slicer on its right side. Remove the tray holder by removing the four Allen (3/32” hex) head capscrews that hold it to the bottom plate. Return the slicer to its normal position.

Note: Use a high quality 1/16” hex wrench for the following steps:

4. Remove the six Allen screws securing the upper front panel and the four screws securing the lower front panel to the case.

5. Remove the four Allen screws securing the case to the back panel.

6. Remove the six Allen screws (three on each side) securing the case to the bottom plate.

7. Gently lift the rear of case enough to just clear the back panel and slide the case forward just enough for the lower front of the case to disengage from the lip on the front of the bottom plate.

9. Carefully maneuver both front panels back through their respective openings in the case while continuing to completely remove the case in a forward direction.

3.2 Technical Description

Referring to schematic 1/4, the vertical displacement of the blade mechanism is controlled by a stepper motor such that each step results in a 10-micron movement of the blade. IC v is an Oscillator that generates the pulses that ultimately drive the stepper motor. In the STEP mode, IC's b and c count these pulses up to the number set on the front panel SLICE THICKNESS thumbwheel switches each time the STEP pushbutton is depressed. In the CONT mode, these counters are bypassed and a steady stream of pulses is gated to IC's W and X which generate the quadrature signal required to step the motor. IC's C-G counts the pulses driving the motor. The outputs of these counters go to IC's N-Q (shown on schematic 2/4), which, with IC's T and M, generate a multiplexed signal to drive the 5 digit, 7 segment LED display which shows blade displacement in microns.

Schematic 3/4 shows the slicer power supply and the circuitry for driving the blade oscillation and advance motors. Op-amp IC B buffers the voltage from the BLADE SPEED potentiometer, and through Q3 drives the motor which oscillates the blade.

The blade drive motor is driven by a transistor H-bridge. In the reverse direction, Q4 and Q2 conduct. In the forward direction, Q5 is turned on, and Q1 drives the motor with the voltage generated by the BLADE ADVANCE potentiometer, buffered by IC A. Logic is provided so that in the AUTOMATIC mode, the closure of the limit switches at either end of the blade's travel reverses the direction and automatically generates a step command before starting the forward movement.

The 80-15-5-02 slicer has a built in refrigeration system which controls a Peltier thermoelectric module, turning it on and off as needed to maintain a set temperature as sensed by a thermistor. A digital display of the sensed temperature is also provided.

Referring to schematic 4/4, the sensing thermistor forms one leg of a Wheatstone bridge which is powered by the reference voltage output of ICA (pin 6), an LM723 voltage regulator. The other legs of the bridge include the front panel TEMPERATURE
potentiometer as well as trimpots T1 and T2 which scale the voltage across it to correspond to temperature settings of 0 to 10 degrees Celsius. The output voltage of the bridge, proportional to the difference in temperature between that sensed by the thermistor and the set point, is differentially compared by IC A. The output voltage of IC A (Pin 10) is about zero if the sensed

temperature is higher than the dial setting of the TEMPERATURE control. This turns on Q3 which, in turn, turns on Q2 and Q1, causing current to flow through the Peltier cooling device. When the sensed temperature falls below the TEMPERATURE setting, IC A, pin 10 goes high, turning off Q3, Q2, Q1 and the Peltier device.

A 3-digit (and minus sign) LED display of temperature is provided by the digital voltmeter circuit (IC E). The voltmeter measures the voltage across the sensing thermistor, which varies reasonably linearly with temperature over the range of –10 degrees C. to 25 degrees C. Trimpots T1 and T2 are used to appropriately bias and scale this voltage so that the voltmeter output reads directly in degrees (and tenth) Celsius.

3.3 Calibration Procedure

1. Motor Speed Adjustments

Trimpots to adjust the blade and tray drive speeds are located on a printed circuit board accessible by removing the case of the instrument. Refer to Dwg. 1188D1.01

a. Blade Advance Calibration

Set the blade controls to Manual, Forward Continuous. With blade advance rate knob turned fully counter clockwise, adjust trim pot #1 so that the blade just stops its forward motion (i.e., the knob has to be advanced off 0 to allow forward motion of the blade).

b. Blade Speed Calibration

Minimum Speed

Turn blade speed knob counter clockwise (reading 0).
Adjust trim pot #2 until the blade oscillation motor is at its stalling point.

2. Refrigeration Calibration (80-15-5-02 ONLY)

Equipment required: Decade resistance box
Digital voltmeter
Oscilloscope

Digital Display calibration (Refer to 10571B1.01) Trimpots T1 and T2 are located on the front panel display board

a. Connect the decade resistance box (R) across pins 3 and 4 of the back panel connector. Set R to 19,050 Ohms. Adjust T2 for a voltage of 3.2 volts at Test Point 2. Adjust T1 for a voltage of 3.5 volts at Test Point 1.

b. Set R to 9,050 Ohms. Adjust T1 for a digital display reading of 12.0 degrees.

c. Set R to 19,050 Ohms. Adjust T2 for a digital display reading of -3.0 degrees.

d. Steps 2 and 3 interact and should be repeated until both specified display readings are obtained.

Temperature controller calibration (Refer to 1148A1.02) Trimpots T1 and T2 are located on the main circuit board, mounted on the bottom plate.

a. Adjust T1 for 2.7 volts at Test Point 3 and T2 for 3.2 volts at Test Point 4.

b. Two trimpots must be adjusted so that the front panel TEMPERATURE control knob corresponds to the temperature at which the Peltier cooling devices switches between ON and OFF. Connect an oscilloscope to Test Point 5. The voltage at this point will either be "low" (about zero volts, indicating that the Peltier cooler is not being turned on) or "high" (above about 8 volts, indicating that the Peltier cooler is being turned on). In steps 3 and 4 below, the trimpots will be adjusted so that this voltage at Test Point 5 is just at the transition point between the high and low states.

c. Adjust R, the decade resistance box, for a digital display reading of 0 degrees (R approximately 16.3 Kilohms). Set the TEMPERATURE control knob to 0. Adjust T2 so that Test Point 5 is just at the transition point. (If Test Point 5 is "high", adjust T2 clockwise to reach the transition point).

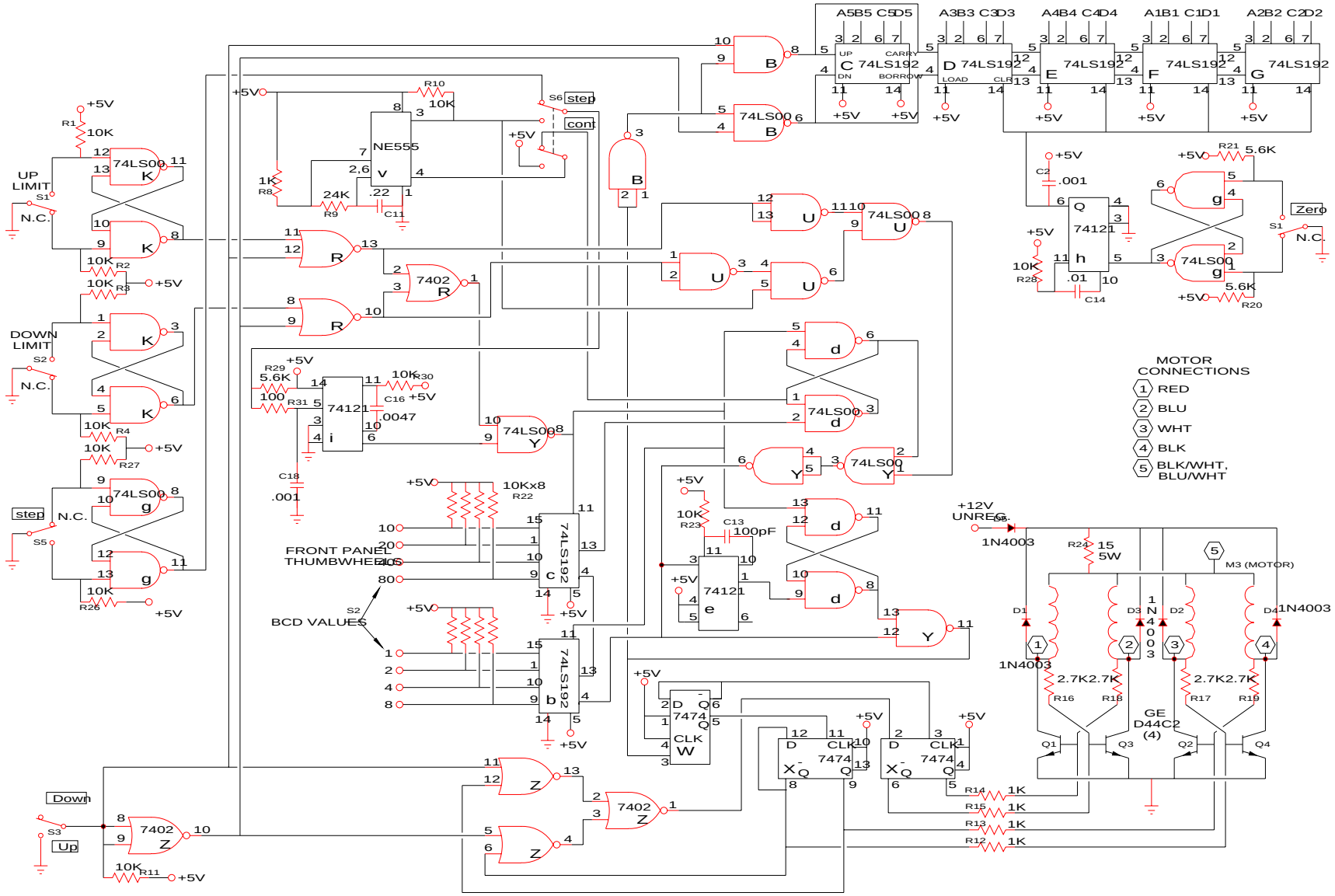
d. Adjust R for a display reading of 10 degrees (R approximately 10K). Set the TEMPERATURE control knob to 10. Adjust T1 so that Test Point 5 is just at the transition point. (If Test Point 5 is "low", adjust T1 clockwise to reach the transition point).

e. Steps 3 and 4 interact and will have to be repeated to obtain the results described. When properly calibrated the voltage at Test Point 5 should be "high" if the TEMPERATURE knob setting (0-10) is lower than the temperature indicated on the digital display.

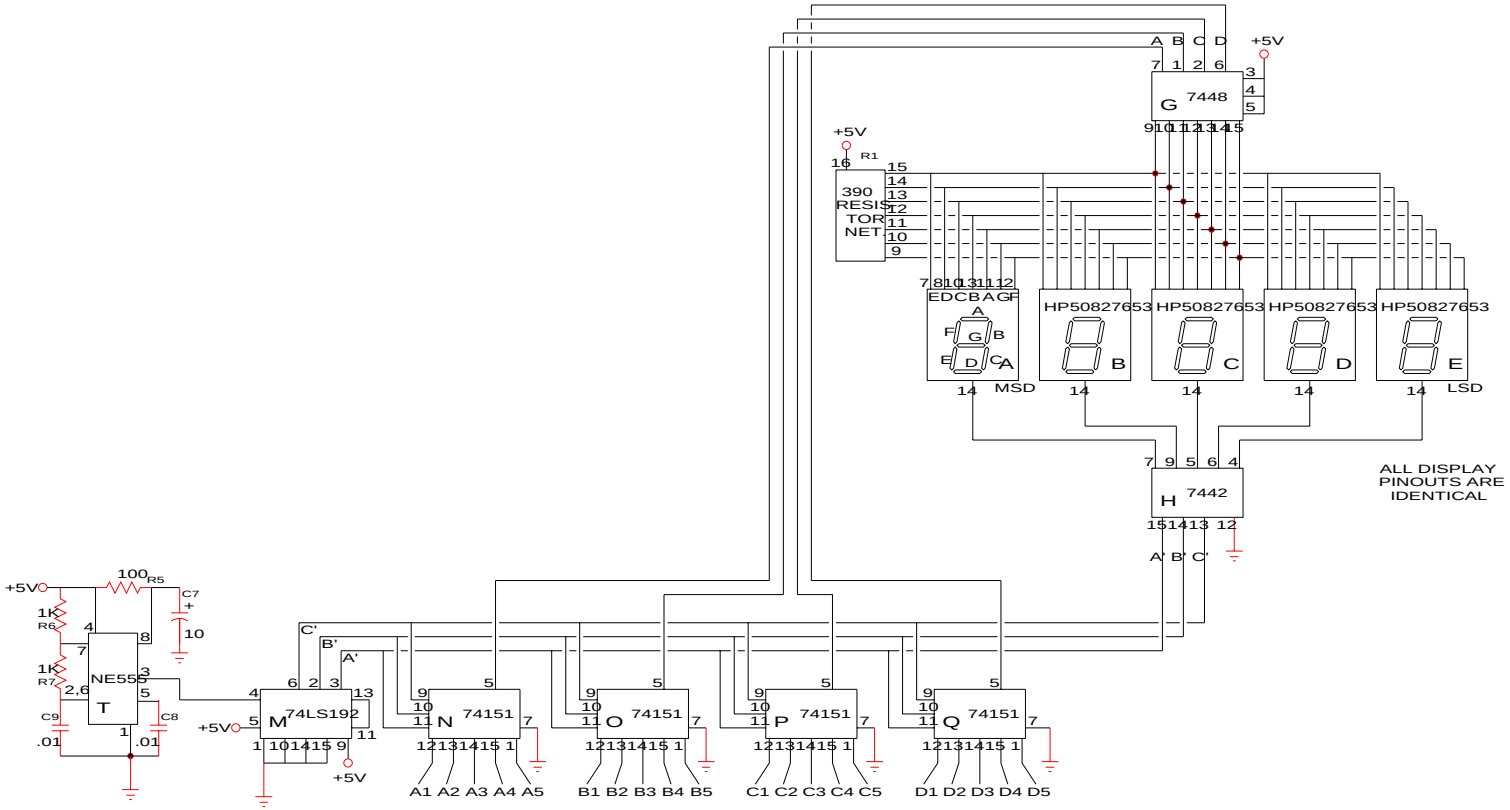
Temperature vs. Thermistor Resistance Table

Degrees Celsius	-5	-3	0	+12	+25
R (Ohms)	21.17K	19.06K	16.33K	9050	5000

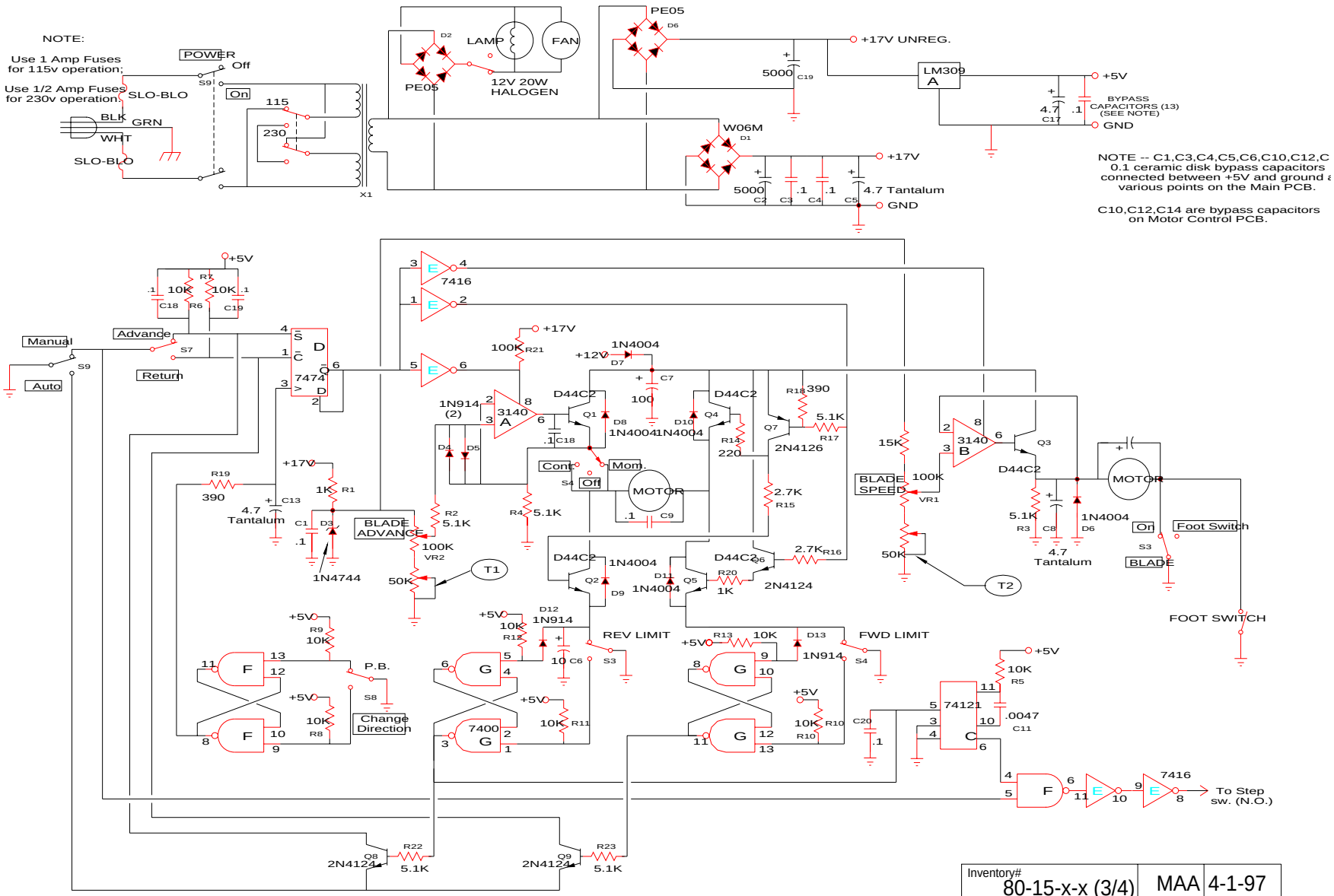
3.4 Master Parts List

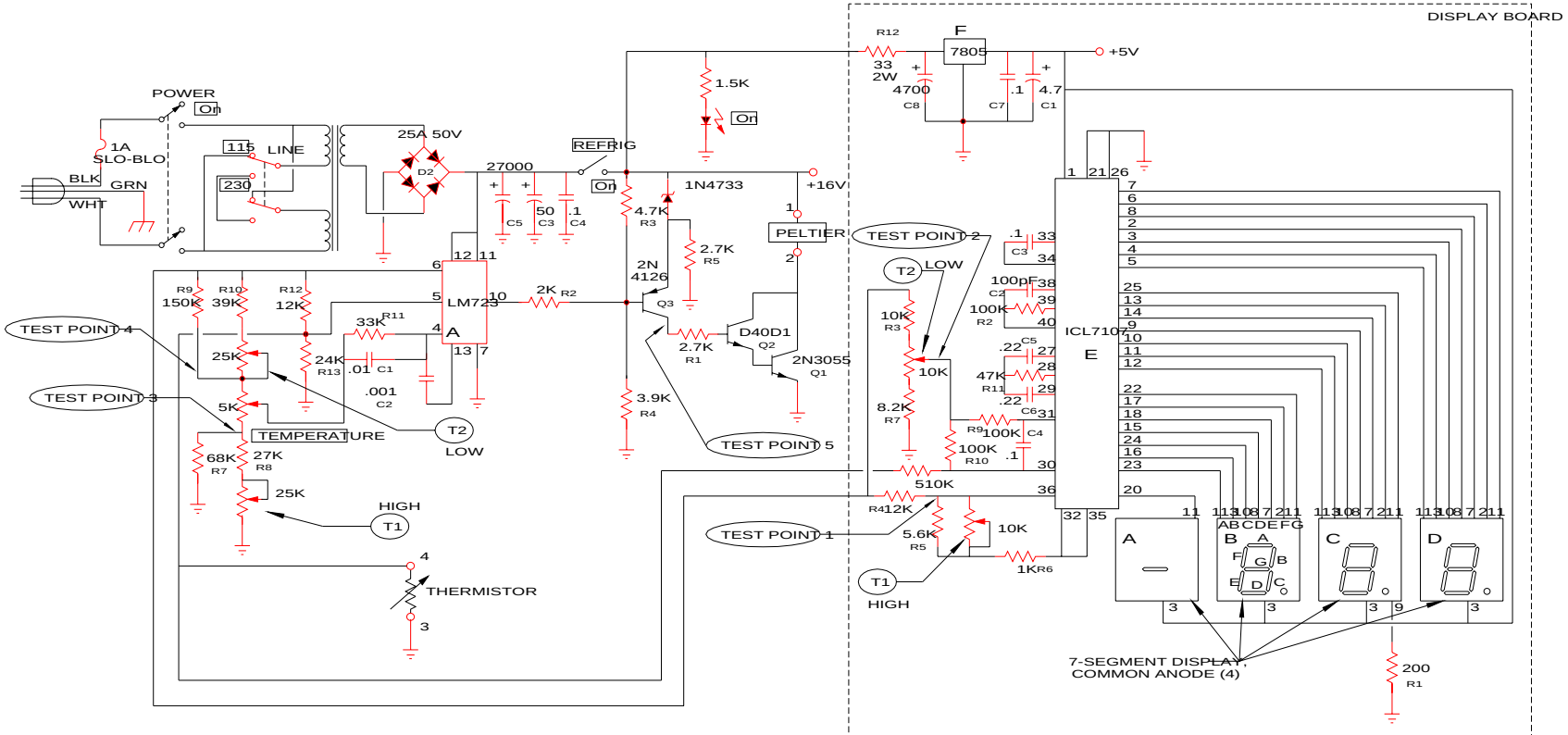


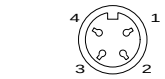
Inventory# 80-15-x-x (1/4)	MAA	4-1-97
OTS 4000 Schematic	File ots4k-s1.cad	



Inventory# 80-15-x-x (2/4)	MAA	4-1-97
OTS 4000 mux/display Schematic	File ots4k-s2.cad	


NOTE:
Use 1 Amp Fuses for 115v operation;
Use 1/2 Amp Fuses for 230v operation.
POWER
Off
On
SLO-BLO
BLK
GRN
WHT
115
230
LAMP
FAN
12V 20W HALOGEN
PE05
+17V UNREG.
LM309 A
+5V
BYPASS CAPACITORS (13) (SEE NOTE)
GND
W06M
+17V
4.7 Tantalum
NOTE -- C1,C3,C4,C5,C6,C10,C12,C 0.1 ceramic disk bypass capacitors connected between +5V and ground a various points on the Main PCB.
C10,C12,C14 are bypass capacitors on Motor Control PCB.
Manual
Advance
Return
Auto
7474
7416
1N914 (2)
3140 A
3140 B
D44C2
1N4004
2N4126
2N4124
BLADE ADVANCE
BLADE SPEED
MOTOR
Cont.
Mom.
Off
On
Foot Switch
FOOT SWITCH
REV LIMIT
FWD LIMIT
P.B.
Change Direction
7400
74121
1N4744
To Step sw. (N.O.)
Inventory# 80-15-x-x (3/4)
MAA 4-1-97
OTS 4000 PS/Motor Schematic
File ots4K-s3.cad





4-PIN SOCKET CONNECTING
THERMISTOR AND PELTIER UNIT,
VIEWED FROM FRONT.

Inventory# 80-15-x-02 (4/4)	MAA	4-30-97
Refrigeration Control Unit	File ots4k-s4.cad	