

Mode Table

Feature	Procedure
Toggle Between °C or °F Setting	Press and release Mode button any time a temperature is displayed
Monitor Mode	With the probe removed from the probe storage channel, press Mode button for more than 2 seconds after Normal temperature is displayed.
Temperature Recall	Press and release Mode button when the display is blank.
Axillary Temperatures	Remove Oral probe from storage well. After OrL is displayed, press Mode button for more than 2 seconds, ALy will be displayed.

DISPLAY INDICATORS



Instrument Malfunction: This icon is displayed if the unit is not functioning properly. Contact the Welch Allyn Customer Service Department.



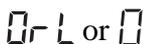
Broken Probe: If displayed, probe may be damaged. Remove and reinstall probe. If error persists, then install a new probe.



Probe Position: Probe has broken contact with the tissue. Once proper contact has been achieved, the icon will be turned off but will reappear at the end of the temperature measurement. It is recommended that a new temperature be taken.



Axillary Probe: This icon is displayed to show that the axillary mode has been selected.



Oral Probe: This icon is displayed to show that the oral mode has been selected.

 or  Rectal Probe: This icon is displayed to show that the rectal mode has been selected.

 Walking Segments: This will be displayed when the thermometer is in process of taking a temperature in the Normal mode.

 Monitor Mode: Monitor mode is generally used for long term temperature monitoring, taking axillary temperatures, or when difficult situations prevent accurate temperatures from being taken in the Normal mode.

 High Temperature: This icon is displayed if the patient's temperature is greater than 108.0°F (42.2°C).

 Low Temperature: This icon is displayed if the patient's temperature is less than 84.0°F (28.9°C).

 High Ambient Temperature: This icon is displayed if the ambient temperature is greater than 104°F (40°C).

 Low Ambient Temperature: This icon is displayed if the ambient temperature is less than 60.8°F (16.0°C).

 Low Battery: This icon flashes when batteries are low and will remain on when batteries are dead.

Display Test: All segments of the thermometer display will appear briefly when the probe is removed from the storage channel to ensure proper function.

5. TROUBLESHOOTING

Many thermometer operational parameters can be tested for proper operation before the unit is taken apart and without needing any tools. Refer to **Operational Characteristics** on page 1-1 and in particular to the **Setup** and **Biotech Mode** sections for guidance on preliminary checks.

If the trouble seems to be calibration related, refer to **Calibration Testing** on page 3-1.

If these sections do not prove useful in resolving the problem and you are sure that the instrument is not performing properly, the following sections should guide you through the debugging process given the proper tools and equipment.

Error Codes

Error codes are divided into four classes:

Probe	Probe errors are generated by the probe or the probe connector and are not errors generated by the thermometer. They do require that temperature measuring be inhibited until the error is cleared. There is no limit to the number of times a probe error can occur. All probe problems are considered by the thermometer to be recoverable. When a probe error occurs, the probe icon is displayed.
Ambient Temperature	Ambient Temperature errors occur when the ambient probe temperature is above 104.0° F or below 60.8° F. During an ambient temperature error, the display shows an "A" with either the up or down arrow icon flashing.
Dead Battery	Dead Battery error occurs when the instrument detects a battery voltage of 3.0 volts or less. The battery icon is displayed without flashing when this error occurs.
Instrument Circuitry	Instrument Circuitry errors are generated from internal test failures and can be recoverable or non-recoverable. Error code numbers are only available in Biotech mode. <ul style="list-style-type: none">• Recoverable errors require that temperature measuring be inhibited until the error is cleared. After displaying the error [X] icon, the instrument will shut itself off and store the error code in memory.• Non-recoverable errors are generated from internal ROM and RAM test failures. The error code will be stored in memory and the LCD will display the error [X] Instrument Malfunction icon. The only way to recover from a ROM or RAM error is to reset the electronics by removing the batteries.

Note: Error codes E0.1, E0.2, E0.3, can sometimes be caused by a faulty probe. It is advisable to remove the probe completely from the instrument and check its functionality as described in the *Operational Characteristics* section before assuming an instrument problem instead of a probe problem. If another probe is available, this can prove useful in tracking down the source of the problem.

Instrument circuitry error codes are listed in the table below.

CLASS	ERR NUM	SELF-TEST DESCRIPTION
Probe	E0.1	Probe heater accumulation test.
Probe	E0.2	Probe a/d pulse width test.
Probe	E0.3	Adaptive probe gain too high or too low test.
Ambient	E1.1	Ambient temperature high test.
Ambient	E1.2	Ambient temperature low test.
Battery	E2.1	“Dead” battery test.
Internal	E3.1	RAM read/write test.
Internal	E3.2	ROM checksum test.
Internal	E3.3	CPU instruction test.
Internal	*	CPU Watchdog test. *Will cause hardware reset, but no error.
Internal	E4.0	PTB resistor a/d pulse width test.
Internal	E4.1	RatioCal resistor a/d pulse width test.
Internal	E5.0	Heater circuit test.
Internal	E5.1	Heater overheated test.
Internal	E5.2	Heater watchdog timeout test.
Internal	E6.0	PTB resistor “temperature” test.

Figure 6 - Self-Test /Error Table

Equipment Required

Most troubleshooting operations can be performed with standard tools and meters.

- A #1 Phillips screwdriver will remove all instrument screws.
- A standard lab 3.5 digit digital multi-meter (DMM) will provide sufficient accuracy for most tests. A needle-tipped pair of probes is recommended.
- For particularly difficult tasks, an oscilloscope is sometimes the only way to analyze high speed signals, but is not generally required.
- Standard electronic tools and supplies for small surface mounted and through hole component rework will be needed to perform any electronics repairs. Some surface mounted components are extremely small and present a challenge for rework by hand. A surface mount rework station is recommended.
- Power and ground are available at the battery terminals E2 (power) and E3 (ground).

Troubleshooting Table

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
No operation	Dead batteries, no batteries, battery missing, battery incorrectly installed	<p>Refer to Battery Removal and Replacement on page 2-2. Check that all batteries are installed in proper direction.</p> <p>Reset electronics (see Instrument Reset/Self Tests on page 1-3).</p> <p>If battery voltage is within specifications, refer to Biotech Mode on page 1-7 and enter Biotech mode to measure battery voltage as seen by electronics.</p>
	Broken battery wire	Open instrument case, install batteries, check for voltage on main PCB at battery wire connections.
	Short circuit preventing operation	Remove batteries, press mode button 5 seconds, set DMM to Ohms, measure resistance of electronics at battery contacts (“+” to bottom right corner, “-” to top left corner). Resistance should climb to more than 2 Megohms as C25 charges.
	Failed component	Check oscillator at U1-7 for 4.91 MHz sine wave. If not present, suspect X1 or U1.
Display problems	LCD frame loose	Check that all 4 plastic hooks for the LCD frame are tight and not broken. The frame should not be lifting off of the PCB.
	Dirty LCD elastomeric conductor strips	Have a new LCD frame handy. Remove old one by unlatching plastic hooks. Clean LCD elastomeric strips, LCD glass contacts, and PCB contacts with lint proof cloth dampened with alcohol.

Troubleshooting Table (continued)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
Display problems (continued)	Cracked LCD	Inspect LCD for hairline cracks, especially in corners.
	Microprocessor failure	Check for improper soldering of pins, crystal operation on O-scope, proper reset.
No beeper sound	Defective horn	Replace horn.
	Broken connection	Check continuity from U1-49 to horn pin 2 and from ground to horn pin 1.
	Defective U1	Check for signal with O-scope at U1-49. Replace microcontroller U1.
No Timer function	Defective Timer button S1	Check for low level (gnd.) signal at U1-26 when timer button S1 is pressed. Replace button if signal is high.
	Broken trace	Check for low level (gnd.) signal at U1-26 when timer button S1 is pressed. Replace Button if signal is high.
No Backlight	Defective backlight	Check LED D3 and resistor R23.
	No /BLGTHCTL signal	Check that signal at U1-42 goes low when unit is in on.
Recalled temperature is not correct.	Unit switched to Monitor mode	If unit is in Monitor mode (whether by the user switch or automatically), the stored temperature is the last one seen by the instrument. This is usually lower than the patient temperature since the probe drops in temperature after removal from the patient.
Probe: Wrong type displayed	Missing Vcc power to R10 and/or R11	With no probe installed, check that probe connector pins J1-B and E are both pulled high when any function is active (recall or timer).

Troubleshooting Table (continued)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
Probe: Wrong type displayed (continued)	Incorrect wiring of probe	<p>Oral probes should have a short between pins B, E and F (refer to instrument PCB designators for probe pin definition).</p> <p>Rectal probes should have a short between pins E and F but open between pins B and E or F.</p> <p>Replace with new probe.</p>
Normal/Monitor Mode switching problems	Ambient above 33.9°C (93.0°F)	Causes auto switch to Monitor mode.
	Switched to Monitor mode before probe in mouth	<p>If 60 seconds pass after ready in Normal mode, unit switches to Monitor mode.</p> <p>If probe is still cooling from a previous temperature and used immediately, it might sense ambient to be above 33.9°C (93.0°F).</p>
	Defective Mode button	<p>Check mode button for proper function.</p> <p>Check U1-25 for low level signal when button is pressed.</p>
	Deffective Probe	Replace probe.
Cannot enter Biotech Mode	Mode button not pressed, and or Instrument not in wall holder (678 only)	Mode button must be pressed while instrument is in the wall holder.
	Probe not connected and or probe shaft not inserted and removed from probe well	Must connect probe to instrument and remove the probe shaft from the probe well while the instrument is in wall holder and mode button is pressed.
	Failed component, broken trace	Check proper Mode button, Probe switch and security switch operation.

Troubleshooting Table (continued)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
Battery Life Problems	Excessive alarms Excessive use in monitor mode	The horn draws significant current. During monitor mode the instrument is continuously drawing current.
	Dead cell	If cell voltage is down significantly in only one cell, this battery is defective. All batteries should drain at the same rate.
	First set shelf life	Due to possibly long stocking times between fabrication and end use, the first set of batteries may have reduced life.
Cal Key doesn't activate thermometer	Probe switch not also activated	When the cal key is connected the display must read CAL for two seconds and then blank. The probe shaft must be inserted and removed from the probe well to activate the probe switch.
Cal Key shows OrL, rEC, or ALy	Defective Cal Key	Replace Cal Key.
Monitor mode temperature reading too low	Probe malfunction	Change probe. Test calibration of entire system (instrument and probe) with the M9600 Calibration Tester.
	Instrument malfunction	Check calibration with Cal Key.
	Improper placement of probe	Probe must be under the tongue and as far back as possible into the sublingual pocket.
	Temperature not stable.	Allow three minutes for Monitor mode reading to stabilize in mouth.

Troubleshooting Table (continued)

SYMPTOM	POSSIBLE CAUSE	PROCEDURE
Monitor mode temperature reading too high	Probe malfunction	Change probe or test calibration of entire system (instrument and probe) with the M9600 Calibration Tester.
	Instrument malfunction	Check calibration with Cal Key.
Normal mode temperature reading too low	Probe malfunction	Recharacterize probe (remove completely from instrument and re-install). Or, change probe. Or, test calibration of entire system using 9600.
	Instrument malfunction	Check calibration with Cal Key.
	Improper placement of probe	Probe must be under the tongue and as far back as possible into the sublingual pocket.
Normal mode temperature reading too high	Probe malfunction	Recharacterize probe (remove completely from instrument and re-install). Or, change probe. Or, test calibration of entire system using 9600.
	Instrument malfunction	Check calibration with Cal Key.
	Improper technique	Movement in mouth after insertion and before final temperature is displayed can cause high readings. Place probe quickly into sublingual pocket and hold still.
	Improper technique	Do not place probe in mouth until the display is showing "OrL".