

# Thermocouple Calibration

## Thermocouple Calibration for Software up to and including Rev. 3.00



**Incorrect or inaccurate calibration may cause unsuccessful sterilization of instruments.**



**Always calibrate the thermocouples after a thermocouple replacement, thermocouple bend or disconnect, controller board replacement or microprocessor / EEPROM replacement, steam generator replacement or probe bracket replacement.**



**Make sure that there is sufficient steam-process distilled water in the unit prior to starting calibration.**



**Do not place the digital reference thermometer in direct sunlight, on the armature or on any other hot surfaces. This may cause improper values on the temperature readout.**

STATIM Cassette Autoclaves have been manufactured using different Controller Boards. See *Controller Board Hardware / Software, Identifying the Controller Board Type*. Assembly and revision numbers are located on the bottom right-hand portion of the component side of the board. For detailed differences between board versions, see *Controller Board Hardware / Software*.

Units containing boards bearing the following numbers must follow *Calibration Procedure for Type A Controller Board*:

01-100005A, Version 3X

01-100004A, Version 3X

01-100004A, Version 4X

01-100020A, Version 3X

01-100638A, Version 3X

01-100992, Version 4X

01-101170, Version 4X

01-101172, Version 4X

## Thermocouple Calibration

Typically, these boards were manufactured with four potentiometers ( $V_{REF}$ , DISP, TC-CHM and TC-BLR) and do not have a printer connector. Refer to these boards as Type A Controller Board.

Units containing boards bearing the following numbers must follow *Calibration Procedure for Type B Controller Boards*:

01-101359, Any version, Type B

01-100881, Any version, Type B

01-101356, Any version, Type B

Units containing boards with the following numbers follow *Calibration Procedure for Software Rev. 4.00 and up*.

01-108191Z, Any version, Type C

01-108380Z, Any version, Type C

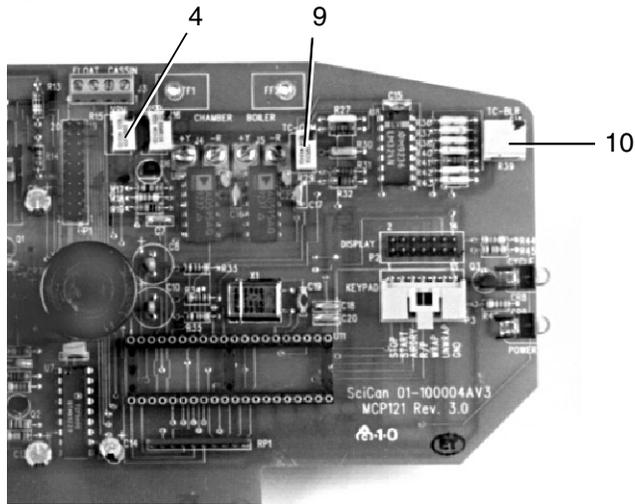
01-108382Z, Any version, Type C

For other Controller Boards, contact SciCan.

Typically, these boards were manufactured with 3 potentiometers ( $V_{REF}$ , DISP and TC-ADJ), a six position J4 connector terminal labelled FLOAT PROBE CASSIN and the P2 printer connector. Refer to these boards as Type B and Type C Controller Boards.

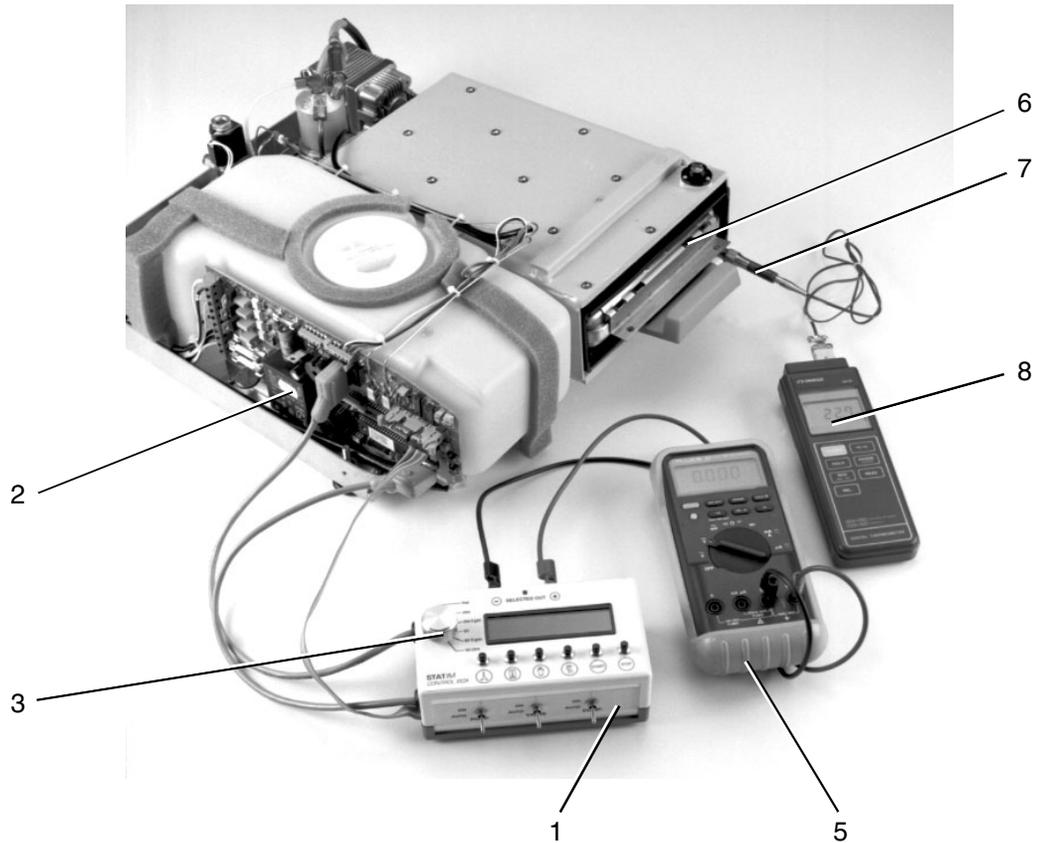
# Thermocouple Calibration

Type A



1. Control Box
2. Controller Board
3. SELECT knob
4. VRH potentiometer
5. digital voltmeter
6. calibration cassette
7. thermocouple
8. digital thermometer
9. TC-CHM potentiometer
10. TC-BLR potentiometer

Figure 1





## Thermocouple Calibration

When referring to the Troubleshooting portion of this service manual, note that there are specific check cassette error messages for Type A Controller Boards, and specific cycle fault messages for Type B Controller Boards.

For calibration equipment hookup and identification see Figure 1.

### Calibration Procedure for Type A Controller Boards

These steps **MUST** be performed in sequence to calibrate a unit with a

Type A Controller Board:

1. Reference Voltage Verification / Adjustment
2. Steam Generator Thermocouple Calibration
3. Chamber Thermocouple Calibration, including Steam Generator recalibration.

### Reference Voltage Verification / Adjustment (Type A Boards)

To verify / adjust the reference voltage, follow these steps (see Figure 1):

1. Turn the autoclave unit **OFF**, connect the Control Box (1) to the Controller Board (2). Connect the digital voltmeter (5) to the  $V_{REF}$  terminals. Set the meter to read DC Volts with a resolution of 1mV.
2. Power the autoclave unit **ON**.
3. Adjust the VRH potentiometer until  $V_{REF}$  is  $4.000\text{ V} \pm 0.001$
4. Once  $V_{REF}$  is adjusted, apply a drop of non-conducting laquer or nail polish to the adjustment screw of the potentiometer.

### Steam Generator Thermocouple Calibration (Type A Boards)

To calibrate the steam generator thermocouple, follow these steps (see Figure 1):

1. Turn the Control Box SELECT knob to blr-chm. This signal is the difference between the chamber and steam generator thermocouples. See, *Required Information and Tools, The Control Box*.

## Thermocouple Calibration

2. Set the meter (5) to read DC Volts with a resolution of 1 mV and locate the TC-BLR (10) potentiometer on the Controller Board.
3. Select the UNWRAPPED INSTRUMENT CYCLE button on the Control Box, then press **START**. Follow the phases of the cycle as they are displayed on the LCD (warming up, purging air, pressurization, sterilization). Calibration occurs during the sterilization phase.
4. With 2 minutes and 25 seconds left in the sterilization cycle adjust the TC-BLR potentiometer until the voltmeter reads  $0.000\text{ V} \pm 0.030\text{ V}$ .

### Chamber Calibration Conversion - Chart A

TCHM (°C)	VCHMXGAIN (VOLTS)	TCHM (°C)	VCHMXGAIN (VOLTS)	TCHM (°C)	VCHMXGAIN (VOLTS)	TCHM (°C)	VCHMXGAIN (VOLTS)
134.0	2.259	135.3	2.300	136.6	2.340	137.9	2.381
134.1	2.262	135.4	2.303	136.7	2.343	138.0	2.384
134.2	2.265	135.5	2.306	136.8	2.347	138.1	2.387
134.3	2.268	135.6	2.309	136.9	2.350	138.2	2.391
134.4	2.271	135.7	2.312	137.0	2.353	138.3	2.394
134.5	2.274	135.8	2.315	137.1	2.356	138.4	2.397
134.6	2.278	135.9	2.318	137.2	2.359	138.5	2.400
134.7	2.281	136.0	2.322	137.3	2.362	138.6	2.403
134.8	2.284	136.1	2.325	137.4	2.365	138.7	2.406
134.9	2.287	136.2	2.328	137.5	2.369	138.8	2.409
135.0	2.290	136.3	2.331	137.6	2.372	138.9	2.413
135.1	2.293	136.4	2.334	137.7	2.375	139.0	2.416
135.2	2.296	136.5	2.337	137.8	2.378		

# Thermocouple Calibration

## Chamber Thermocouple Calibration (Type A Boards)

There are no quick ways to calibrate a unit. Calibration requires a number of readings and adjustments to achieve the required values. Wait for equipment readings to stabilize and record them as quickly and precisely as possible.

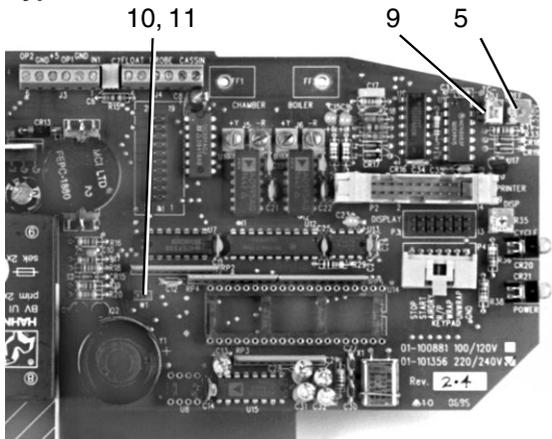
To calibrate the cassette thermocouple, follow these steps (see Figure 1):

1. Install the thermocouple (7) into the calibration cassette (6) and attach the digital thermometer (8). Ensure that the thermocouple and digital thermometer have matched serial numbers.
2. Turn the Control Box (1) SELECT knob (3) to **chm X gain**. See, *Required Information and Tools, The Control Box*. Locate the TCHM potentiometer (9) on the Controller Board (2).
3. Set the meter (5) to read DC Volts with a resolution of 1 mV.
4. Select the WRAPPED INSTRUMENT CYCLE button on the Control Box, then press **START**. Follow the phases of the cycle as they are displayed on the LCD (warming up, purging air, pressurization, sterilization). Calibration occurs during the sterilization phase.
5. After approximately 2 minutes into the sterilization phase look for the digital thermometer (8) reading to remain constant for at least 2 seconds and record the values of the digital thermometer (T<sub>CHM</sub>) and digital voltmeter (V<sub>M</sub>).
6. Using the T<sub>CHM</sub> value just recorded, find the corresponding V<sub>CHMXGAIN</sub> value from the chamber calibration conversion chart. See Chart A.
7. Adjust the T<sub>CHM</sub> potentiometer until V<sub>M</sub> matches V<sub>CHMXGAIN</sub> for the observed T<sub>CHM</sub> to within  $\pm 0.005$  V.
8. Start another cycle and verify that the calibration readings are within acceptable values. If not, repeat steps 4 through 7 until acceptable values are achieved.
9. Repeat the steam generator thermocouple calibration procedure.

# Thermocouple Calibration

- 10. Start another cycle and verify that the calibration readings are within acceptable values. If the readings are not within these values repeat step 9 until the proper voltmeter reading is obtained.
- 11. Once adjusted, apply a drop of non-conducting laquer or nail polish to the adjustment screw of the TC-ADJ potentiometer.

Type B



- 1. Control Box
- 2. Controller Board
- 3. SELECT knob
- 4. digital voltmeter
- 5. Vref potentiometer
- 6. calibration cassette
- 7. thermocouple
- 8. digital thermometer
- 9. TC-ADJ potentiometer
- 10. Calibration jumper connection
- 11. Calibration jumper (not shown)

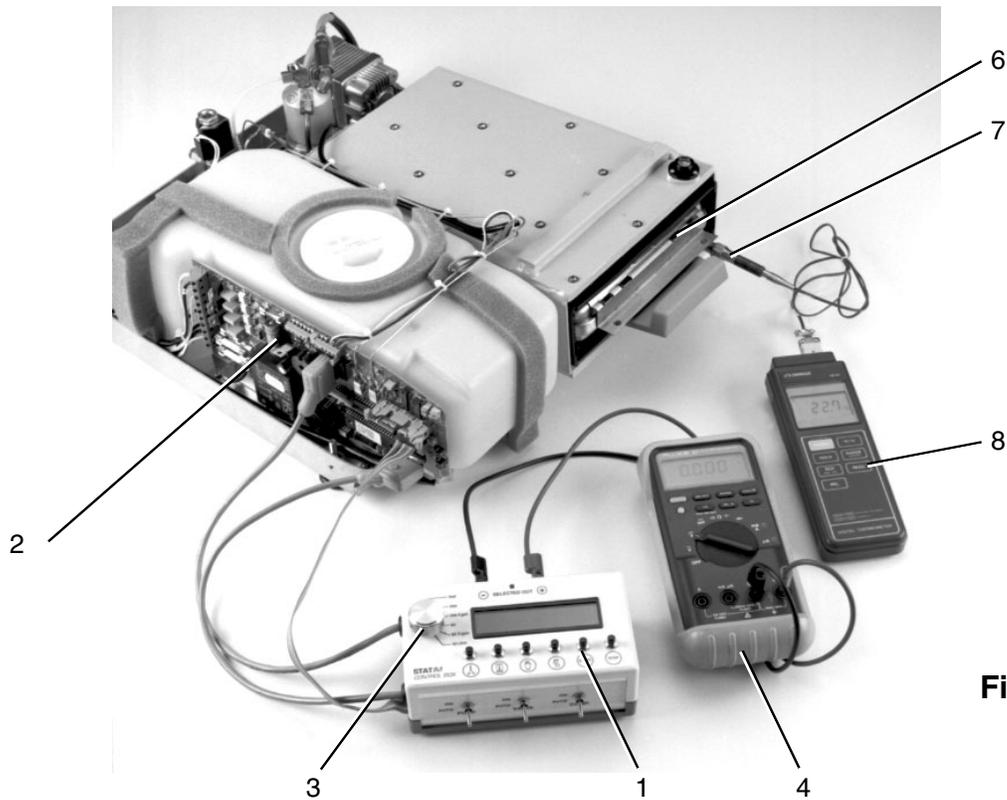


Figure 2

# Thermocouple Calibration

## Calibration Procedure for Type B Controller Boards



The chamber and steam generator thermocouples must be calibrated to ensure the correct operation of the STAT/M. The steam generator thermocouple is calibrated automatically by a special calibration cycle in the Type B Controller Boards. The chamber thermocouple is calibrated by adjusting a potentiometer on the Controller Board while comparing the temperature on the LCD display with the temperature measured by the digital reference thermometer within the calibration cassette.

In calibration mode no error messages are displayed. For calibration equipment hookup and identification, observe these steps (see Figure 2):

To calibrate a unit with a Type B Controller board, follow these steps (see Figure 2):



1. Before starting calibration, turn the STAT/M **OFF** and remove the cover. Check that there is sufficient steam process distilled water in the reservoir, and that the calibration cassette (6) is correctly engaged in the STAT/M.
2. Install the thermocouple (7) into the cassette and attach the digital thermometer (8). Ensure that the thermocouple and digital thermometer have matched serial numbers.
3. Install the calibration jumper (11) to Controller Board pins marked W1 (10).
4. Adjust  $V_{REF}$ . See *Reference Voltage Verification and Adjustment (Type B Boards)*.
5. Calibrate the steam generator thermocouple. See *Steam Generator Thermocouple Calibration (Type B Boards)*.
6. Calibrate the chamber thermocouple. See *Chamber Thermocouple Calibration (Type B Boards)*.
7. Repeat step 5 and verify the chamber thermocouple calibration by comparing the chamber temperature on the LCD with the reference thermometer temperature.
8. After calibration is complete, turn the STAT/M **OFF**, remove the calibration jumper and disconnect the Control box.

# Thermocouple Calibration

## Reference Voltage Verification / Adjustment (Type B Boards)

To verify / adjust the reference voltage follow these steps (see Figure 2):

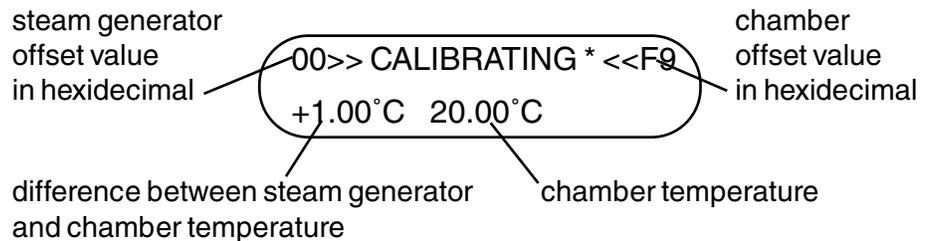
1. Connect the control box (1) to the Controller Board (2) and the digital voltmeter to the VREF terminals on the control box. Set the voltmeter (4) to read DC Volts with a resolution of 1mV.
2. Power the Statim **ON**.
3. Adjust the VREF potentiometer until VREF is 2.520 V ± 0.001 mV. Once VREF is adjusted, apply a drop of non-conducting laquer or nail polish to the adjustment screw of the potentiometer.

## Steam Generator Thermocouple Calibration (Type B Boards)

To calibrate the steam generator thermocouple, follow these steps (see Figure 2):

1. Turn the autoclave unit **OFF** and install a calibration jumper on Controller Board header W1. Power the unit **ON**. The LCD should appear similar to the example in step 2.
2. To start a steam generator self-calibration cycle, hold down the UNWRAPPED cycle button on the control box and press the **START** button. An asterisk \* will appear next to the message CALIBRATING.

The LCD message appears:



### example

If the asterisk \* does not appear, press the **STOP** button on the control box twice to reset the unit. Turn the power switch **OFF** then **ON** again. Hold down the UNWRAPPED cycle button on the control box and press the **START** button to start the self-calibration again.

## Thermocouple Calibration

3. During the steam generator warm up (before the cassette temperature reaches 100°C), adjust the TC-ADJ potentiometer (9) so that the displayed chamber temperature matches the temperature of the digital thermometer to within 2°C.
4. As the cycle proceeds, the chamber temperature reaches the sterilization temperature, drops to 115°C and then regains sterilization temperature. After 20-40 seconds, a long beep will sound indicating that steam generator calibration is complete. The number in the upper left-hand corner of the LCD has changed to display the new steam generator offset value.

E8>> CALIBRATING\* <<F5  
+0.00°C 135.00°C

### *example*

5. Press the **STOP** button on the control box to end the steam generator calibration cycle and to depressurize the cassette. Press **STOP** a second time to reset the unit.

## Chamber Thermocouple Calibration (Type B Boards)

To calibrate the chamber thermocouple, follow these steps (see Figure 2):

1. Turn the power switch to **OFF**. Ensure the calibration jumper is in place and turn the power switch **ON**. The LCD will read:

E8>> CALIBRATING <<F5  
+60.00°C 90.00°C

### *example*

2. To start a chamber calibration cycle, press and release the UNWRAPPED cycle button on the control box and then press the **START** button. The STAT/M will run a regular UNWRAPPED cycle, but continue to show calibration information on the LCD.

## Thermocouple Calibration

3. Allow the chamber to reach the sterilization temperature. To change the temperature display on the LCD to match the temperature displayed on the digital thermometer, adjust the TC-ADJ potentiometer (9) on the Controller Board. Continue adjusting TC-ADJ until the temperatures on the LCD and digital thermometer are within  $\pm 0.25^{\circ}\text{C}$ .
4. Observe the temperatures displayed on the LCD and the digital thermometer for 30 seconds. The temperatures registered should remain within  $\pm 0.25^{\circ}\text{C}$  of one another. Adjust TC-ADJ if not.
5. Press the **STOP** button on the control box when finished. Wait for the beeps to signal that the cassette may be removed.
6. Recalibrate the steam generator thermocouple. See *Thermocouple Calibration (Type B Boards)*.

# Thermocouple Calibration

## Thermocouple Calibration for Software Rev. 4.00 and up



**Incorrect or inaccurate calibration may cause unsuccessful sterilization of instruments.**



**Always calibrate the thermocouples after a thermocouple replacement, thermocouple bend or disconnect, controller board replacement or microprocessor / EEPROM replacement.**



**Make sure that there is sufficient steam process distilled water in the STAT/M prior to starting calibration.**



**Do not place the digital reference thermometer in direct sunlight, on the armature or any other hot surfaces. This may cause improper values on the temperature readout.**

The chamber and steam generator thermocouples must be calibrated to ensure the correct operation of the STAT/M. The steam generator thermocouple is calibrated automatically by a special calibration cycle in the STAT/M. The chamber thermocouple is calibrated by adjusting a potentiometer on the Controller Board while comparing the temperature on the LCD display with the temperature measured by the digital reference thermometer within the calibration cassette. In calibration mode no error messages are displayed.

To calibrate the STAT/M, follow these steps (see Figure 3):

1. Turn the STAT/M **OFF** and remove the cover. Fill the reservoir with steam process distilled water and prime the pump. See the Operator's Manual for instructions on priming the pump. Replace the stopper in the tube and leave it outside the unit for further use.
2. Install a calibration jumper on Controller Board header W1 located to the left of the microprocessor. Connect the Control Box to the controller board.
3. Set the control box SELECT knob to V<sub>REF</sub> and connect a voltmeter as shown in Figure 2.
4. Power the Unit **ON**. The following LCD message appears:

BBB.B BC    TTT.T TO  
                  CCC.C

# Thermocouple Calibration

4.1 The value in the lower right-hand corner of the display (CCC.C) is the difference between the steam generator and chamber temperatures. The value in the upper left corner (BBB.B) is the steam generator temperature. The following two digits in the upper left corner

Type C

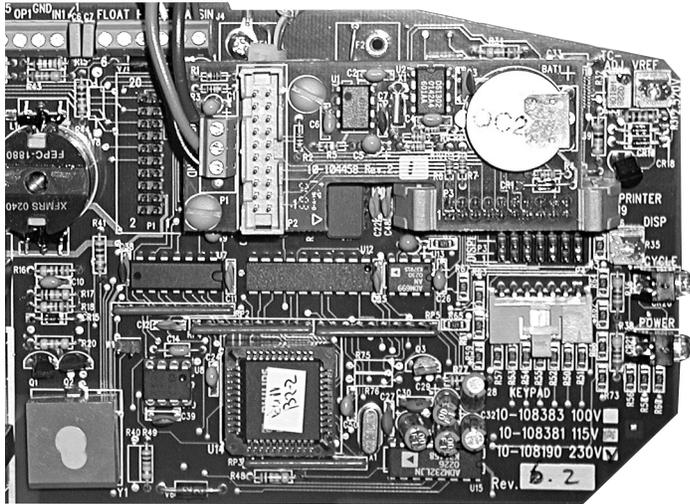
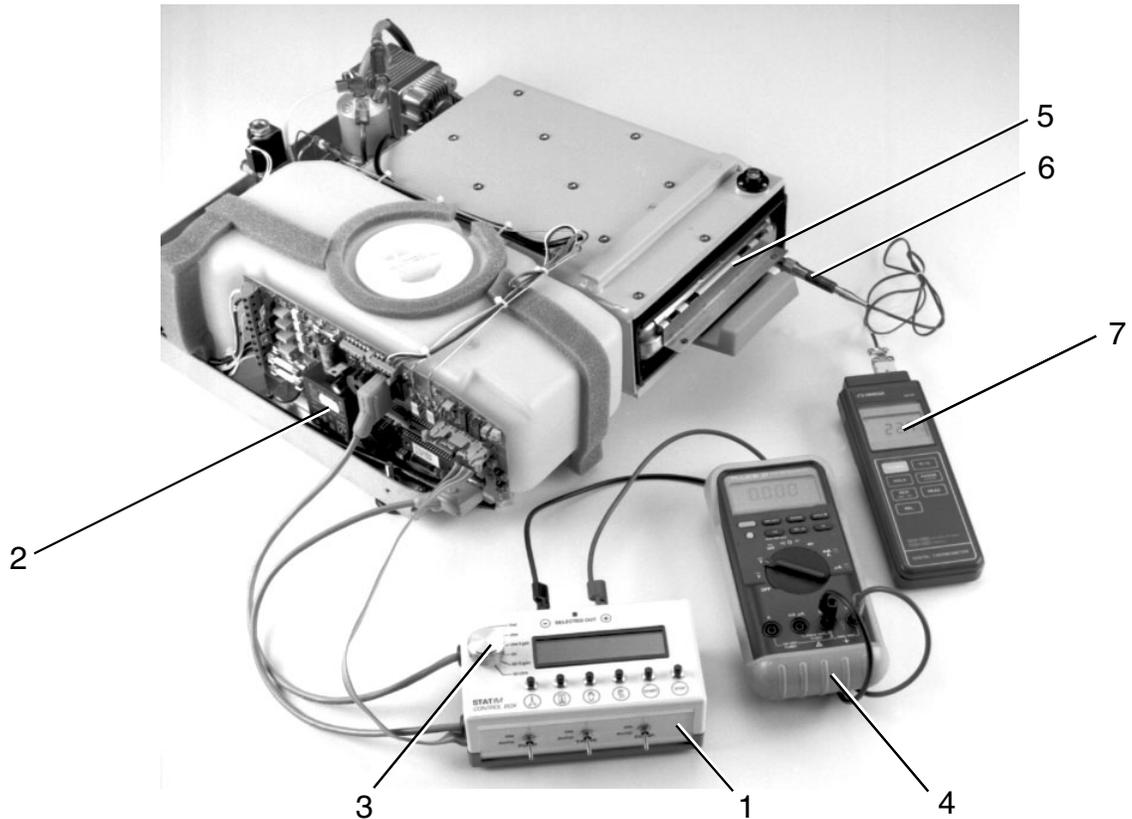


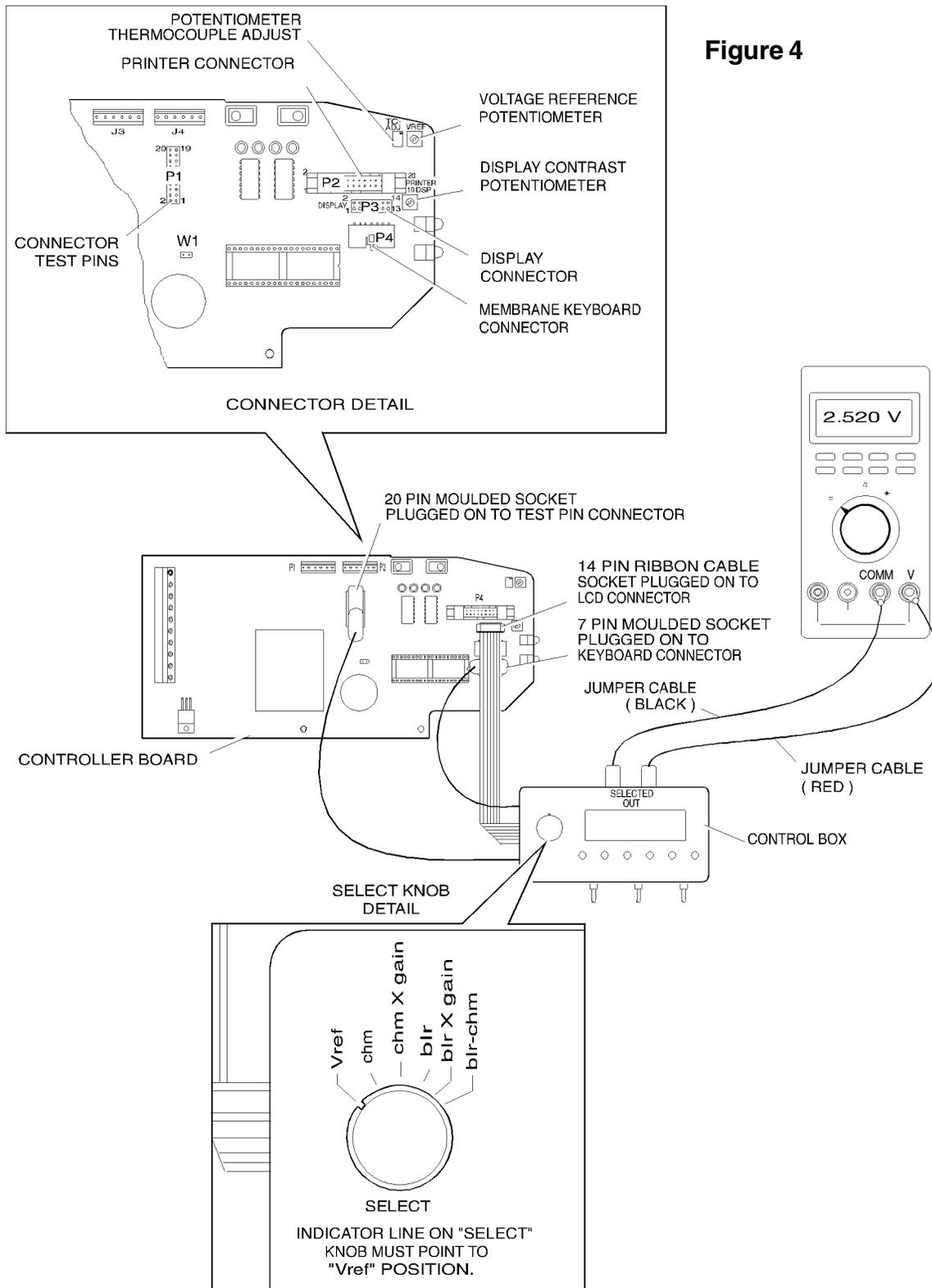
Figure 3

1. Control Box
2. Controller Board
3. SELECT knob
4. digital voltmeter
5. calibration cassette
6. thermocouple
7. digital thermometer

NOTE: 2000 unit shown



# Thermocouple Calibration



## Thermocouple Calibration

of the display (BC) represent the steam generator offset value in hexadecimal. The two digits in the upper right corner of the display (TO) represent the chamber offset value in hexadecimal and to the left of it (TTT.T) is the chamber temperature value.

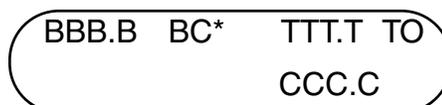
5. Adjust the  $V_{REF}$  potentiometer on the Controller Board to set the reference voltage to  $2.520\text{ V} \pm 0.001\text{ V}$ .
6. Before starting calibration check that there is sufficient steam process distilled water in the reservoir, and that the calibration cassette is correctly engaged in the STAT/M. In this mode, error messages are not displayed.
7. Install the calibration cassette into the STAT/M and attach the digital reference thermometer.
8. Calibrate the steam generator thermocouple. See *Steam Generator Thermocouple Calibration*. (Software Rev. 4.00 and up)
9. Calibrate the chamber thermocouple. See *Chamber Thermocouple Calibration*. (Software Rev. 4.00 and up)
10. After calibration is complete, turn the STAT/M **OFF** and remove the calibration jumper.
11. Disconnect the Control box.
12. Connect the right angle LCD connector to Controller Board P3.
13. Connect the keypad connector to Controller Board P4.
14. Reinstall the cover. See *STAT/M Cover Removal and Replacement*.

# Thermocouple Calibration

## Steam Generator Thermocouple Calibration (Software Rev. 4.00 and up)

To calibrate the steam generator thermocouple, follow these steps (see Figure 3):

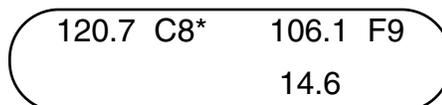
1. To start a steam generator self-calibration cycle, hold down the UNWRAPPED cycle button on the control box and press the **START** button.



BBB.B BC\* TTT.T TO  
CCC.C

If the asterisk \* does not appear, press the **STOP** button on the control box. Turn the power switch **OFF** then **ON** again. Hold down the UNWRAPPED cycle button on the control box and press the **START** button to start the self-calibration again.

2. During the steam generator warm up (before the cassette temperature reaches 100°C), adjust the calibration potentiometer so that the displayed chamber temperature matches the temperature of the digital thermometer to within 2°C.
3. As the cycle proceeds, the chamber temperature will eventually reach sterilization temperature. After 3.5 min, a long beep will sound indicating that steam generator calibration is complete. The second number in the upper left-hand corner of the LCD has changed to display the new steam generator offset value.



120.7 C8\* 106.1 F9  
14.6

### *example*

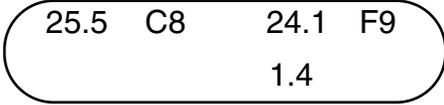
4. Press the **STOP** button on the control box to end the steam generator calibration cycle.

# Thermocouple Calibration

## Chamber Thermocouple (Software Rev. 4.00 and up)

To calibrate the chamber thermocouple, follow these steps (see Figure 3):

1. Turn the power switch to **OFF**. Ensure the calibration jumper is in place and turn the power switch **ON**. The LCD will read:

*example* 

2. To start a chamber calibration cycle, press and release the UNWRAPPED cycle button on the control box and then press the **START** button. The STAT/M will run a regular UNWRAPPED cycle, but continue to show calibration information on the LCD.
3. Allow the chamber to reach the sterilization temperature. To change the temperature display on the LCD to match the temperature displayed on the digital thermometer, adjust the TC-ADJ potentiometer on the Controller board. Continue adjusting TC-ADJ until the temperatures on the LCD and digital thermometer are within  $\pm 0.1^\circ\text{C}$ .
4. Observe the temperatures displayed on the LCD and the digital thermometer for 30 seconds. The temperatures registered should remain within  $\pm 0.25^\circ\text{C}$  of one another. Adjust TC-ADJ if not.
5. Press the **STOP** button on the control box when finished. Wait for the beeps to signal that the cassette may be removed.

## Document Change Record

Document 96-104260		Title: Thermocouple Calibration	
Revision	ECO	Notes	Date
2.0	04-0020	Updated chapter as per prEN13060 requirements.	January 16, 2004
1.0	97-069	Initial Release	November 24, 1997