

# FWTI Temperature Sensor, FW300A/FW301/REF FW303, FW400/FW401/REF FW403, FW600/FW601/FW603 Blood/Fluid Warmer

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Temp. (°C)	Resis. (ohms)	Temp. (°C)	Resis. (ohms)	Temp. (°C)	Resis. (ohms)	Temp. (°C)	Resis. (ohms)	Temp. (°C)	Resis. (ohms)	Temp. (°C)	Resis. (ohms)	Temp. (°C)	Resis. (ohms)
35	1471	39	1249	43	1064	47	910	51	781	55	673	59	581
35.1	1465	39.1	1244	43.1	1060	47.1	907	51.1	778	55.1	670	59.1	579
35.2	1459	39.2	1239	43.2	1056	47.2	903	51.2	775	55.2	668	59.2	577
35.3	1453	39.3	1234	43.3	1052	47.3	900	51.3	772	55.3	665	59.3	575
35.4	1447	39.4	1229	43.4	1047	47.4	896	51.4	769	55.4	663	59.4	573
35.5	1441	39.5	1224	43.5	1043	47.5	893	51.5	767	55.5	660	59.5	571
35.6	1435	39.6	1219	43.6	1039	47.6	889	51.6	764	55.6	658	59.6	569
35.7	1429	39.7	1214	43.7	1035	47.7	886	51.7	761	55.7	655	59.7	567
35.8	1423	39.8	1209	43.8	1031	47.8	882	51.8	758	55.8	653	59.8	565
35.9	1417	39.9	1204	43.9	1027	47.9	879	51.9	755	55.9	651	59.9	563
36	1411	40	1199	44	1023	48	876	52	752	56	648	60	561
36.1	1405	40.1	1195	44.1	1019	48.1	872	52.1	749	56.1	646		
36.2	1400	40.2	1190	44.2	1015	48.2	869	52.2	747	56.2	644		
36.3	1394	40.3	1185	44.3	1011	48.3	866	52.3	744	56.3	641		
36.4	1388	40.4	1180	44.4	1007	48.4	862	52.4	741	56.4	639		
36.5	1383	40.5	1176	44.5	1003	48.5	859	52.5	738	56.5	637		
36.6	1377	40.6	1171	44.6	999	48.6	856	52.6	735	56.6	634		
36.7	1371	40.7	1166	44.7	995	48.7	853	52.7	733	56.7	632		
36.8	1366	40.8	1161	44.8	991	48.8	849	52.8	730	56.8	630		
36.9	1360	40.9	1157	44.9	988	48.9	846	52.9	727	56.9	627		
37	1355	41	1152	45	984	49	843	53	725	57	625		
37.1	1349	41.1	1148	45.1	980	49.1	840	53.1	722	57.1	623		
37.2	1344	41.2	1143	45.2	976	49.2	836	53.2	719	57.2	620		
37.3	1338	41.3	1139	45.3	972	49.3	833	53.3	716	57.3	618		
37.4	1333	41.4	1134	45.4	968	49.4	830	53.4	714	57.4	616		
37.5	1327	41.5	1129	45.5	965	49.5	827	53.5	711	57.5	614		
37.6	1322	41.6	1125	45.6	961	49.6	824	53.6	709	57.6	611		
37.7	1316	41.7	1120	45.7	957	49.7	821	53.7	706	57.7	609		
37.8	1311	41.8	1116	45.8	954	49.8	817	53.8	703	57.8	607		
37.9	1306	41.9	1112	45.9	950	49.9	814	53.9	701	57.9	605		
38	1300	42	1107	46	946	50	811	54	698	58	603		
38.1	1295	42.1	1103	46.1	942	50.1	808	54.1	695	58.1	600		
38.2	1290	42.2	1098	46.2	939	50.2	805	54.2	693	58.2	598		
38.3	1285	42.3	1094	46.3	935	50.3	802	54.3	690	58.3	596		
38.4	1279	42.4	1090	46.4	932	50.4	799	54.4	688	58.4	594		
38.5	1274	42.5	1085	46.5	928	50.5	796	54.5	685	58.5	592		
38.6	1269	42.6	1081	46.6	924	50.6	793	54.6	683	58.6	590		
38.7	1264	42.7	1077	46.7	921	50.7	790	54.7	680	58.7	587		
38.8	1259	42.8	1073	46.8	917	50.8	787	54.8	678	58.8	585		
38.9	1254	42.9	1068	46.9	914	50.9	784	54.9	675	58.9	583		

Figure 3—Resistance/Temperature Chart

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Read and understand these instructions and precautions before using this device.

If you have any questions or problems contact your local dealer.

### DANGER

**Risk of electric shock.** Refer servicing to qualified medical equipment service personnel.

### WARNING

- Use the FWTI Temperature Sensor only for service testing Gaymar FW300A, FW301, FW303, FW400, FW401, FW403 and FW600, FW601, FW603 Blood/Fluid Warmers.  
**Do not use for patient infusion procedures. Blood contamination may result.**
- Repairs should be performed only by qualified medical equipment service personnel in accordance with the appropriate *Service Manual*.  
**Otherwise, damage to the Blood/Fluid Warmer and improper therapy may result.**

This device's accuracy is  $\pm 0.2^{\circ}\text{C}$ . Verify its accuracy at least yearly by using a known temperature (e.g. an ice bath). Do not submerge wires.

### DESCRIPTION

This instruction describes how to use the FWTI Thermistor Temperature Sensor to perform a Control/Overtemp Check on FW300A, FW301, FW303, FW400, FW401, FW403 and FW600, FW601, FW603 Blood/Fluid Warmers.

After using this test device, always complete the functional check on the Blood/Fluid Warmer. Refer to the appropriate *Blood/Fluid Warmer Service Manual* for the *Functional Check*.

### ITEMS REQUIRED

- An ohmmeter (accuracy of 1.5%, maximum excitation current of 100  $\mu\text{A}$ ) and the *Resistance/Temperature Chart* (figure 3, back cover). Verify the accuracy of the ohmmeter.
- A Gaymar Blood/Fluid Warming Set, model D25340CE
- Water only. **Do not use with blood.**

In addition, the following flow measurement/control equipment is required to perform the above test:

- Fluid source with a calibrated flowmeter and accuracy of  $\pm 12$  ml/minute (cc/minute) (e.g., a Gaymar FW22 Flowmeter), or
- Fluid source with adjustable flow control. Use a stop watch and graduated cylinder to adjust flow rate.

(continued on next page)

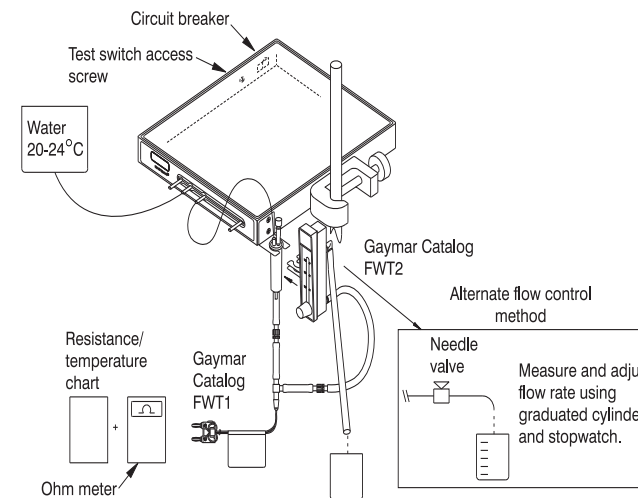


Figure 1—Test Setup (FW300 / 400 Series)

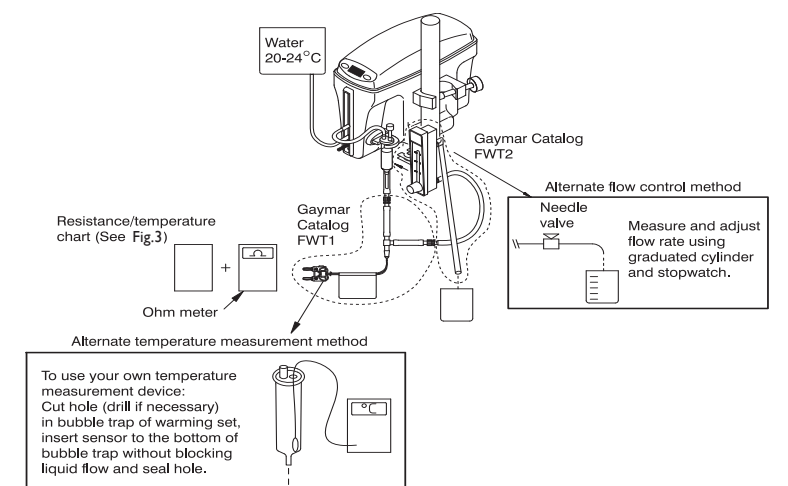


Figure 2—Test Setup (FW600 Series)

**FWTI Temperature Sensor,  
FW300A/FW301/REF FW303, FW400/FW401/REF FW403,  
FW600/FW601/FW603 Blood/Fluid Warmer**

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**CALIBRATION**

The Medi-Temp II Blood/Fluid Warmer's electronic controller and RTD sensor system is calibrated at a flow rate of 100 ml per minute. Verify correct output temperature as follows:

[CALIBRATION CHECK]

1. Connect test setup (see fig. 1, p. 1 for FW300/400 series and fig. 2, p. 1 for FW600 series.). Use a standard Blood/Fluid Warming Set (model D25340CE) with Gaymar FWTI Temperature Sensor connected to the output of the bubble trap.

*Alternate Method 1:* Put a hole in the top of the bubble trap and insert a temperature measurement device through this hole. Make certain sensor is completely submerged in fluid then seal the hole in the bubble trap.

2. Connect the FWT2 Flowmeter or flow measurement/control device to the output of the FWTI Temperature Sensor. Insure room ambient temperature is 20° to 24°C.

*Alternate Method 2:* If using the sensor in the bubble trap method, connect the FWT2 flowmeter or flow measurement/control device to the output of the bubble trap.

3. Flow room temperature water at **100** ml per minute (cc/min) through the Warmer. Verify bubble trap is maintained 1/2 to 2/3 full.
4. Turn Warmer on and allow to run for 10 minutes. For FW600 series, adjust the set point to 43°C.
5. After 10 minutes, verify output water temperature by reading the resistance measurement so that the value falls within the following range:

Model	Temperature	Resistance
FW300A	38.5°C ±1.1°C.	1219 to 1333 ohms
FW301	"	"
FW303	"	"
FW400	43.0°C ±1.1°C.	1112 to 1019 ohms
FW401	"	"
FW403	"	"
FW600	"	"
FW601	"	"
FW603	"	"

If values are not within the ranges, see the *Troubleshooting* section of the *Service Manual*.

[OVERTEMP CHECK] - (FW300/400 series)

**NOTE:** For FW600 series, the overtemp protection system is verified each time the unit is switched from STANDBY to RUN mode. Steps 6 to 10 are performed only on the FW300/400 series.

6. Remove the test switch access screw (fig. 1). Using an electrically nonconductive tool, push and hold switch S2. This will force the heater on. The display temperature will rise.
7. Verify that the audible alarm sounds and the word "hl" alternately flashes on the display when the display temperature exceeds the following value:

Model	Temperature
FW300A, FW301, FW303	42°C
FW400, FW401, FW403	45°C

If it does not, see the *Troubleshooting* section of the appropriate *Service Manual*.

8. Continue to hold the S2 switch. Using the temperature measurement equipment, read the output resistance/temperature at the instant the display blanks with the alarm still sounding. This is the trip point of the S3 over temperature safety thermostat. The thermostat trip point (alarm sounding, display off) should be:

Model	Temperature	Resistance
FW300A	44.6°C to 52.4°C.	999 to 741 ohms
FW301	"	"
FW303	"	"
FW400	48.6°C to 58.4°C.	856 to 594 ohms
FW401	"	"
FW403	"	"

If values are not within these ranges, replace the S3 switch. See the *Repair/Replacement Procedures* section of the appropriate *Service Manual*.

**NOTE:** The Warmer display value should not be used for this test.

**NOTE:** The S4 thermostat is designed to open at temperatures above the S3 thermostat. It is a secondary fire protection device.; it is not a patient safety device. When the S4 thermostat trips, the entire unit (display, audible, and heater) turns off.

**The S4 thermostat is tested at Gaymar before each unit is shipped. Gaymar does not recommend testing the S4 thermostat in the field.**

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9. Turn Warmer off but continue to allow flow of water. This will cool the Warmer.
10. Turn Warmer back on. If the audible alarm sounds at power up, the thermostat is still activated. Turn Warmer off again to allow more time for cooling.
11. Complete the functional check of the Blood/Fluid Warmer. Refer to the appropriate *Service Manual* for the *Functional Check and Safety Inspection*.
12. Disconnect the setup. For FW300/400 series, replace the test switch access screw. Discard the Warmer Set. **Do not connect used Warmer Sets to patient-connected infusion lines.**

[OVERTEMP] - (FW600 series)

The following procedure may be used to force an OVERTEMP condition in order to observe that the overtemp protection system works:

- A. Insert any D25000 series Warming cassette into the warming unit. Using hot tap water (46°C–50°C), flow hot water through the cassette for approximately 1-3 minutes.
- B. Connect AC power to the warming unit. The device should immediately sound the audible alarm and light the RFU (REMOVE FROM USE) light.

Alarm Activation:

The FW600 Series Blood / Fluid warming device has two independent, redundant, temperature sensing and monitoring circuits to assure the fluid temperature within the device does NOT exceed safe limits. The main temperature control circuit will interrupt power to the heaters if the fluid temperature within the warming device exceeds 43.5°C. If the primary interrupt device is unable to interrupt power to the heaters (component failure), the backup sensing circuit will activate a secondary interrupt device when the fluid temperature exceeds 45.0°C. The backup device however, utilizes 'Smart Sensor' technology, therefore it may or may not be accompanied by an audible alarm. When activated, the backup circuit will first determine if heater power has been successfully interrupted by the primary control circuit. If so, the backup system will conclude that the OVERTEMP is a result of a transient overshoot, such as one would expect when a high flow procedure is suddenly stopped, and will consequently not activate the audible alarm.

**If however, heater power is still present when the backup circuit is activated, the system will immediately activate the secondary interrupt device, sound the audible alarm, and ILLUMINATE the 'Remove From Use' indicator light.**

To verify the actual TRIP temperature of the backup circuit:

1. Mount the FW600 series blood / fluid warming device to IV pole with **NO** warming cassette inserted.
2. Apply AC Power to the device and select 43°C Setpoint.
3. Observe display. The display should begin to ramp up to the setpoint. The unit will overshoot the setpoint, because there is no load (cassette) detected.
4. As the temperature begins to approach 45.0°C, listen closely for an audible 'CLICK' sound. The temperature being displayed by the device at the moment the 'CLICK' is heard, is the actual trip temperature.
5. Record the temperature reading.
6. Unplug unit from AC POWER, then immediately re-apply Power.
7. Successful activation of the backup circuit will be verified by a continuous audible alarm.
8. Remove POWER and allow unit to cool (15 min) before returning to service.