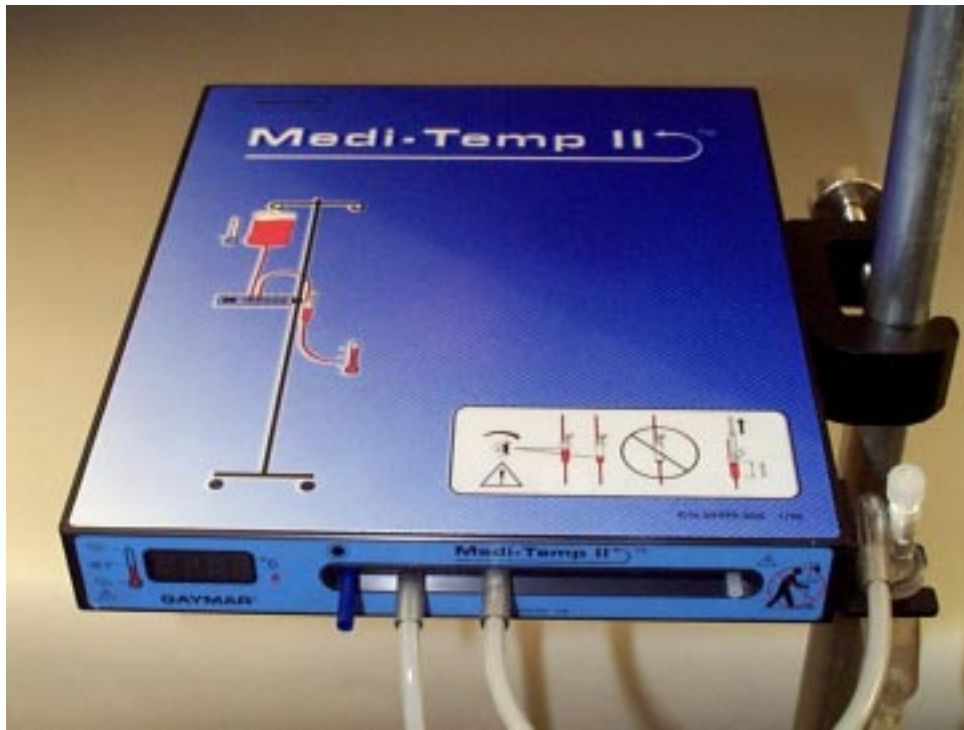


Medi-Temp II™

FW400/FW401/REF FW403 Blood/Fluid Warmer



CE
0086

Service Manual

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Before you begin . . .



Important

Before using the Medi-Temp II model FW400/FW401/ REF FW403 ("FW400 series") Blood/Fluid Warmer, please read and understand the *Operator's Manual* and its *SAFETY PRECAUTIONS* prior to each application.

Review the *SAFETY PRECAUTIONS* in section 1.1 of this *Service Manual* prior to performing service.

If you have any questions, please contact your local dealer for assistance.

1.0 Indications for Use

This device is intended to aid in the prevention of inadvertent hypothermia during administration of blood, blood products, and other fluids.



1.1 Safety Precautions

DANGER



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

WARNING

Repairs should be performed only by qualified medical equipment service personnel in accordance with this *Service Manual*.
Otherwise, damage to the Blood/Fluid Warmer and improper therapy may result.

CAUTION

- Do not immerse the Warmer in cleaning or disinfectant solutions. Do not submerge it in liquids; it is fluid-resistant, not fluid-proof.
Immersion could result in malfunction or equipment damage.
- For grounding reliability of the Blood/Fluid Warmer, plug only into a properly grounded outlet.

2.0 Repair Policy

For customers who repair FW400 series Blood/Fluid Warmers at their location, this manual contains information to allow a qualified biomedical technician to make necessary repairs.

2.1 Limited Warranty

The FW400 series Blood/Fluid Warmer is warranted free of defects in material and workmanship under normal use and operation for a period of one year, under the terms and conditions of the Gaymar warranty in place at time of purchase. During the warranty period, Gaymar will repair or replace at its sole option, free of charge, any defective parts or products returned with prior authorization prepaid to Gaymar Industries.

Warranty does not cover products abused, misused, or altered outside the factory. There are no obligations on the part of Gaymar for consequential damages arising out of or in connection with the use or performance of the product. Gaymar disclaims all implied warranties including, but not limited to, the implied warranties of merchantability and of fitness for a particular purpose.

2.2 In-Warranty Repairs

All in-warranty field repairs must be authorized by Gaymar's Technical Service Department before proceeding. During the warranty period, Gaymar will repair or replace at its sole option, free of charge, any defective parts or products returned with prior authorization prepaid to Gaymar Industries.

2.3 Out-of-Warranty Repairs

Within the USA:

The following repair options are available when local servicing is elected:

1. Defective Component

Replacement parts can be ordered. Specify the Gaymar part number. Refer to the parts list in section 10 of this manual.

2. Machine Repairs

If the Warmer becomes inoperative and the cause of the problem cannot be determined, the complete Warmer can be returned to the factory for servicing at the purchaser's expense.

Outside the USA:

Contact your local dealer.

2.4 Return Authorization

Please contact Gaymar to obtain an RG (Returned Goods) number prior to returning the Warmer.

- NOTE:
- Warmers will not be accepted for repairs unless they have been cleaned and disinfected.
 - Warming Sets will not be accepted for return unless they are in the original, unopened, sterile packaging.

Please contact your local dealer or Gaymar Industries at:

Phone: 1 800 828-7341
(716) 662-2551

Fax: 1 800 993-7890
(716) 662-0748

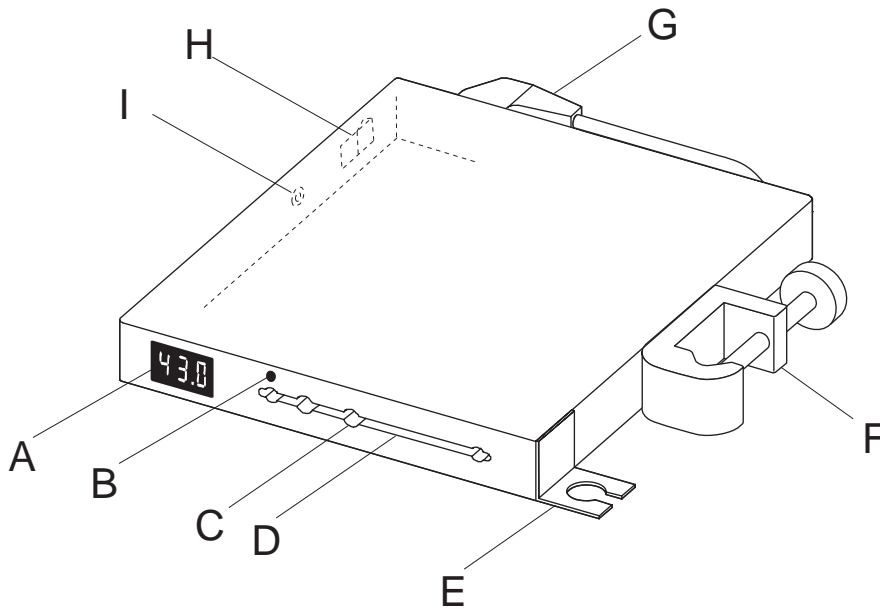
3.0 Product Description

The Medi-Temp II FW400 series Blood/Fluid Warmer is a simple, dry heat device designed for safe and rapid in-line warming of blood, blood products, and other fluids through the utilization of disposable Blood/Fluid Warming Sets. The Warmer does not provide fluid flow rate control. Blood, blood products, and other fluids at temperatures 10°C and below will be warmed to between 36°C and 43°C at flow rates of 10 to 300 ml/min. Room temperature fluids (20°C) can be warmed at flow rates up to 500 ml/min. The disposable Blood/Fluid Warming Sets are available in Standard, Standard with Extensions, Pediatric, and High Flow models.

3.1 Warmer (See figure 1)

The Medi-Temp II FW400 series Blood/Fluid Warmer is a sealed, fluid-resistant device. A lighted on/off circuit breaker is located on the side panel. An LED temperature display is located on the front panel. Fluid temperature is indicated in degrees Celsius on the display. Also located on the front of the unit is a slot for insertion of the Blood/Fluid Warming Set's cassette. On the side of the unit is a holder for the bubble trap.

The Blood/Fluid Warmer can be placed in an X-Ray cassette slot within an operating room table or on horizontal surfaces. An integral pole clamp also allows the unit to be pole mounted. A kit for vertical mounting (P/N 78264-00) is available.



A	LED Temperature Display	E	Bubble Trap Holder
B	Blue Guide Rail Location Indicator	F	Pole Clamp
		G	Detachable Power Cord
C	Exit Port Relief	H	Lighted On/Off Circuit Breaker
D	Warming Set Cassette Slot	I	Test Switch Access Screw

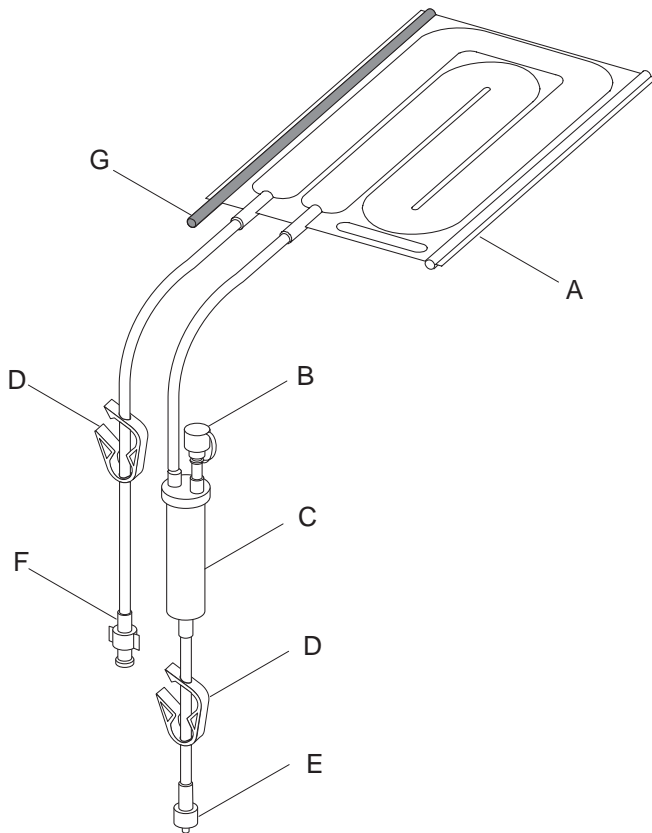
Figure 1—Medi-Temp II FW400 Series Blood/Fluid Warmer

Service Manual

FW400 Series Blood/Fluid Warmer

3.2 Disposable Warming Sets (see figure 2)

The Medi-Temp II FW400 Series Blood/Fluid Warmer is designed to be used with Gaymar D25000 Series Blood/Fluid Warming Sets only. The following Blood/Fluid Warming Sets are available for use at this time. Check with your local dealer for more details.



A	Flexible Cassette	E	Male Luer (to Patient)
B	Manual Air Eliminator (Relief Valve)	F	Female Luer (to Blood/Fluid Source)
C	Bubble Trap	G	Blue Guide Rail
D	Clamp		

Each Warming Set consists of a flexible cassette (for insertion into the warmer) and a bubble trap with a manual air eliminator. They are designed for use below 300 mm Hg pressure with hospital standard intravenous (IV) administration sets and venipuncture sets utilizing luer type connectors. Each Warming Set also has input and output pinch clamps. See figure 2.

The Standard Warming Set is designed for use at 300 ml/min or lower flow rates. The Standard Warming Set with Extensions provides the user with added patient lead length (0.6 m; 2 ft). The priming volume of the Standard Warming Set is 39 ml. The priming volume of the Standard Warming Set with Extensions is 48 ml.

The Pediatric Warming Set has a lower priming volume of 30 ml. Its patient connection lead utilizes thicker walled tubing to provide added insulation at the lower pediatric warming flow rates.

The High Flow Warming Set uses leads having a larger inner diameter. This reduces restriction during circumstances requiring rapid infusion. The priming volume of the High Flow Warming Set is 79 ml. The High Flow Warming Set also incorporates a 200 micron filter and larger bubble trap.

Description	Catalog No.
Standard	D25340CE
Standard with Extensions	D25310CE
Standard with Extensions (60")	D25315CE
Pediatric	D25320CE
High Flow	D25330CE

Figure 2—Medi-Temp II FW400 Series Blood/Fluid Warmer—
Standard Warming Set

3.3 Theory of Operation (refer to section 10, Drawings/Parts List and section 11, Wiring Diagram)

The Medi-Temp II FW400 series Blood/Fluid Warmer electrically consists of:


- power entry module and detachable power cord
- lighted on/off circuit breaker
- heater plate assembly
- RTD sensor
- dual heaters
- temperature controller
- two bimetallic thermostats
- PC board containing audible alarm circuitry and heater/controller interface circuitry.

The Warmer connects to line voltage via the power inlet and a detachable power cord. The lighted circuit breaker provides overcurrent protection as well as on/off function. An RTD sensor on the inside surface of the heater plate assembly senses blood/fluid temperature when a Warming Set Cassette is inserted into the Warmer. The temperature

controller uses this RTD information to control the fluid temperature to a nonadjustable set point of 43.0°C by applying power to the heaters via an optocoupler and triac on the PC board. The sensed temperature is displayed on the temperature controller's display (which is viewable from the front of the Warmer). The controller activates audible alarm circuitry on the PC board and also provides a visual display of the temperature if the RTD sensed temperature goes above 45°C or below 34°C.

Two bimetallic thermostats mounted on the heater plate assembly will also interrupt power to the heaters in the event of a Warmer failure. See section 5.4.

4.0 Technical Specifications

	FW400	FW401	FW403
Voltage	~120V	~100V	~220V–240V
Current	9A	11A	4.5A
Capacity	1200W		
Frequency	50/60 Hz		50 Hz
Ambient Temperature	60°F–85°F (15.6°C–29.4°C)		
Power Cord	Detachable, 15 feet long. Use only UL listed type SJT, 16 AWG conductor cord with molded on grounding type hospital grade attachment plug.		Detachable, 4.6 meters long. Use only an international (harmonized) 3-wire cord using cordage approved to HD-21 conductor size 1.00 mm ² (H05VVf3G1.00).
Classification	Class I grounded, splash-proof equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.  IPX4		
Weight	10 pounds (4.5 kg)		
Size	1 3/8" x 9 1/4" x 10 3/4" (35 mm x 235 mm x 273 mm)		

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FW400 Series Blood/Fluid Warmer



5.0 Controls and Indicators

5.1 Electronic System Self Check

Each time the Warmer is turned on, it performs a self-check (about 2 seconds) before lighting the display. If a problem is detected, an error code will be displayed and the Warmer must be removed from use.

5.2 Temperature Control



The Medi-Temp II FW400 series Blood/Fluid Warmer noninvasively senses fluid temperature on the surface of the Warming Set Cassette. At steady state, the Warmer indicates approximately 43.0°C on its display. Output fluid temperature will be 36°C–43°C for 10°C input fluid temperature. Fluid temperature is affected by fluid flow rate as shown in figure 3 below.

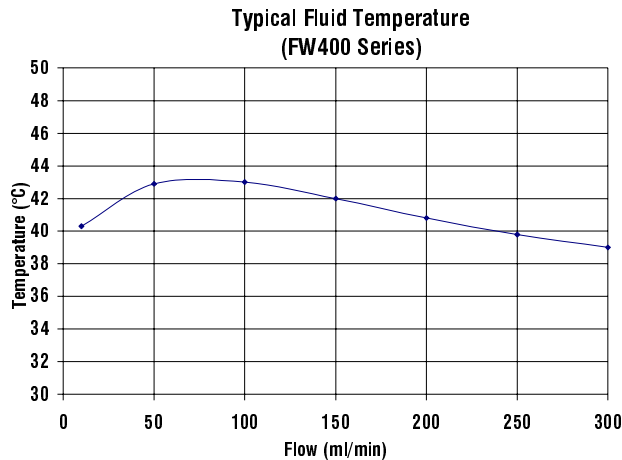


Figure 3—Typical fluid temperature vs. flow values

Room temperature fluid may be warmed at flow rates up to 500 ml/min.

5.3 Control Alarm - hi



If a fluid temperature over 45°C is sensed by the Warmer, it turns the heaters off and activates an audible alarm. The display will alternately indicate the word "hi" and the temperature.

The audible alarm may be silenced during this condition by turning the unit off then on again.

If the fluid temperature drops below 45°C, the unit will resume normal operation.

5.4 Over Temperature Safety Thermostats



In the event of Warmer failure, there are two mechanical thermostats that will interrupt power to the heaters.

The first thermostat will turn off the heaters, activate the audible alarm and turn the display blank.

The second thermostat will interrupt power to the Warmer if the first one fails.

Cold fluid through the Warming Set can be used to reset the thermostats. The unit must be turned off, then back on to reset the alarm circuits.

5.5 Control Alarm - LO



If the sensed fluid temperature drops below 34°C, the Warmer will activate an audible alarm, and the display will alternately indicate the word "LO" and the temperature.

6.0 Cleaning

CAUTION

Do not immerse the Warmer in cleaning or disinfectant solutions. Do not submerge it in liquids; it is fluid-resistant, not fluid-proof.

Immersion could result in malfunction or equipment damage.

Unplug unit prior to cleaning.

To clean the external surfaces of the Warmer, use a nonabrasive cleaning solution (such as warm soapy water). Spray or wipe solution on with a clean cloth. Wipe off contaminants and rinse with water.

To clean the cassette slot, flush with cleaning solution over a sink. (The slot is open at the end to facilitate draining.) Use the thin brush (Gaymar P/N 10027-000) supplied with the Warmer to clean inside the slot. Rinse slot with warm water.

Wipe Warmer dry with a clean, dry cloth.

Apply a disinfectant such as 10% chlorinated bleach solution (chlorinated bleach with 5.25% sodium hypochlorite) to the Warmer and cassette slot and allow to dry.

7.0 Functional Check and Safety Inspection

To assure optimum performance, dependability, and safety, the following should be performed every twelve months or as specified in the facility's preventive maintenance program.

When performing the following procedures, pay particular attention to test setups. Any deviation from the setups, procedures, or test equipment may result in incorrect or misleading results. The following test procedures will verify proper operation of the FW400 series Medi-Temp II Blood/Fluid Warmer.

WARNING

Always perform the *Functional Check and Safety Inspection* after making repairs and before returning the Warmer to patient use.

Failure to perform the Functional Check and Safety Inspection could result in death or serious injury, equipment damage, or malfunction of the Warmer.

Inspection Form

An *Inspection Form* (figure 5, page 9) is provided to facilitate and document the inspection process.

Equipment or tools required

The following test equipment (or equivalent) is required to perform the Functional Check and Safety Inspection:

- Gaymar Standard Blood/Fluid Warming Set, model D25340CE
- Temperature Measurement Device (see figure 4, page 7)
 - Temperature sensor (Gaymar catalog FWT1) and an ohmmeter (accuracy, 1.5% of reading; maximum excitation current of 100 μ A) and the resistance/temperature chart (see figure 10);
- or,
- Waterproof temperature sensor/meter with an accuracy of $\pm 0.3^{\circ}\text{C}$ across the range 30°C to 60°C and a thermal time constant of 2 seconds or faster.
- Flow Measurement Device (see figure 4)
 - Fluid source with calibrated flow meter with a minimum accuracy of ± 12 ml/minute (Gaymar FWT2 Flowmeter);
- or,
- Fluid source with adjustable flow control. Use a stop watch and graduated cylinder to adjust flow rate.

- Clean and dry compressed air source
- Current Leakage/Ground Resistance Tester
- AC Voltmeter

The Medi-Temp II FW400 series Blood/Fluid Warmer is rated IPX4—splashproof. **To insure against ingress of liquids into the machine, it is important that the labels, covers, and screws be kept in good condition. Replace labels that are peeling, ripped, or illegible.**

7.1 Physical Inspection

Check that the following items are in good condition and secure. Replace if necessary.

- Screws
- Labels, if peeling or missing
- Cover on the on/off circuit breaker
- Bubble trap bracket
- Pole clamp
- Power entry module
- Power cord and plug

7.2 Calibration / Overtemp Check

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 with a set point of 43.0°C . Verify correct output temperature as follows:

[CALIBRATION CHECK]

1. Connect test setup as in figure 4. Use a standard Blood/Fluid Warming Set (model D25340CE) with Gaymar FWT1 Temperature Sensor connected to the output of the bubble trap. An alternate method is to put a hole in the top of the bubble trap and insert a Temperature Measurement Device waterproof sensor into the bubble trap (to the bottom). This measurement method will require sealing the bubble trap hole around the sensor. See figure 4.
2. Connect the FWT2 Flowmeter or flow measurement/control device to the output of the FWT1 Temperature Sensor; or, if using the sensor in the bubble trap method, connect the FWT2 Flowmeter or flow measurement/control device directly to the output of the D25340CE Warming Set. Insure room ambient temperature is 20° to 24°C .
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.

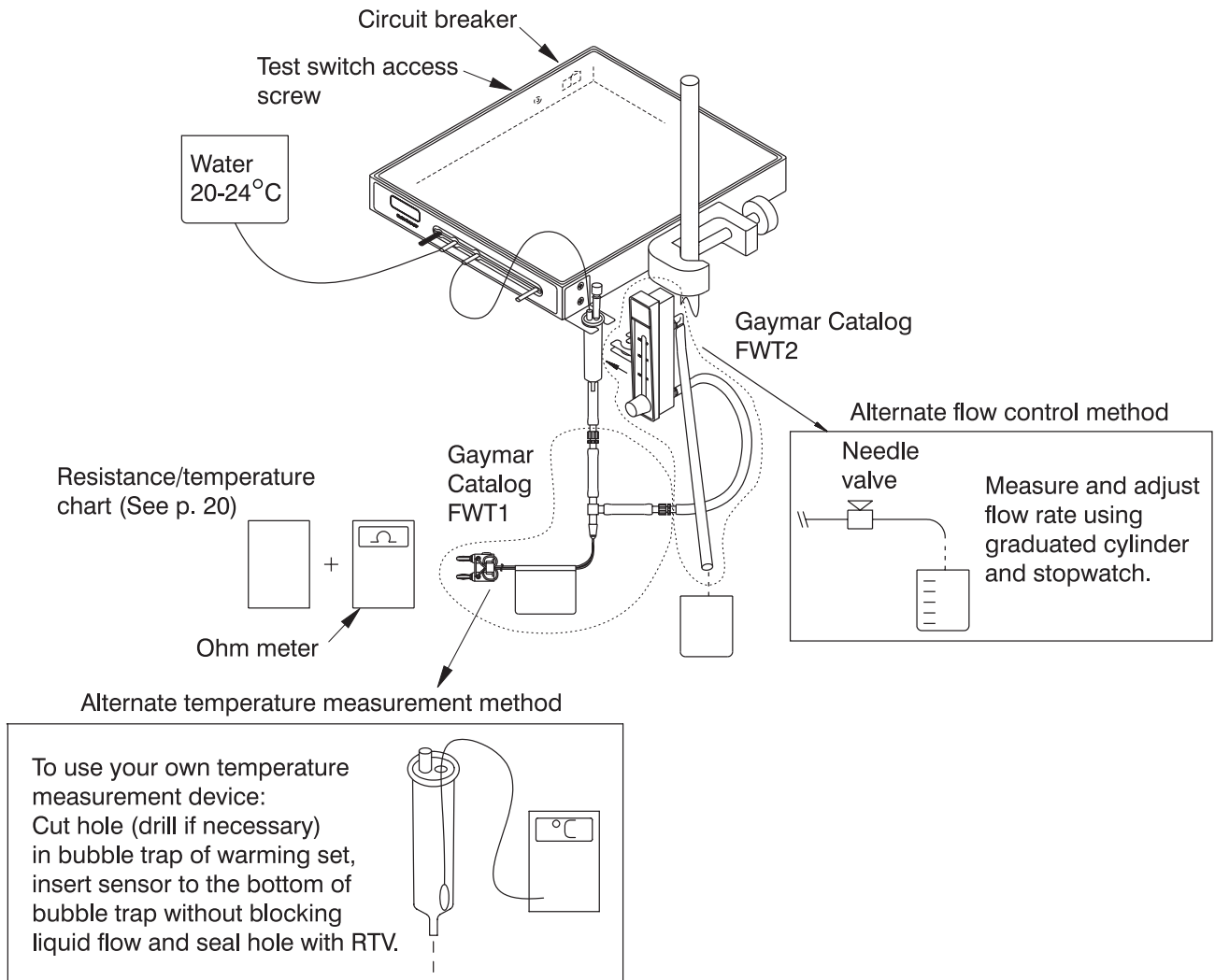


Figure 4—Temperature Measurement Test Setup

4. Turn Warmer on and allow to run for 10 minutes.
5. After 10 minutes, verify output water temperature is $43.0^{\circ}\text{C} \pm 1.1^{\circ}\text{C}$. If using the FWT1 Temperature Sensor and an ohmmeter, verify thermistor temperature sensor is within the range of 1019 to 1112 ohms (see resistance/temperature chart, figure 10). If not within this range, recheck the test setup. See section 8.6.

[OVERTEMP CHECK]

6. Verify the flow is still 100 ml per minute. Remove the test switch access screw (item I, figure 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 "HI" is alternately flashed on the display when the display temperature surpasses 45°C . If it does not, see section 8.2.
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 48.6°C to 58.4°C , or within a FWT1 Temperature Sensor range of 856 to 594 ohms. If it is not, replace it. See section 9.4.

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.

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. Inspect the O ring on the test switch access screw. Replace the O ring if necessary. Reinstall the test switch access screw.

7.3 Controller "LO" Alarm Check

1. Turn Warmer on without a Warming Set in place. Allow display to stabilize at approximately 43.0°C .
2. Using a compressed air nozzle pointed into the disposable slot at the exit port relief (see figure 1), flow compressed air. This will cool the sensor and should reduce the display temperature to below 34°C . Insure the audible alarm activates and the word "LO" alternately flashes on the display when below 34°C . If it does not, see section 8.2.

7.4 Ground Resistance Test

Use a current leakage/ground resistance tester to measure the resistance between the ground pin on the power plug and either of the two stainless screws on the bottom side of the Warmer (item 35, figure 8B). The resistance value should not exceed 0.50 ohms. If it does, see section 8.8.

7.5 Current Leakage Test

Measure the maximum earth leakage current (ground open). Measure at all combinations of

- line polarity
- neutral open/closed

Measure with the heater on in the neutral closed test. If the leakage values exceed the values listed on the *Inspection Form* (figure 5, page 9), see section 8.9.

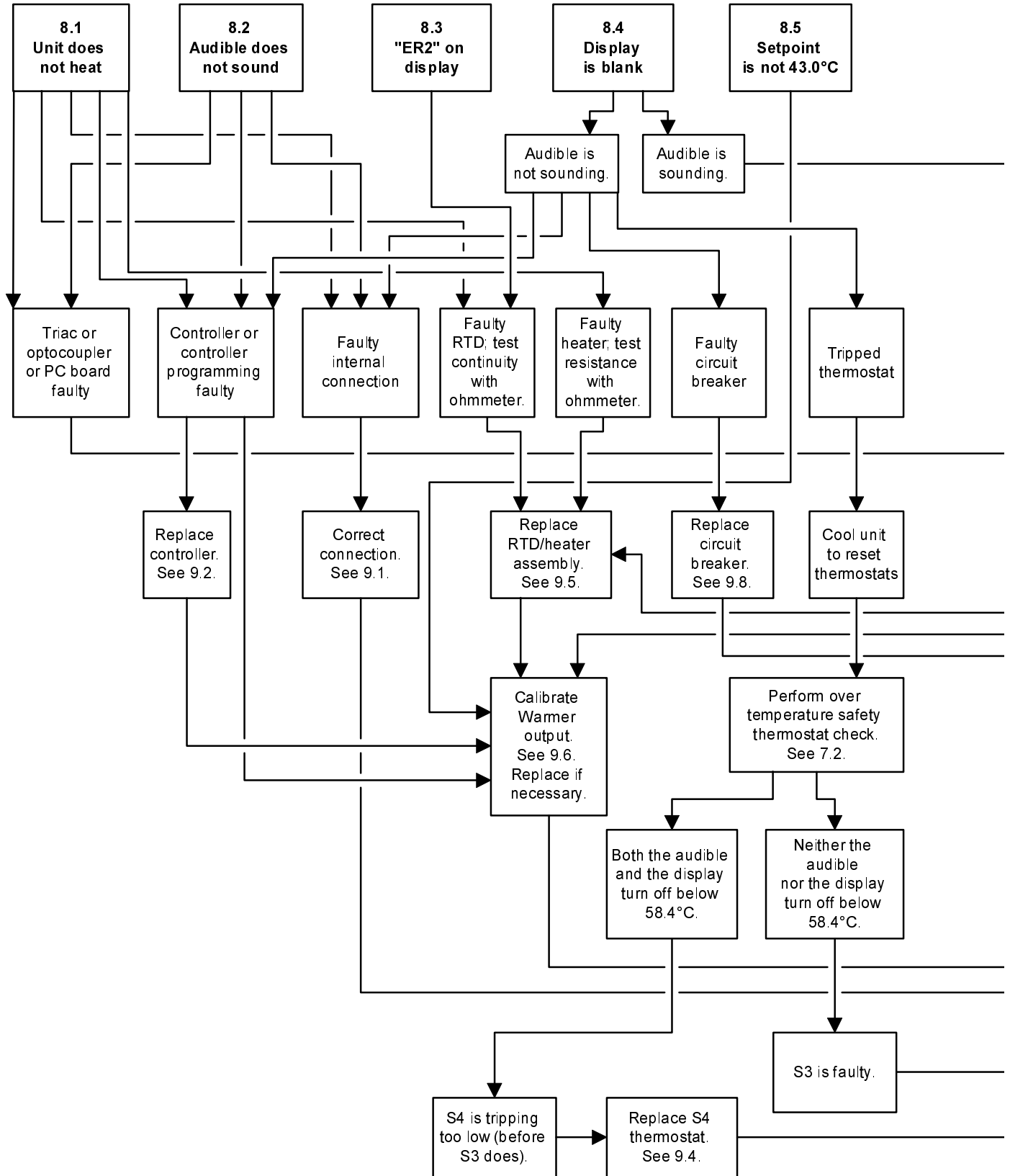
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FW400 Series Blood/Fluid Warmer

7.6 Inspection Form

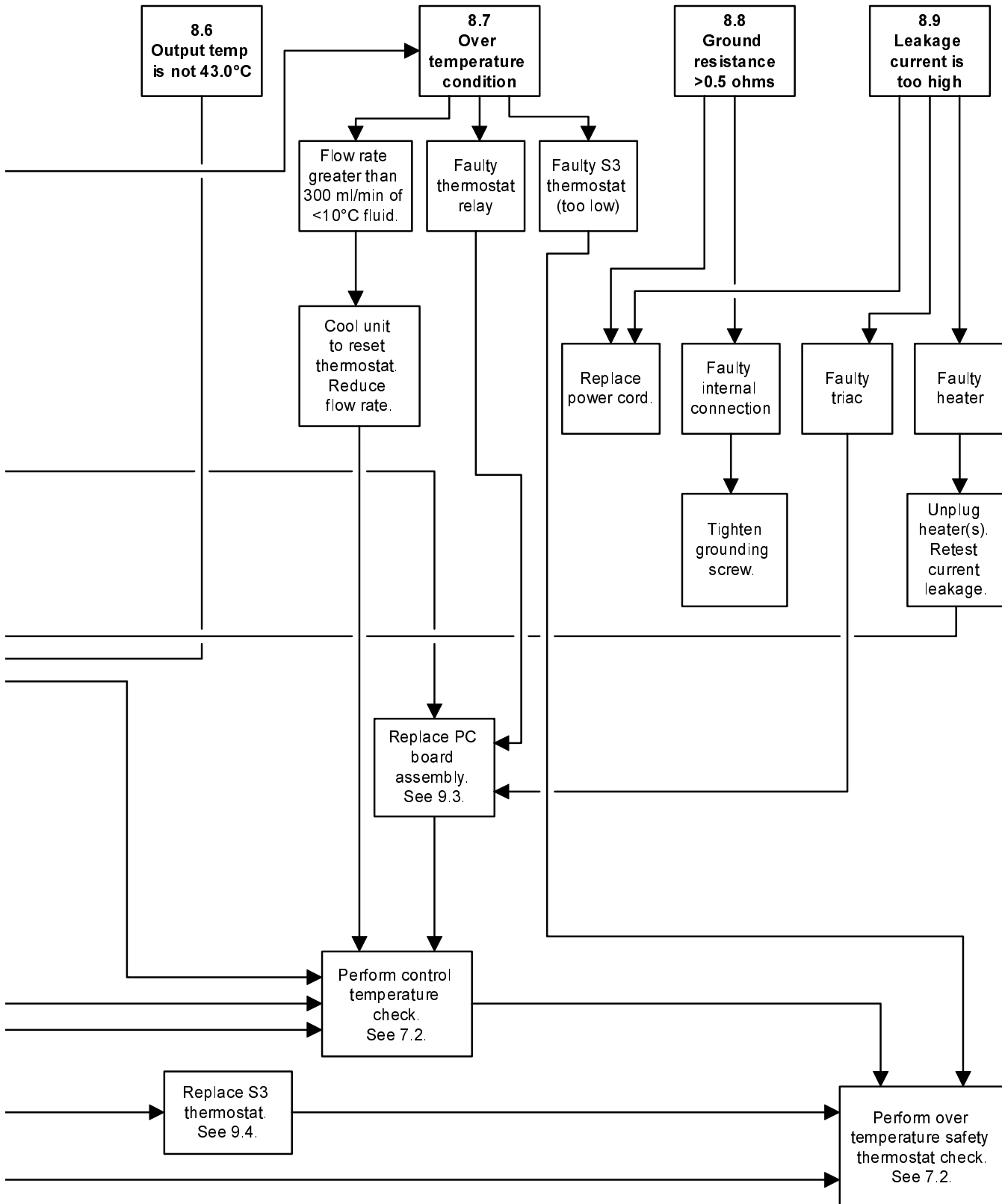
FW400 Series Blood/Fluid Warmer Functional Check and Safety Inspection Form			
Serial Number _____			
	Item	Observation	Results
7.1	Physical Inspection OK?	Screws	Yes/No
		Labels	Yes/No
		Cover on the on/off switch	Yes/No
		Bubble trap/holder	Yes/No
		Pole clamp	Yes/No
		Power entry module	Yes/No
		Power cord and plug	Yes/No
7.2	Calibration Check	Does fluid measure 43.0°C ± 1.1°C?	Yes/No
	Overtemp Alarm Check	Does alarm activate above 45°C?	Yes/No
	S3 Over Temperature Safety Thermostat Check	Does output temperature remain within 48.6°C to 58.4°C?	Yes/No
		Was the test switch access screw reinstalled?	Yes/No
7.3	Controller "LO" Alarm Check	Does alarm activate below 34°C?	Yes/No
7.4	Ground Resistance Check	Is ground resistance <0.5 ohms?	Yes/No
7.5	Current Leakage Test FW400 (neutral closed) FW400 (neutral open) FW401 (neutral closed) FW401 (neutral open) FW403 (neutral closed) FW403 (neutral open)	Is earth leakage <100µA?	Yes/No
		Is earth leakage <200µA?	Yes/No
		Is earth leakage <75µA?	Yes/No
		Is earth leakage <125µA?	Yes/No
		Is earth leakage <175µA?	Yes/No
		Is earth leakage <300µA?	Yes/No

Figure 5—Inspection Form

8.0 Troubleshooting



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9.0 Repair/Replacement Procedures

To identify replacement parts, refer to figure 8A/8B. To order replacement parts, contact your local dealer or Gaymar Industries.

NOTE: Any repair that opens the Warmer requires removal and replacement of the top label.

Do not attempt to reuse the old label.

WARNING

- Use only Gaymar replacement parts as identified in the parts lists (see figures 8A/8B). **Using substitute parts could result in Warmer malfunction or patient injury.**
- Repairs should be performed only by qualified medical equipment service personnel in accordance with this *Service Manual*. **Otherwise, damage to the Blood/Fluid Warmer and improper therapy may result.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 6-9) after making repairs and before returning the Warmer to patient use. Document your findings on the *INSPECTION FORM* (p. 9). **Failure to perform the Functional Check and Safety Inspection could result in death or serious injury, equipment damage, or malfunction of the Warmer.**

CAUTION

- The bottom cover of the Warmer should not be removed before the top cover. **Blind removal of the bottom cover may damage the Warmer.**
- The Warmer is designed to be fluid-resistant by utilizing sealants and gaskets. Inspect gaskets and labels during reassembly. Replace any that are damaged to maintain this fluid resistance. **Failure to retain this fluid resistance could result in Warmer malfunction.**

9.1 General Disassembly/Reassembly

Disassembly:

1. Unplug Warmer.
2. Remove top label.
3. Remove the 19 cross-recess screws from the top cover. **Do not remove screws from the bottom cover.**
4. Remove top cover.

Reassembly:

1. Insure the frame O ring is in place. Replace top cover and 19 screws (use the 17 black screws around the perimeter).
2. Perform the *Functional Check and Safety Inspection*. See section 7.
3. Install new top label.

9.2 Replacing the Controller

To replace the controller (item 13, figures 8A/8B), you will need to replace the top label (item 7) and the front label (item 15). Replace the frame O ring (item 27) if necessary. Use RTV sealant (item 6) as described.

1. Unplug Warmer.
2. Remove top label.
3. Remove 19 cross-recess screws from top cover. **Do not remove screws from the bottom cover.**
4. Remove top cover.
5. Disconnect PC board cable and RTD wires from the controller's terminal block by loosening the screws on the terminal block. Note the routing of the cable and wires.
6. Remove the front label.
7. Remove controller retainer (item 38, fig. 8A/8B) by removing 2 cross-recess screws.
8. Remove controller gasket.
9. Slide controller out the front of unit.
10. Place a thin bead of RTV sealant around bezel of new controller, then insert controller back into housing.
11. Reconnect PC board cable and RTD wires to controller terminal block.

NOTE: Route the cable and wires as originally found.

12. Calibrate the Warmer output. See section 9.6, *Calibrating the Warmer Output*.
13. Inspect/reinstall controller gasket. Replace if damaged.
14. Replace controller retainer and screws.
15. Replace top cover and 19 screws (use the 17 black screws around the perimeter). Insure the frame O ring is in place.
16. Perform *Functional Check and Safety Inspection*. See section 7.
17. Clean off any adhesive left on the frame from the old label. Install new front label.
18. Clean off any adhesive left on the cover from the old label. Install new top label. Use RTV sealant on the threads of two screws (item 35, fig. 8B).

9.3 Replacing the PC Board Assembly

To replace the PC board assembly (items 23, 24, or 25; figures 8A/8B), you will need to replace the top label (item 7) and use heat sink compound. Replace the frame O ring (item 27) if necessary. Use RTV sealant (item 6) as described.

1. Unplug Warmer.
2. Remove top label.
3. Remove 19 cross-recess screws from top cover. **Do not remove screws from the bottom cover.**
4. Remove top cover.
5. Disconnect all wires from terminal block of PC board. Disconnect wires from circuit breaker.
6. Remove the four screws which mount the PC board assembly to the lower plate. Remove the screw and lockwasher which mounts the triac.
7. Remove the PC board. Do not remove the PC board insulation from the unit.
8. Apply heat sink compound to the new triac heat sink surface. Install triac using screw and lockwasher. Install new PC board assembly using four screws.
9. Reconnect all wires to PC board assembly terminal block. Refer to figure 8B and the wiring diagram (figure 9) for correct wiring.
10. Reconnect wires to circuit breaker (brown wire on top).

11. Replace top cover and 19 screws (use the 17 black screws around the perimeter). Insure the frame O ring is in place.
12. Perform *Functional Check and Safety Inspection*. See section 7.
13. Clean off any adhesive left on the cover from the old label. Install new top label. Use RTV sealant on the threads of two screws (item 35, fig. 8B).

9.4 Replacing Thermostats

To replace either of the thermostats (items 16 and 17, figures 8A/8B), you will need to replace the top label (item 7). Replace the frame O ring (item 27) if necessary. Use RTV sealant (item 6) as described.

1. Unplug Warmer.
2. Remove top label.
3. Remove 19 cross-recess screws from top cover. **Do not remove screws from the bottom cover.**
4. Remove top cover.
5. Remove the two thermostat mounting screws and lockwashers. Remove thermostat.
6. Disconnect thermostat wires from terminal block of PC board assembly.
7. Replace thermostat, two thermostat mounting screws, and lockwashers. Do not use heat sink compound.
8. Reconnect thermostat wires to PC board assembly terminal block. Refer to figure 8B and wiring diagram (figure 9) for correct wiring. Be sure to tape the wires as shown in figure 8B.
9. Replace top cover and 19 screws (use the 17 black screws around the perimeter). Insure the frame O ring is in place.
10. Perform *Functional Check and Safety Inspection*. See section 7.
11. Clean off any adhesive left on the cover from the old label. Install new top label. Use RTV sealant on the threads of two screws (item 35, fig. 8B).

9.5 Replacing the RTD/Heater Assembly

If the RTD/Heater Assembly requires repair or replacement, please return the Warmer to your local dealer or Gaymar Industries. See *Return Authorization* (section 2.4, page 1).

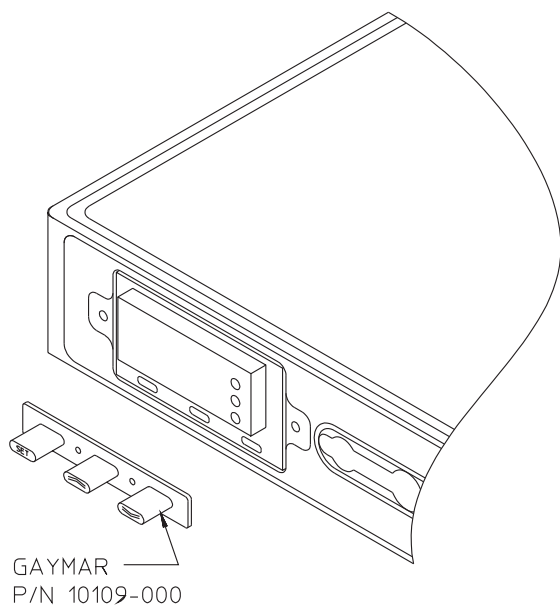


Figure 6—Installing Push-button keys

9.6 Calibrating the Warmer Output

To calibrate the Warmer output, you will need push-button keys (Gaymar P/N 10109-000; see figure 6 above).

1. Connect Warmer test setup as shown in figure 4. Use a Standard Blood/Fluid Warming Set (model D25340CE) with an FWT1 Temperature Sensor connected to the output of the Warming Set. An alternate method is to put a hole in the top of the bubble trap and insert a temperature measurement device sensor into the bubble trap (to the bottom). This measurement method will require sealing the bubble trap hole around the sensor.
2. Connect the FWT2 Flowmeter or flow measurement/control device to the output of the FWT1 Temperature Sensor; or, if using the sensor in the bubble trap method, connect the FWT2 Flowmeter or flow measurement/control device directly to the output of the D25340CE Warming Set. Insure ambient room temperature is 20° to 24°C.
3. Power up Warmer.

DANGER

Risk of electrical shock when parts are electrified.

4. Flow room temperature fluid at 100 ml per minute through the Warmer. Insure bubble trap is maintained 1/2 to 2/3 full.
5. Turn Warmer on and allow display to stabilize at approximately 43.0°C.
6. Measure output water temperature. The correct output water temperature is 43.0°C ± 1.1°C. If using FWT1 and an ohmmeter, the range should be within 1112 to 1019 ohms. See the Resistance/Temperature Chart (figure 10).
7. If output water temperature is not within specification, calculate the offset needed to obtain correct output. The goal temperature is 43.0°C. If current output temperature is too high, a positive (or more positive) offset should be used. If the output temperature is too low, a negative (or more negative) offset should be used. See figure 7.

Output Temperature (measured)	Required Output Temperature	Calculate	Calibration Offset to Use in Controller
41.9°C	43.0°C	41.9-43.0=-1.1	[-1.1]
42.3°C	43.0°C	42.3-43.0=-0.7	[-0.7]
43.6°C	43.0°C	43.6-43.0=0.6	[+0.6]
43.8°C	43.0°C	43.8-43.0=0.8	[+0.8]

Figure 7—Sample Offset Calculations

8. With the front label, controller retainer, and controller gasket removed from the Warmer, insert the push-button keys onto the face of the controller (“set” button on the left).

NOTE: The following three steps allow access to the calibration offset menu location. These steps may be repeated at any time to view the current offset condition or make an adjustment in it.
9. Depress both the “up arrow” and “down arrow” buttons simultaneously until the letters “Aut” appear on the controller display. Depress the “up arrow” or “down arrow” key until the letters “Pid” appear.
10. Hold down the “set” button and depress either the “up arrow” or “down arrow” button until “yes” appears in the display, then release the “set” button.
11. Depress the “down arrow” button to index the display to indicate “CAL”.
12. Press the “set” button and hold it while pressing the “up arrow” or “down arrow” button to enter the offset value calculated from step 7.

NOTE: The next step is used to return to the current measured temperature from any place in the menu.

13. Depress both the “up arrow” and “down arrow” buttons for three seconds until the measured temperature appears in the display.
14. Repeat step 6 to verify correct output temperature. Repeat steps 7 through 13 as needed.
15. Inspect/reinstall controller gasket. Replace if damaged.
16. Replace controller retainer and screws.
17. Perform *Functional Check and Safety Inspection*. See section 7.
18. Clean off any adhesive left on the frame from the old label. Install new front label.

9.7 Replacing the Power Inlet Assembly

To replace the power inlet assembly (item 12, figures 8A/8B), you will need to replace the top label (item 7) and use RTV sealant (item 6). Replace the frame O ring (item 27) as necessary.

1. Unplug Warmer.
2. Remove top label.
3. Remove 19 cross-recess screws from top cover.
4. Remove top cover.
5. Disconnect blue and brown wires from circuit breaker.
6. Remove the nut and lockwasher from the ground terminal and disconnect the ground wire.
7. Remove the two cross-recess mounting screws holding the power inlet assembly.
8. Remove assembly from Warmer.
9. Scrape away old RTV sealing material from frame.
10. Insert new power inlet assembly through gasket into frame after applying RTV to frame hole.
11. Replace screws.
12. Reconnect ground wire to ground terminal. Place lockwasher on terminal first, then ground wire, then second lockwasher, and then the nut. Insure nut is tight.
13. Reconnect wires to circuit breaker (brown wire on top).
14. Replace top cover and 19 screws (use the 17 black screws around the perimeter). Insure frame O ring is in place.

15. Perform *Functional Check and Safety Inspection*. See section 7.
16. Clean off any adhesive left on the cover from the old label. Install new top label. Use RTV sealant on the threads of two screws (item 35, fig. 8B).

9.8 Replacing the Circuit Breaker

To replace the circuit breaker (items 1, 2, or 3, figures 8A/8B), you will need to replace the top label (item 7), on/off label (item 8), and use RTV sealant (item 6). Replace circuit breaker gasket (item 4), circuit breaker cover (item 5), and frame O ring (item 27) if necessary.

1. Unplug Warmer.
2. Remove top label.
3. Remove 19 cross-recess screws from top cover.
4. Remove top cover.
5. Disconnect the wires from circuit breaker.
6. Remove on/off label.
7. Remove two cross-recess retainer mounting screws and remove retainer.
8. Remove cover.
9. Remove gasket.
10. Remove circuit breaker from frame.
11. Apply RTV to underside of circuit breaker lip and install new circuit breaker into frame. Insure circuit breaker is positioned so that the off position is closest to corner of frame.
12. Reinstall gasket, then cover.
13. Replace retainer and screws.
14. Reconnect wires to circuit breaker, so that the brown wires are on top, blue wires are on bottom, and the wires from the power inlet are connected to the terminals on the circuit breaker labelled “line”.
15. Replace top cover and 19 screws (use the 17 black screws around the perimeter). Insure the frame O ring is in place.
16. Perform *Functional Check and Safety Inspection*. See section 7.
17. Clean off any adhesive left on the cover from the old label. Install new top label. Use RTV sealant on the threads of two screws (item 35, fig. 8B).
18. Clean off any adhesive left on the cover from the old label. Install new on/off label.

10.0 Drawings/Parts List

NOTE: Most replacement tasks will require more than one of the parts in figures 8A/8B. Refer to section 9 before ordering parts.

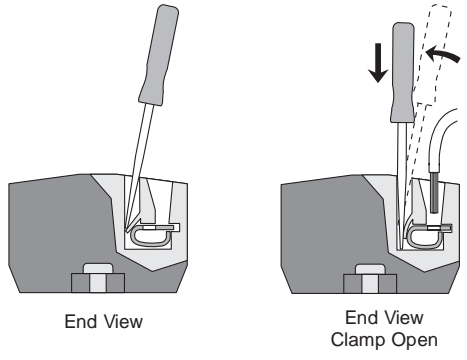
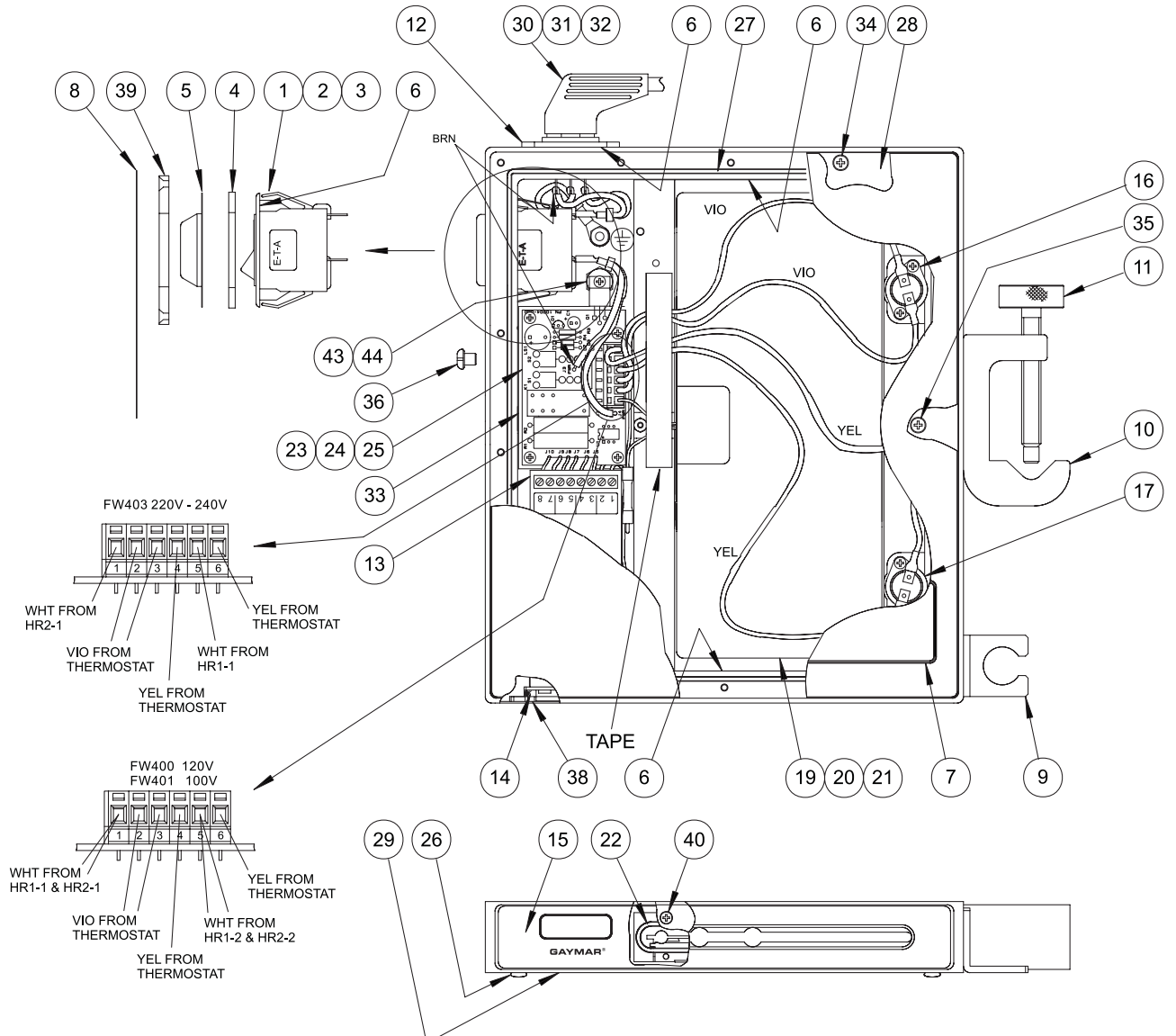
Item	Description	Part Number	Item	Description	Part Number
1	Circuit breaker (FW400, 120V)	90961-013	28	Top cover kit	78130-000
2	Circuit breaker (FW401, 100V)	90961-013	29	Bottom cover kit (FW400)	78166-000
3	Circuit breaker (FW403, 220V–240V)	90961-014		Bottom cover kit (FW401)	78169-000
4	Circuit breaker gasket	10086-000		Bottom cover kit (FW403)	78167-000
5	Circuit breaker cover	10087-000	30	Power cord (120V)	10031-000
6	RTV sealant (electrical)	91056-001	31	Power cord (100V)	10031-000
7	Top label	09999-000	32	Power cord (220V–240V):	
8	On/off label	10002-000		Power cord (Continental Europe)	PC001
9	Bubble trap bracket	10044-000		Power cord (United Kingdom)	PC002
10	Clamp	10043-000		Power cord (Australia)	PC003
11	Swivel head screw	91439-000		Power cord (Switzerland)	PC004
12	Power inlet assembly	09977-000		Power cord (Italy)	PC005
13	Controller kit	78165-000		Power cord (Denmark)	PC006
14	Controller gasket	09966-000		Power cord (Israel)	PC007
15	Front label	10567-000	33	PC board insulator	10062-000
16	Thermostat assembly, S3 (close on rise)	10576-000	34	Screws, 6-32 x 0.312 long, flat head, 82°, steel, black oxide (17 per side, 34 total)	91476-058
17	Thermostat assembly, S4 (open on rise)	10576-001	35	Screws, 6-32 x 1/4 long, SS, flat head, 82° (2 per side, 4 total)	91275-057
19*	RTD/heater assembly (120V)	N/A	36	Screw, self-sealing	91474-021
20*	RTD/heater assembly (100V)	N/A	38	Controller retainer	09952-000
21*	RTD/heater assembly (220V-240V)	N/A	39	Circuit breaker retainer	09947-000
22*	Heater plate O ring	N/A	40	Screw, self-sealing	91474-007
23	PC board assembly (FW400, 120V)	10185-001	41	Power cord lock (not shown)	78158-000
24	PC board assembly (FW401, 100V)	10185-001	42	Push-button keys for controller (see fig. 6)	10109-000
25	PC board assembly (FW403, 220V–240V)	10185-000	43	Spacer	10010-000
26	Bumper	90566-004	44	Triac	90709-002
27	Frame O-ring	09975-000	45	Vertical mounting kit (not shown)	78264-000

* Do not attempt to replace the RTD/heater assembly or heater plate O ring. See 9.5, page 13.

Figure 8A—Parts List

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www.gaymar.com P/N 11079-000 12/00



To release wires from terminal block, insert a small screwdriver in slot nearest wire and pull towards center.








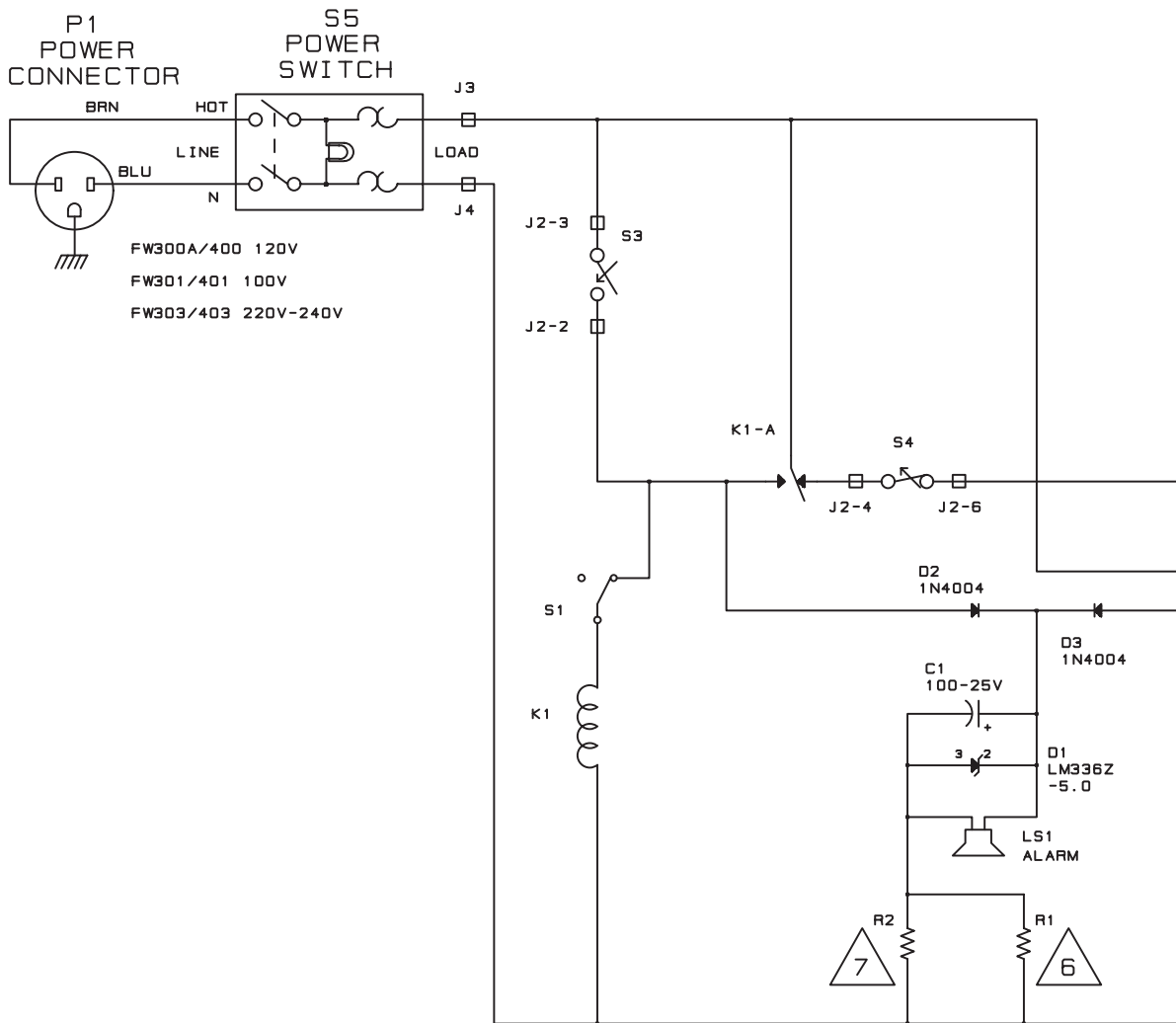
- Power Cords (Item 32)
-  PC001
 -  PC002
 -  PC003
 -  PC004
 -  PC005
 -  PC006
 -  PC007

Figure 8B—Assembly Drawing

11.0 Wiring Diagram



NOTES:

1. ALL RESISTANCES ARE IN OHMS.
2. ALL RESISTORS ARE 5% UNLESS NOTED.
3. ALL CAPACITORS ARE IN MICROFARADS UNLESS NOTED.
4. CAUTION: THE ACTUAL ASSEMBLIES ARE SUSCEPTIBLE TO DAMAGE FROM ELECTROSTATIC DISCHARGE. HANDLING OF THE ASSEMBLIES SHALL BE ACCOMPLISHED WITH ADEQUATE GROUNDING PROVISIONS TO PREVENT ELECTROSTATIC DISCHARGE DAMAGE.



5. THIS DRAWING CORRELATES TO DRAWING (C) 09890 REVISION: D.

6. FW303/403 (220V-240V) USES 10K-5W. FW300A/400 (120V) AND FW301/401 (100V) USES 2.5K-5W.
7. FW303/403 (220V-240V) USES 10K-5W. NOT USED ON FW300A/400 (120V) AND FW301/401 (100V).
8. FW303/403 (220V-240V) WIRED PER DETAIL A. FW300A/400 (120V) AND FW301/401 (100V) WIRED PER DETAIL B.
9. FW303/403 (220V-240V) USES 30 OHM. FW300A/400 (120V) AND FW301/401 (100V) USES 15 OHM.

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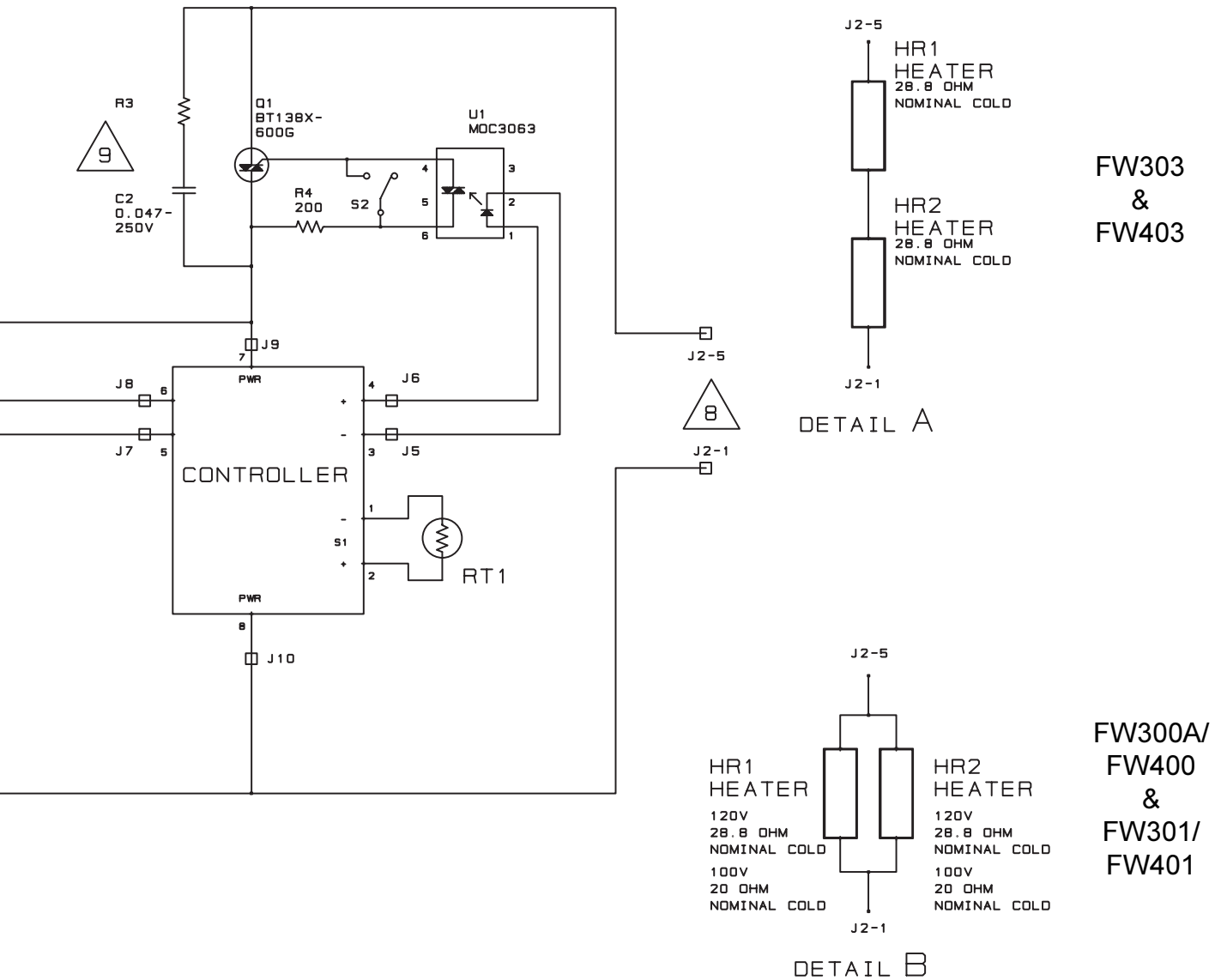


Figure 9—Wiring Diagram

**12.0 Resistance/Temperature Chart
for Gaymar FWT1 Temperature Sensor**

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	748	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	718	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 10—
Resistance/
Temperature
Chart*



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