Thermo Scientific NESLAB ThermoFlex™

Recirculating Chillers
(Deluxe Controller)

Thermo Scientific Manual P/N U00939 Rev. 10/22/09

Installation
Operation
Basic Maintenance

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Label 2

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WARRANTY

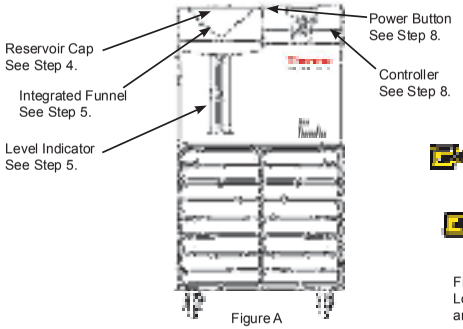


Figure A

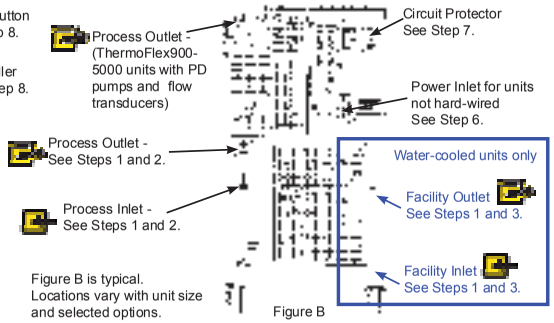


Figure B is typical.
Locations vary with unit size
and selected options.

Figure B

What you need to get started:

- An adjustable wrench
- Facility water supply and return (water-cooled units)
- Appropriate hose or plumbing
- Appropriate size clamps or connection type
- Teflon® Tape or appropriate sealant

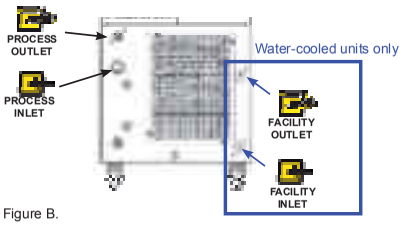
Process Fluid Connections (FNPT)

Outlet		
ThermoFlex900 - 10000	P1 P2 T1	1/2" cast bronze
ThermoFlex3500 - 5000	P3 P4	3/4" cast bronze
ThermoFlex7500 - 10000	P3 P5	1" wrought copper
Inlet - Same size as outlet		all units stainless steel

Facility Water Connections (FNPT)

Inlet/Outlet	
ThermoFlex1400 - 5000	½" cast bronze
ThermoFlex7500 - 10000	¾" cast bronze

1 Pull out the plastic shipping plugs.



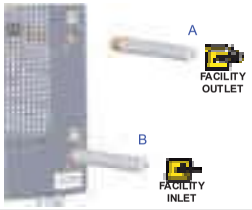
See Figure B.

2 Connect the ThermoFlex PROCESS OUTLET (A) to the fluid inlet on your application. Connect the ThermoFlex PROCESS INLET (B) to the fluid outlet on your application. Ensure the connections are sealed and secure. **For air-cooled units skip to Step 4.**

See Figure B.

3 Connect the ThermoFlex FACILITY OUTLET (A) to your facility water return or drain. Connect the ThermoFlex FACILITY INLET (B) to your facility water supply. Ensure the connections are sealed and secure.

For water-cooled units only.



See Figure B.

4 Remove the reservoir cap by unscrewing it counter-clockwise.

See Figure A.

5 *Slowly* fill reservoir with clean process fluid (see Table 1), utilizing sight tube for easy fluid level monitoring. When the reservoir is full replace the reservoir cap, hand tight. Since the reservoir capacity may be small compared to your application and air may need to be purged from the lines, have extra cooling fluid on hand to keep the system topped off when external circulation is started.

Note: Be careful not to fill the reservoir above MAX LEVEL fill line. This will result in a unit over flow error (O FLO) which will cause the unit to shut down.

See Figure A.

6 Verify the appropriate voltage. For units supplied with a line cord, insert female end of power cord into chiller and then insert male end of power cord into power outlet. (The line cord is located under the shipping crate's lid. Do not discard the lid until the cord is located.)

Note: ThermoFlex900-5000 units equipped with the Variable Voltage or Global Voltage option have a voltage configuration panel located behind an access panel on the rear of the unit. Refer to the Voltage Instruction Sheet shipped with the unit, or see manual Appendix B.

Note: For units requiring hard wiring see Section 3 in the manual.

See Figure B.

7 Place the circuit protector to the on (I) position.

See Figure B.

8 Press ⏻.

The controller will display **QUICK START**.

Note: Before proceeding, if the unit is equipped with a deionization filter cartridge, refer to Section 5 in the manual for installation.

Please see reverse side for additional information.

See Figure A.

Safety Precautions:

The unit is designed for indoor use only.

Never place unit in a location where excessive heat, moisture, inadequate ventilation, or corrosive materials are present.

Never use flammable or corrosive fluids with this unit.

Never connect process fluid lines to your facility water supply or to any pressurized liquid source.

If your unit is equipped with a positive displacement pump (P1 or P2), ensure your application plumbing lines and fittings are rated to withstand a minimum of 185 psi.

Before using any fluid or performing maintenance where contact with the fluid is likely refer to the manufacturer's MSDS for handling precautions.

Table 1 - Acceptable Fluids:

Use of any fluid not listed below will void the manufacturer's warranty.

Standard Temp Units	High Temp Units
Filtered/Single Distilled water	Filtered water*
0 - 75% Ethylene Glycol/Water	0 - 50% Ethylene Glycol/Water*
0 - 75% Propylene Glycol/Water	0 - 50% Propylene Glycol/Water*
Deionized water (1 - 3 MΩ- cm, compensated)	*to 88°C for units with P1 and P2 pumps *to 90°C for units with other pumps (when fluid properly maintained)

QUICK START	
UNITS	
Setpoint	20
TEMPERATURE	
PRESSURE	
FLUID LEVEL	
AUTO REFILL*	
FLOW*	
Line Frequency*	60HZ
☐ Auto Restart	
☐ Audible Alarms	
RA FAN SPEED MODE*	
Care Level	1
SERIAL COMM - DCOM*	
ANALOG COMM - ACOM*	
RESISTIVITY*	
mm/dd/yy	hh:mm:ss
◀ Quick Start Done	

*Displays only on units equipped with the option.

NOTE Any setting can be changed after the unit is started.

The controller can display only six lines of the QUICK START menu at a time. If a change to any of the default settings is needed, use the up and down arrow buttons to scroll to and highlight the desired setting, then press the enter button.

If the text on any setting is all capital letters, the setting has a sub-menu. Pressing enter will bring up the sub-menu. The sub-menus allow you to view/change the applicable values. Highlight the desired setting and press enter. The setting will start to flash indicating it can be changed. Use the arrow buttons to change the value. Once the desired value is displayed, press enter again to stop the flashing and accept the new value. When all the desired changes are made press the left arrow or esc key to return to the QUICK START menu.

NOTE: If the unit exceeds the fault value it will shut down, the controller will display a fault message and, if enabled, sound the alarm. If the unit exceeds the warning value the unit will continue to run, the controller will display a warning message and, if enabled, sound the alarm.

Lines that are not all capital letters indicate the changes can be made directly on the QUICK START menu, i.e. Setpoint and Line Frequency. Use the same procedure to change these values.

If the line has a blank box, i.e. Auto Restart, pressing enter with that line highlighted will turn the box black. A black box indicates the feature is enabled. Press enter again to turn the box blank. A blank box indicates the feature is disabled.

Display	Indication	Range	Default
UNITS	Controller temperature, pressure and flow display scales. (Flow display is optional.)	C or F psi, bar or kPa	C psi
		gpm or lpm	gpm
Setpoint	Setpoint value.	+5°C to +40°C (+90° for high temp)	+20°C
TEMPERATURE	Temperature fault and warning values.	+2°C to +43°C (+93°C for high temp)	High +42°C (+92°C for high temp) Low +3°C
PRESSURE	Pressure fault, warning and time delay values.	Pump dependent - refer to Table 1	Pump dependent - refer to Table 1
	(The delay sets the length of time needed after a pressure fault before the unit shuts down.)	Time Delay: 0 to 30 seconds	High Time Delay: 0 seconds (60 seconds for P3 - P5 pumps) Low Time Delay: 10 seconds
FLUID LEVEL	Reservoir low level fault and warning values.	Heater dependent - refer to Table 3	Heater dependent - refer to Table 3
AUTO REFILL	Optional auto refill values. (On is the % of fluid level in the reservoir needed to turn refill on. Time Out is the maximum time the option will operate. Setting the time to 0 disables the option.)	On: 6%- 100% Time Out: 0 - 900 seconds	Heater dependent, see manual
FLOW	Process fluid flow fault and warning values.	Pump dependent - refer to Table 2	Pump dependent - refer to Table 2
Line Frequency	The incoming frequency (Units with a P3 - P5 pump *and* the capability to run on either 50 Hz or 60 Hz only. The selected frequency automatically adjusts the firmware's fixed high pressure default setting.)	50 Hz or 60 Hz	60 Hz
Auto Restart	Enables the auto restart.	☐ or ■	☐
Audible Alarms	Enables the audible alarm.	☐ or ■	☐
RA FAN SPEED MODE	Fan speed. ThermoFlex2500 air-cooled units only (Auto allows the fan to run under the conditions listed in the manual, see Section 3. On allows the fan to run at high speed all the time.)	On or Auto	Auto
Care Level	The preventive care cleaning frequency reminder for the unit's air and fluid filters.	off, 1 (1000 hours), 2 (2000 hours) 3 (3000 hours)	1
SERIAL COMM - DCOM	Optional serial communications. (See manual for additional information.)	Off, RS232, RS485	Off
ANALOG COMM - ACOM	Optional analog communications. (See manual for additional information.)	Refer to manual	
RESISTIVITY	Enables/configures the resistivity option. (See manual for additional information.)	☐ or ■ Setpoint: 0.2 to 3.0 MΩ-cm Interval: 0.1 to 0.5 MΩ-cm Warning High: 0.0 to 3.5 MΩ-cm Warning Low: 0.0 to 3.5 MΩ-cm	☐ Setpoint: 1.0 MΩ-cm Interval: 0.1 MΩ-cm Warning High: 3.0 MΩ-cm Warning Low: 0.5 MΩ-cm
mm/dd/yy	Sets the date. Some error messages display the date of occurrence.		
hh:mm:ss	Sets the time. Some error messages display the time of occurrence.		
Quick Start Done	To end the quick start procedure and save changes press the enter button. To leave the quick start and not save press the left arrow or esc button. In either case the screen will go blank.		

Table 1			
T1 P1 P2 Pumps:	Fault Range 3 to 105 PSI	High Default 105 PSI	Low Default 3 PSI
T1 P1 P2 Pumps:	Warning Range 4 to 100 PSI	High Default 100 PSI	Low Default 4 PSI
P3 P4 P5 Pumps	See Manual		

Table 2	Range	High Default	Low Default
T1 P1 P2 Pumps:	0.8 to 10.5 GPM	10.5 GPM	0.8 GPM
P3 P4 P5 Pumps:	0.8 to 30.0 GPM	30.0 GPM	0.8 GPM

Table 3		
Heater	Warning Range	Default
None	6 - 100%	6%
1 kW:	58 - 100%	58%
2.3 kW:	93 - 100%	93%
5.0 kW:	87 - 100%	87%
4.6 kW:	72/87* - 100%	72/87%*
Heater	Fault Range	Default
None	0 - 100%	0%
1 kW:	52 - 100%	52%
2.3 kW:	87 - 100%	87%
5.0 kW:	81 - 100%	81%
4.6 kW:	66/81* - 100%	66/81%*

* see manual

Preface

Compliance

CSA Approved - Laboratory equipment-electrical

File # 105974_C_000

CLASS: 8721-05 CAN/CSA-C22.2 No. 61010-1-04

CLASS: 8721-05 ANSI/UL Standard 61010-1

Products tested and found compliant with the requirements defined in the EMC standards defined by 89/336/EEC as well as Low Voltage Directive (LVD) 73/2 can be identified by the CE Mark on the rear of the unit. The testing has demonstrated compliance with the following directives:

- LVD, 73/23/EEC IEC/EN 61010-1
- EMC, 89/336/EEC IEC/EN 61326-1

For any additional information, refer to the Declaration of Conformity that shipped with the unit.

NOTE The CSA compliance for ThermoFlex7500, ThermoFlex10000 and all high-temperature units is pending. ▲

WEEE

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling/ disposal companies in each EU Member State, dispose of or recycle this product through them. Further information on Thermo Fisher Scientific's compliance with these Directives is available at:

www.thermo.com/WEEERoHS

After-sale Support

Thermo Fisher Scientific is committed to customer service both during and after the sale. If you have questions concerning the unit operation, or questions concerning spare parts or Service Contracts, call our Sales, Service and Customer Support phone number, see this manual's inside cover for contact information.

When calling, please refer to the labels on the inside cover. These labels list all the necessary information needed to properly identify your unit.

Feedback

We appreciate any feedback you can give us on this manual. Please e-mail us at thermoscientificmanuals@thermofisher.com. Be sure to include the manual part number and the revision date listed on the front cover.

Warranty

Thermo Scientific NESLAB ThermoFlex units have a warranty against defective parts and workmanship for 24 months from date of shipment. See back page for more details.

Unpacking

Retain all cartons and packing material until the unit is operated and found to be in good condition. If the unit shows external or internal damage contact the transportation company and file a damage claim. Under ICC regulations, this is your responsibility.

Out of Box Failure

An Out of Box Failure is defined as any product that fails to operate in conformance with sellers published specifications at initial power up. Install the unit in accordance with manufacturer's recommended operating conditions within 30 days of shipment from the seller.

Any Temperature Control product meeting the definition of an Out of Box Failure must be packed and shipped back in the original packaging to Thermo Fisher Scientific for replacement with a new unit; seller to pay the cost of shipping. Customer must receive a Return Material Authorization (RMA) from Thermo Fisher prior to shipping the unit.

Section 1 Safety

Safety Warnings

Warnings are posted throughout the manual. These warnings are designated by an exclamation mark inside an equilateral triangle and text highlighted in bold. Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, or personal injury or death.

The lightning flash with arrow symbol, within an equilateral triangle, is intended to alert the user to the presence of non-insulated "dangerous voltage" within the unit's enclosure. The voltage magnitude is significant enough to constitute a risk of electrical shock.

This label indicates the presence of hot surfaces.

Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your unit. If you have any questions concerning the operation of your unit or the information in this manual, please contact us. See inside cover for contact information.

Never place the unit in a location where excessive heat, moisture, or corrosive materials are present. ▲

The unit construction provides protection against the risk of electrical shock by grounding appropriate metal parts. The protection may not function unless the power cord is connected to a properly grounded outlet. It is the user's responsibility to assure a proper ground connection is provided. ▲

Never connect the process fluid inlet or outlet fittings to your building water supply or any water pressure source. ▲

Do not use automotive antifreeze. Commercial antifreeze contains silicates that can damage the pump seals. Use of automotive antifreeze will void the manufacturer's warranty. ▲

Never use flammable or corrosive fluids with any ThermoFlex unit, this is especially critical with high temperature units. Use of these fluids will also void the manufacturer's warranty. ▲

Before using any fluid or performing maintenance where contact with the fluid is likely refer to the manufacturer's MSDS for handling precautions. ▲

When using a process fluid mixture of 0 - 75% ethylene glycol and water or 0 - 75% propylene glycol and water, check the fluid concentration on a regular basis. Changes in concentration can impact system performance. See Section 3. ▲

Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty. ▲

Transport the unit with care. Sudden jolts or drops can damage the unit's components. ▲

Drain the unit before it is transported and/or stored in near or below freezing temperatures, see Draining in Section 8. Store the unit in the temperature range -25°C to 60°C (with packaging), and <80% relative humidity. ▲

For high-temperature units, ensure the fluid is at a safe temperature (below 55°C) before handling or draining. ▲

The circuit protector located on the rear of the unit is not intended to act as a disconnecting means. ▲

Observe all warning labels. ▲

Never remove warning labels. ▲

Never operate damaged or leaking equipment. ▲

Never operate the unit without process fluid in the reservoir. ▲

Always turn off the unit and disconnect the power cord from the power source before performing any service or maintenance procedures, or before moving the unit. ▲

Never operate the unit with panels removed. ▲

Never operate equipment with damaged power cords. ▲

Refer service and repairs to a qualified technician. ▲

Section 2 General Information

Description

The Thermo Scientific NESLAB ThermoFlex™ recirculating chiller is designed to provide a continuous supply of fluid at a constant temperature and volume. The unit consists of an air-cooled or water-cooled refrigeration system, heat exchanger, recirculating pump, reservoir, and a microprocessor controller.

Specifications

	ThermoFlex900	ThermoFlex1400	ThermoFlex2500
Standard Unit Process Fluid Temperature/Setpoint Range	+5°C to +40°C +41°F to +104°F	+5°C to +40°C +41°F to +104°F	+5°C to +40°C +41°F to +104°F
High-Temperature Unit Process Fluid Temperature/Setpoint Range	Not Available Not Available	+5°C to +90°C +41°F to +194°F	+5°C to +90°C +41°F to +194°F
Ambient Temperature Range All Units	+ 10°C to +40°C + 50°F to +104°F	+10°C to +40°C +50°F to +104°F	+10°C to +40°C +50°F to +104°F
Temperature Stability	±0.1°C	±0.1°C	±0.1°C
Cooling Capacity at 20°C 60 Hz 50 Hz	900 W (3074 BTU) 750 W (2561 BTU)	1400 W (4781 BTU) 1170 W (3996 BTU)	2500 W (8538 BTU)* 2200 W (7513 BTU)
	*To meet this specification, the ThermoFlex2500 air-cooled units require the fan to be operating in the high-speed mode, see Section 3.		
Heater Size 208V/230V	Not Available	1.0kW/1.2kW or 2.3kW/2.8kW	2.3kW/2.8kW
Refrigerant	R134A	R134A	R134A
Reservoir Volume Gallons Liters	1.9 7.2	1.9 7.2	1.9 7.2
Footprint or Dimensions (H x W x D)			
Inches Centimeters	27.3 x 14.2 x 24.6 69.2 x 36.0 x 62.4	27.3 x 14.2 x 24.6 69.2 x 36.0 x 62.4	29.0 x 17.2 x 26.5 73.6 x 43.6 x 67.3
Unit Weight P2 Pump (empty) lb kg	130.5 59.2	130.5 59.2	175.5 79.6
Pumping Capacity			
P1 - Positive Displacement 60 Hz 50 Hz	2.1 gpm @ 60 psig (7.9 lpm @ 4.1 bar) 1.7 gpm @ 60 psig (6.4 lpm @ 4.1 bar)		
P2 - Positive Displacement 60 Hz 50 Hz	4.0 gpm @ 60 psig (15.1 lpm @ 4.1 bar) 3.3 gpm @ 60 psig (12.5 lpm @ 4.1 bar)		
T1 - Turbine 60 Hz* 50 Hz*	3.5 gpm @ 60 psig (13.3 lpm @ 4.1 bar) 2.5 gpm @ 60 psig (9.5 lpm @ 4.1 bar)		
* Pumping capacity pressure values for turbine pumps are differential pressures between the inlet and the outlet of the unit.			

- Cooling capacity based on P2 pumps with no backpressure. Heat input from the pump will result in a reduction in cooling capacity. The cooling capacity reduction will vary based on the pump chosen as well as pump backpressure and flow.
- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage. Other fluids, fluid temperatures, ambient temperatures, altitude or operating voltages will affect performance. See Section 3.
- Additional dimensions are at the end of this section, add 1/8" (3 mm) to height for SEMI units.
- Add 5 pounds (2 kilograms) for global voltage units.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

Specifications

	ThermoFlex3500	ThermoFlex5000
Standard Unit Process Fluid Temperature/Setpoint Range	+5°C to +40°C +41°F to +104°F	+5°C to +40°C +41°F to +104°F
High-Temperature Unit Process Fluid Temperature/Setpoint Range	+5°C to +90°C +41°F to +194°F	+5°C to +90°C +41°F to +194°F
Ambient Temperature Range All Units	+10°C to +40°C +50°F to +104°F	+10°C to +40°C +50°F to +104°F
Temperature Stability	±0.1°C	±0.1°C
Cooling Capacity at 20°C 60 Hz 50 Hz	3500 W (11953 BTU) 3050 W (10416 BTU)	5000 W (17076 BTU) 4400 W (15027 BTU)
Heater Size 208V/230V	2.3kW/2.8kW	2.3kW/2.8kW
Refrigerant	R407C	R407C
Reservoir Volume Gallons Liters	1.9 7.2	1.9 7.2
Footprint or Dimensions (H x W x D)		
Inches Centimeters	38.9 x 19.3 x 30.9 98.7 x 48.8 x 78.4	38.9 x 19.3 x 30.9 98.7 x 48.8 x 78.4
Unit Weight P1/ P2/P3/P4 (empty) lb kg	264/264/270/303 120/120/123/138	NA/264/270/303 NA/120/123/138
Pumping Capacity		
P1 - Positive Displacement 60 Hz 50 Hz	2.1 gpm @ 60 psig (7.9 lpm @ 4.1 bar) 1.7 gpm @ 60 psig (6.4 lpm @ 4.1 bar)	Not Available Not Available
P2 - Positive Displacement 60 Hz 50 Hz	4.0 gpm @ 60 psig (15.1 lpm @ 4.1 bar) 3.3 gpm @ 60 psig (12.5 lpm @ 4.1 bar)	4.0 gpm @ 60 psig (15.1 lpm @ 4.1 bar) 3.3 gpm @ 60 psig (12.5 lpm @ 4.1 bar)
T1 - Turbine 60 Hz* 50 Hz*	3.5 gpm @ 60 psig (13.3 lpm @ 4.1 bar) 2.5 gpm @ 60 psig (9.5 lpm @ 4.1 bar)	3.5 gpm @ 60 psig (13.3 lpm @ 4.1 bar) 2.5 gpm @ 60 psig (9.5 lpm @ 4.1 bar)
P3 - Centrifugal Pump 60 Hz* 50 Hz*	10 gpm @ 32 psid (37.9 lpm @ 2.2 bar) 10 gpm @ 20 psid (37.9 lpm @ 1.4 bar)	10 gpm @ 32 psid (37.9 lpm @ 2.2 bar) 10 gpm @ 20 psid (37.9 lpm @ 1.4 bar)
P4 - Centrifugal Pump 60 Hz* 50 Hz*	15 gpm @ 57 psid (56.8 lpm @ 3.9 bar) 15 gpm @ 34 psid (56.8 lpm @ 2.3 bar)	15 gpm @ 57 psid (56.8 lpm @ 3.9 bar) 15 gpm @ 34 psid (56.8 lpm @ 2.3 bar)

* Pumping capacity pressure values for turbine and centrifugal pumps are differential pressures between the inlet and the outlet of the unit.

- Cooling capacity based on P2 pumps with no backpressure. Heat input from the pump will result in a reduction in cooling capacity. The cooling capacity reduction will vary based on the pump chosen as well as pump backpressure and flow.
- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage. Other fluids, fluid temperatures, ambient temperatures, altitude or operating voltages will affect performance. See Section 3.
- Additional dimensions are at the end of this section, add 1/8" (3 cm) to height for SEMI units.
- Add 30 pounds (14 kilograms) for global voltage units.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

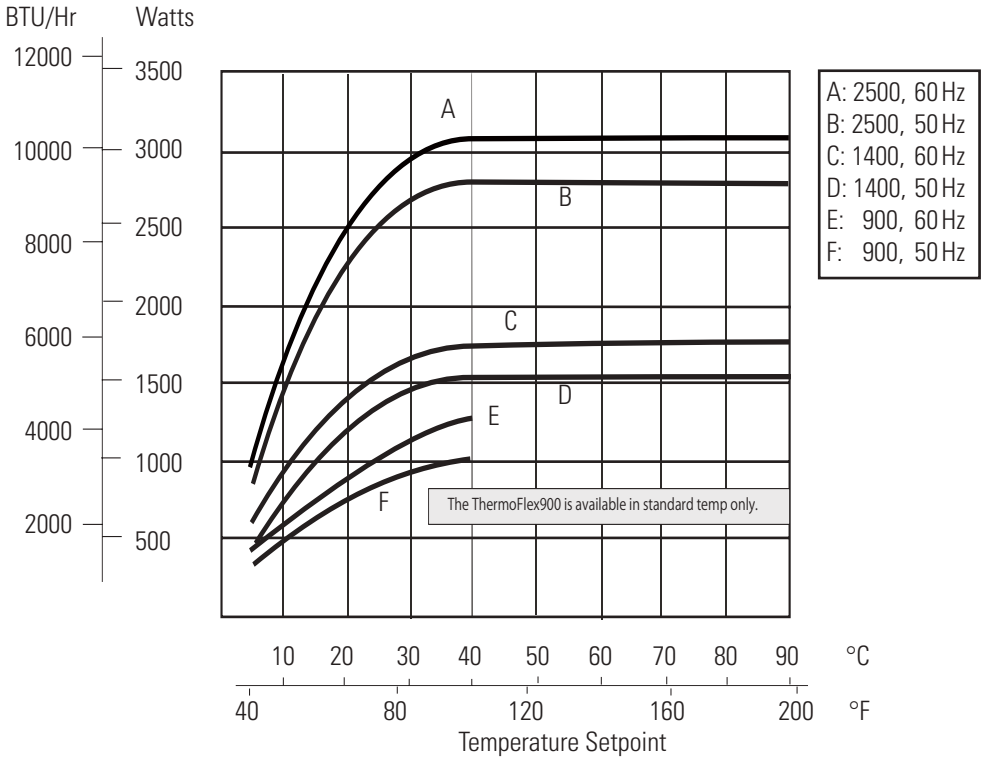
Specifications

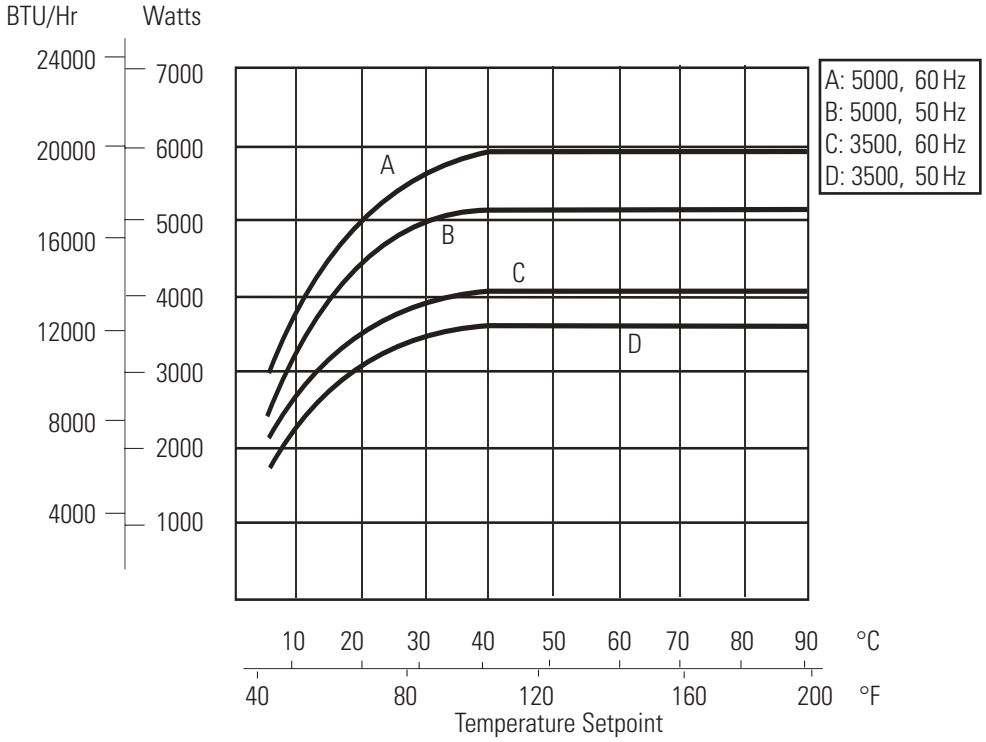
	ThermoFlex7500	ThermoFlex10000
Standard Unit Process Fluid Temperature/Setpoint Range	+5°C to +40°C +41°F to +104°F	+5°C to +40°C +41°F to +104°F
High-Temperature Unit Process Fluid Temperature/Setpoint Range	+5°C to +90°C +41°F to +194°F	+5°C to +90°C +41°F to +194°F
Ambient Temperature Range All Units	+10°C to +40°C +50°F to +104°F	+10°C to +40°C +50°F to +104°F
Temperature Stability	± 0.1°C	± 0.1°C
Cooling Capacity at 20°C 60 Hz 50 Hz	7500 W (25575 BTU) 6425 W (21910 BTU)	10000 W (34100 BTU) 8500 W (28985 BTU)
Heater Size	5.0kW at 208V/6.1kW at230V 4.6kW at 400V/6.1kW at460V	5.0kW at 208V/6.1kW at230V 4.6kW at 400V/6.1kW at460V
Refrigerant	R407C	R407C
Reservoir Volume Gallons Liters	4.75 17.9	4.75 17.9
Footprint or Dimensions (H x W x D)		
Air-Cooled Inches Centimeters	52.3 x 25.2 x 33.8 132.7 x 63.9 x 85.6	52.3 x 25.2 x 33.8 132.7 x 63.9 x 85.6
Water-Cooled Inches Centimeters	45.9 x 25.2 x 33.8 116.6 x 63.9 x 85.6	45.9 x 25.2 x 33.8 116.6 x 63.9 x 85.6
Unit Weight P2/P3/P5 (empty)		
Air-Cooled lb kg	356/372.5/405.5 161.5/169/184	356/372.5/405.5 161.5/169/184
Water-Cooled lb kg	315/331.5/364.5 143/150/165	315/331.5/364.5 143/150/165
Pumping Capacity		
P2 - Positive Displacement 60 Hz 50 Hz	4.0 gpm @ 60 psig (15.1 lpm @ 4.1 bar) 3.3 gpm @ 60 psig (12.5 lpm @ 4.1 bar)	4.0 gpm @ 60 psig (15.1 lpm @ 4.1 bar) 3.3 gpm @ 60 psig (12.5 lpm @ 4.1 bar)
P3 - Centrifugal Pump 60 Hz* 50 Hz*	10 gpm @ 32 psid (37.9 lpm @ 2.2 bar) 10 gpm @ 20 psid (37.9 lpm @ 1.4 bar)	10 gpm @ 32 psid (37.9 lpm @ 2.2 bar) 10 gpm @ 20 psid (37.9 lpm @ 1.4 bar)
P5 - Centrifugal Pump 60 Hz* 50 Hz*	20 gpm @ 60 psid (75.7 lpm @ 4.1 bar) 20 gpm @ 35 psid (75.7 lpm @ 2.4 bar)	20 gpm @ 60 psid (75.7 lpm @ 4.1 bar) 20 gpm @ 35 psid (75.7 lpm @ 2.4 bar)

* Pumping capacity pressure values for centrifugal pumps are differential pressures between the inlet and the outlet of the unit. P5 pumping capacity in high temperature units is slightly lower, see P5 Pumping Capacity curves in this Section.

- Cooling capacity based on P2 pumps with no backpressure. Heat input from the pump will result in a reduction in cooling capacity. The cooling capacity reduction will vary based on the pump chosen as well as pump backpressure and flow.
- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage. Other fluids, fluid temperatures, ambient temperatures, altitude or operating voltages will affect performance. See Section 3.
- Additional dimensions are at the end of this section.
- Add 30 pounds (14 kilograms) for global voltage units with a P2 pump. Add 10 pounds (4.5 kilograms) for units with a P3 or P5 pump.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

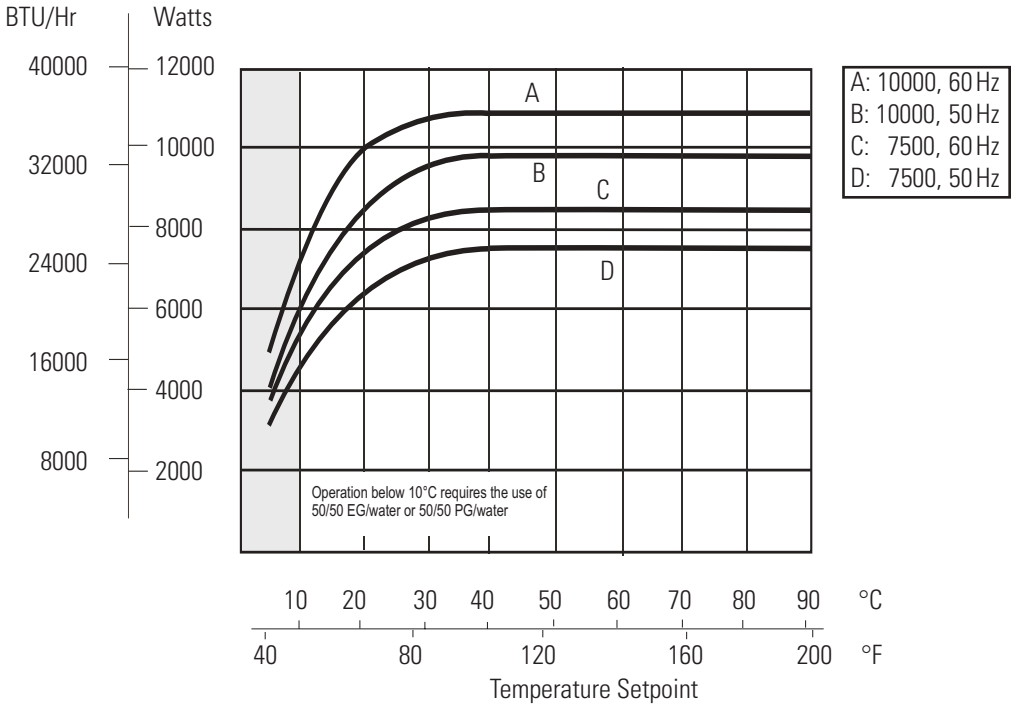
Cooling Capacity





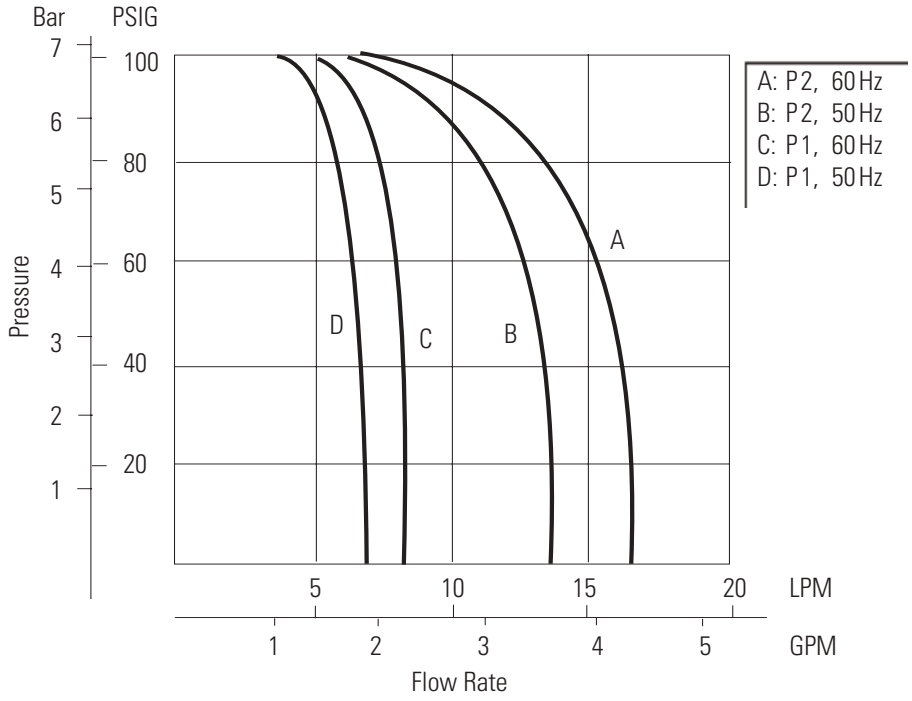
- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage, on units with P 2 pumps with no back pressure. Other fluids, fluid temperatures, ambient temperatures, altitude, operating voltages or pumps will affect performance. See Section 3.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

Cooling Capacity

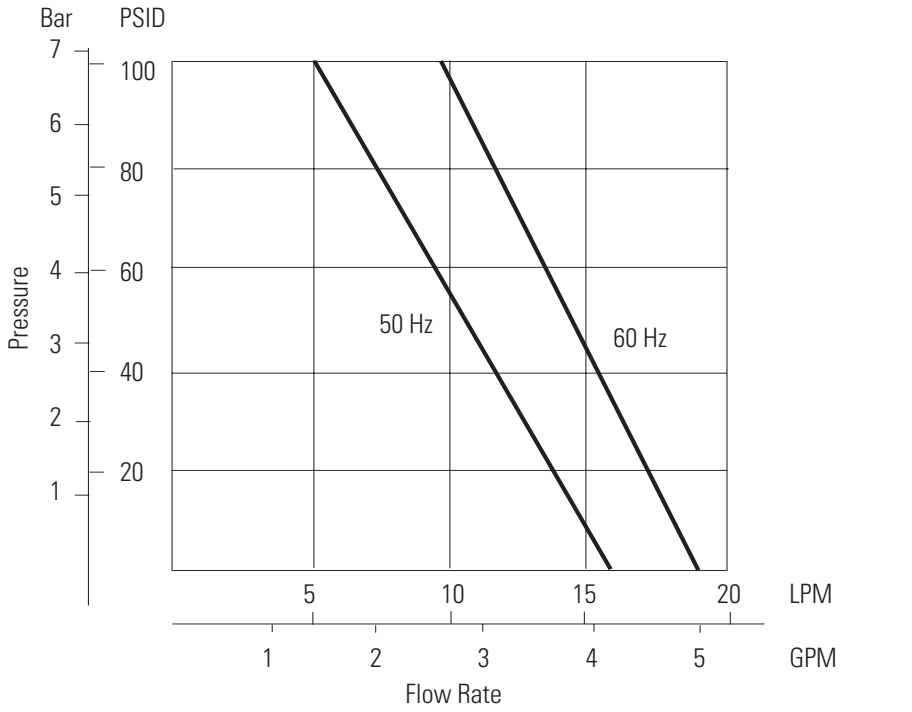


- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage, on units with P2 pumps with no back pressure. Other fluids, fluid temperatures, ambient temperatures, altitude, operating voltages or pumps will affect performance. See Section 3.
- Units require the use of 50/50 EG/water or 50/50 PG/water below 10°C process temperature to prevent freezing/glazing of the plate exchanger.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

Pumping Capacity
Positive Displacement
Pump P1/P2

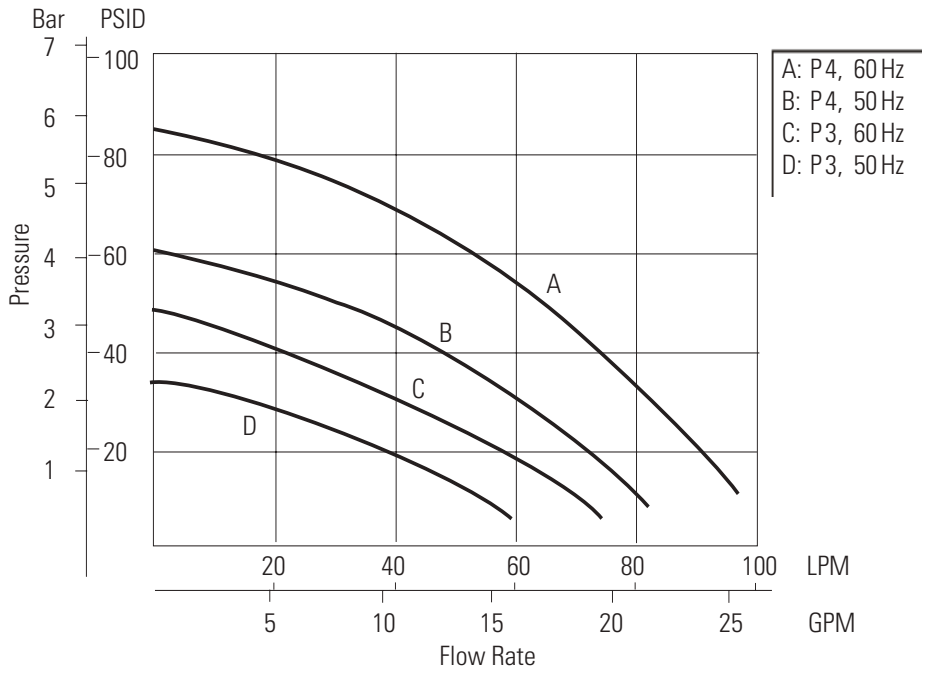


Pumping Capacity
Turbine Pump T1

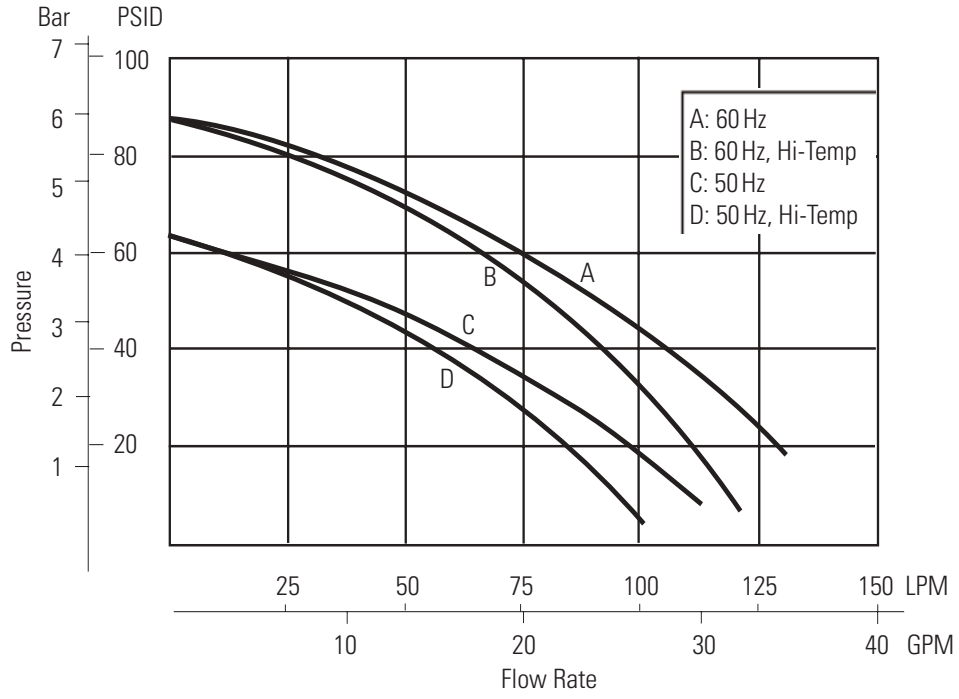


- Pump curves are nominal values. Pressure values for turbine pumps are differential pressures between the inlet and the outlet of the unit.
- Pump performance results were obtained with no restrictions on the return to the system or with any options installed. For example, utilizing the DI option will result in a 0.5 gpm flow reduction.
- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage. Other fluids, fluid temperatures, ambient temperatures, altitude or operating voltages will affect performance. See Section 3.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

Pumping Capacity
Centrifugal Pump P3/P4



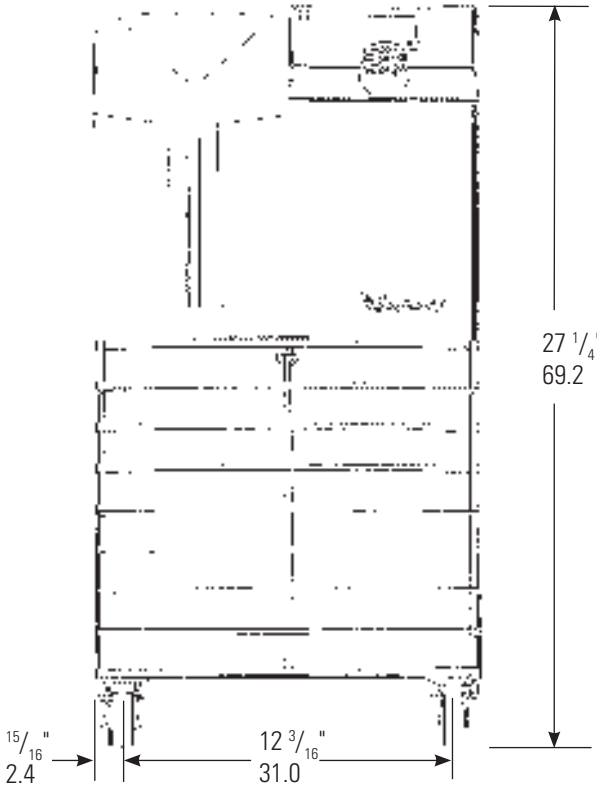
Pumping Capacity
Centrifugal Pump P5



- Pump curves are nominal values. Pressure values for centrifugal pumps are differential pressures between the inlet and the outlet of the unit.
- Pump performance results were obtained with no restrictions on the return to the system or with any options installed. For example, utilizing the DI option will result in a 0.5 gpm flow reduction.
- Specifications obtained at sea level using water as the recirculating fluid, at a 20°C process setpoint, 25°C ambient condition, at nominal operating voltage. Other fluids, fluid temperatures, ambient temperatures, altitude or operating voltages will affect performance. See Section 3.
- Thermo Fisher Scientific reserves the right to change specifications without notice.

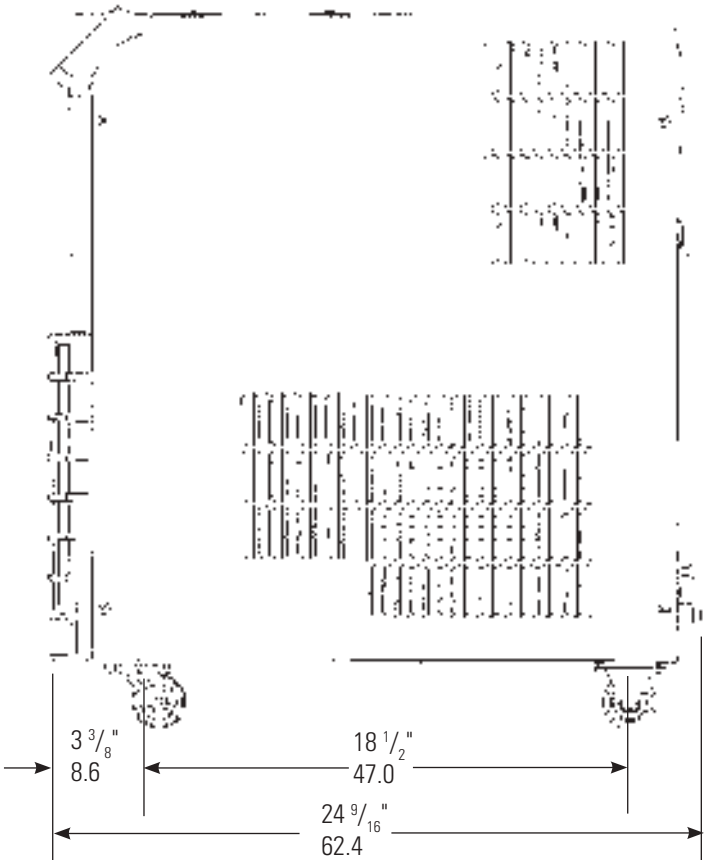
ThermoFlex900/1400
Dimensions
(inches/centimeters)

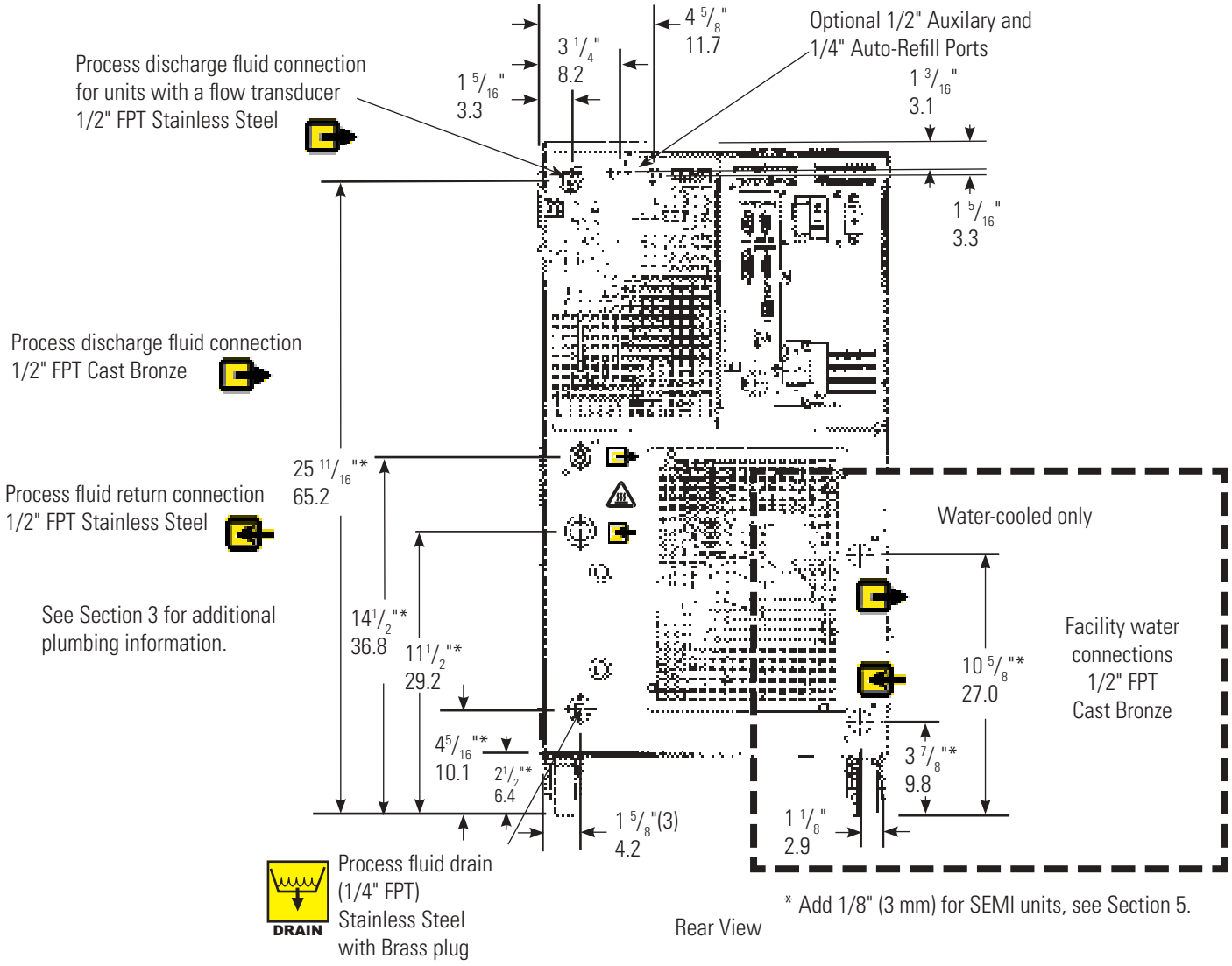
Front View

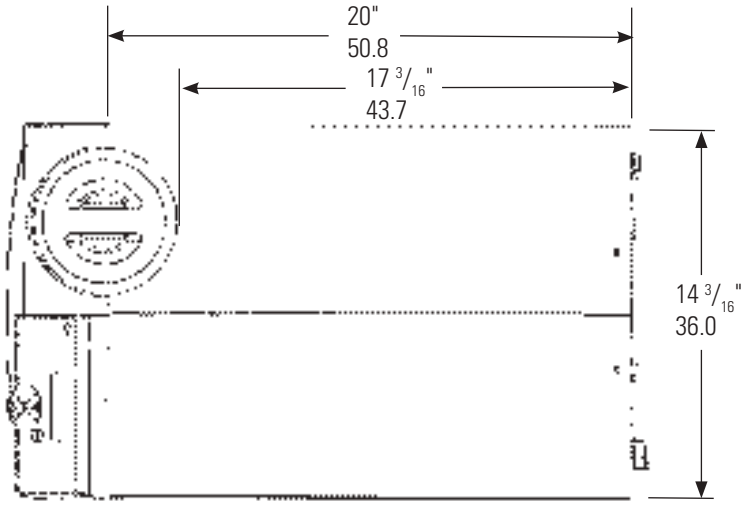


* Add 1/8" (3 mm) for SEMI units, see Section 5.

Side View







Shipping crate dimensions (approximate):

21" (53 cm) wide

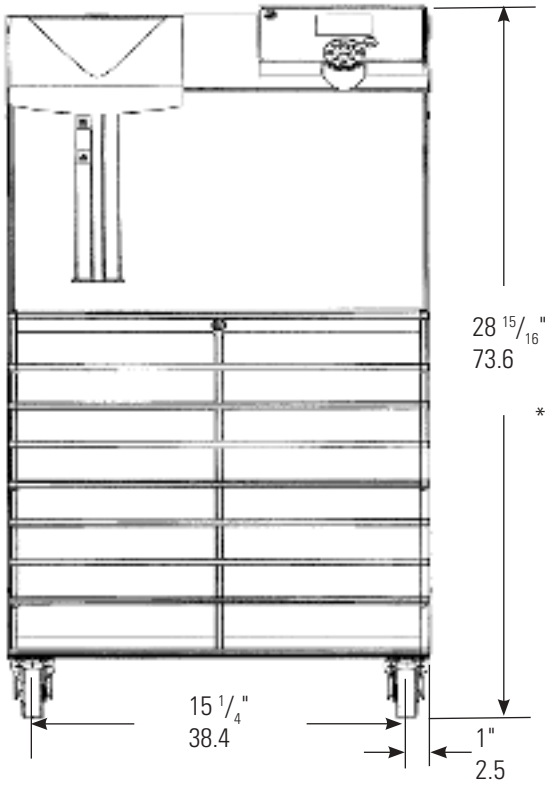
35" (89 cm) tall

40" (102 cm) deep

- Thermo Fisher Scientific reserves the right to change specifications without notice.

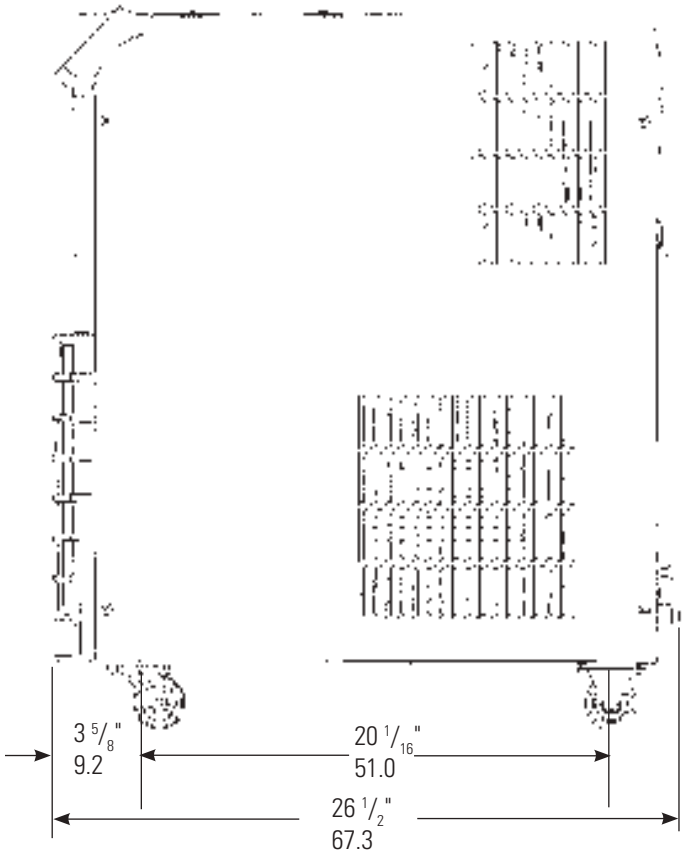
ThermoFlex2500
Dimensions
(inches/centimeters)

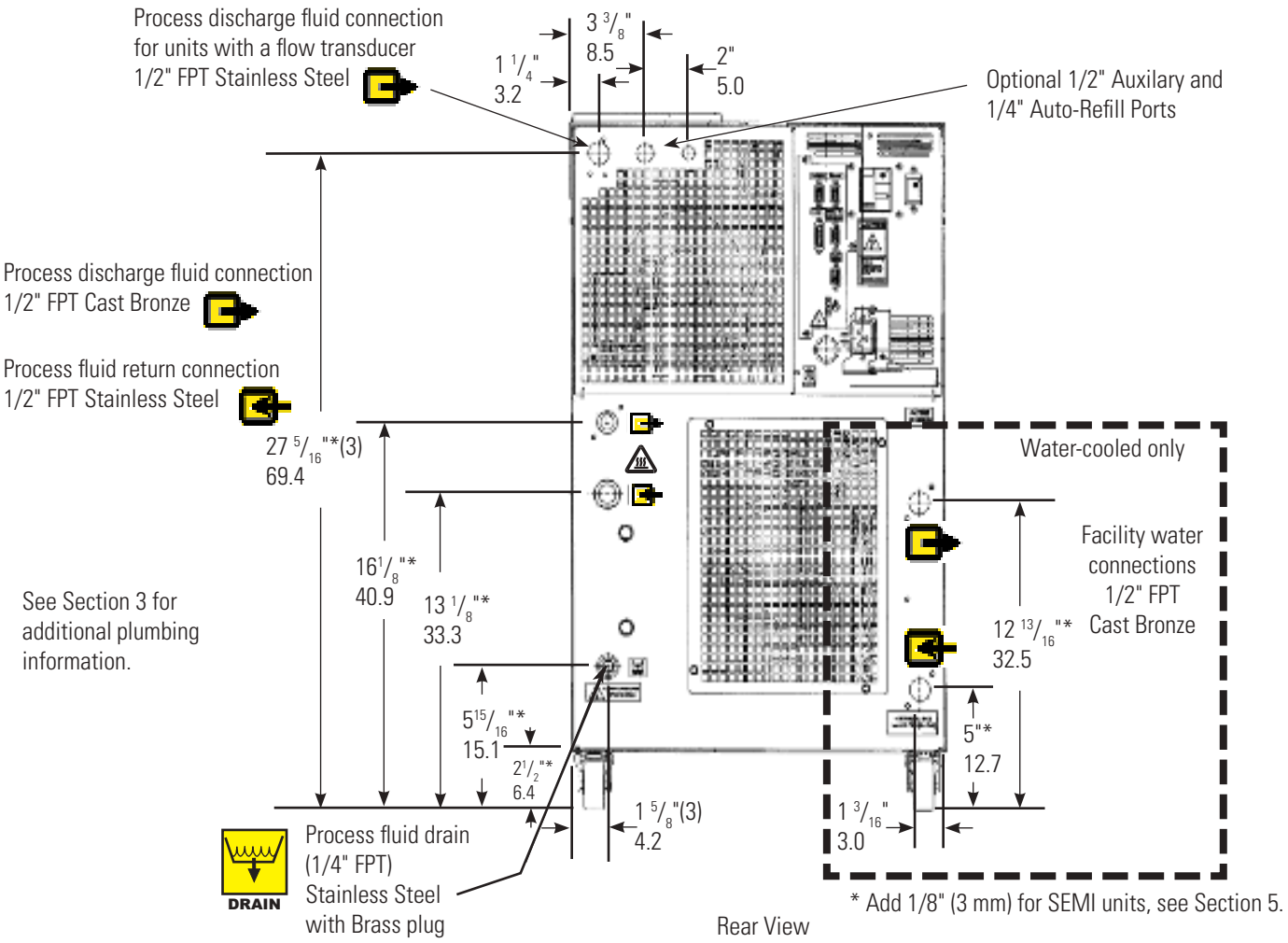
Front View

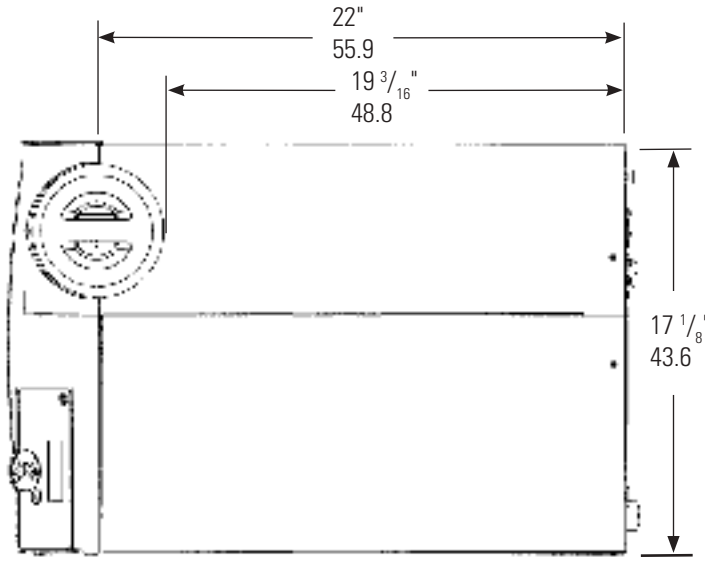


* Add 1/8" (3 mm) for SEMI units, see Section 5.

Side View



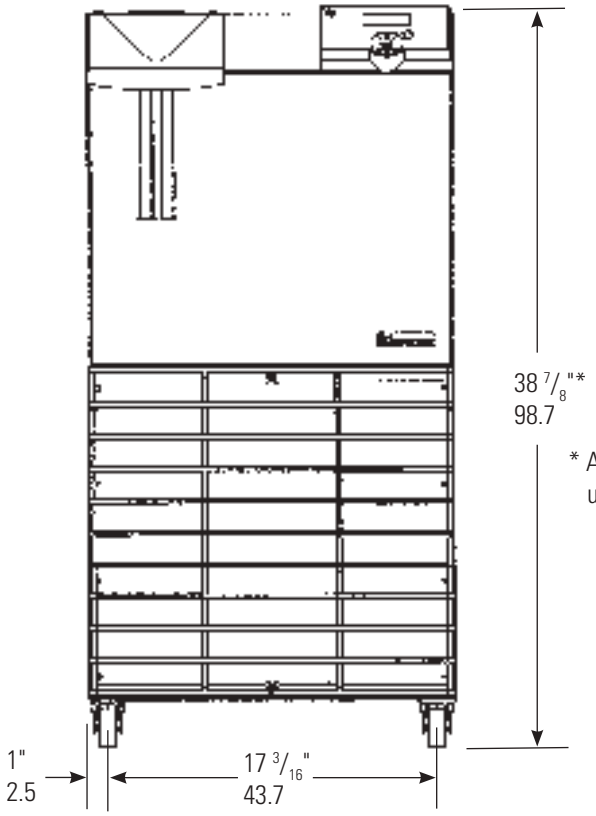




- Thermo Fisher Scientific reserves the right to change specifications without notice.

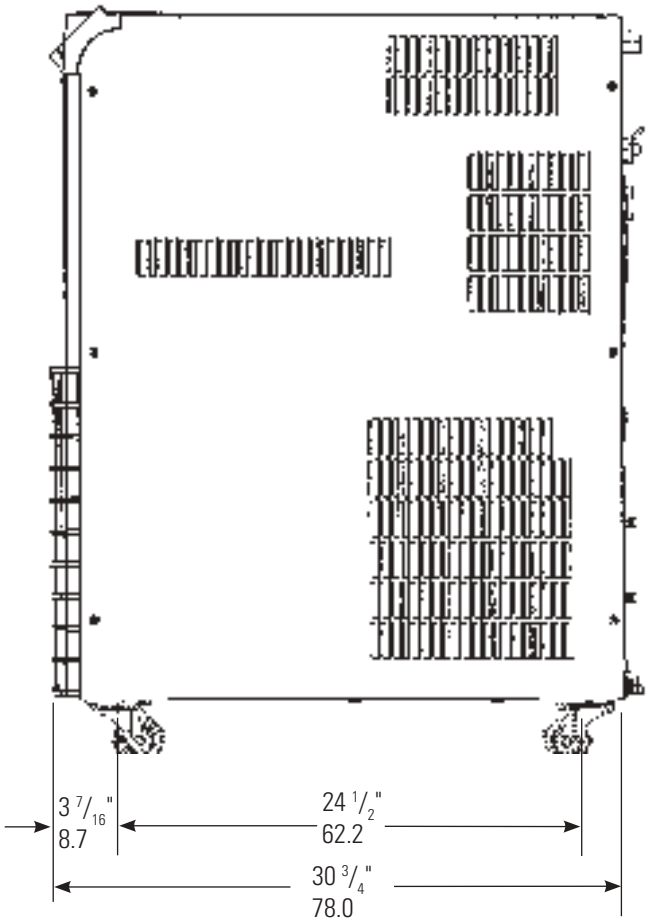
ThermoFlex3500/5000
Dimensions
(inches/centimeters)

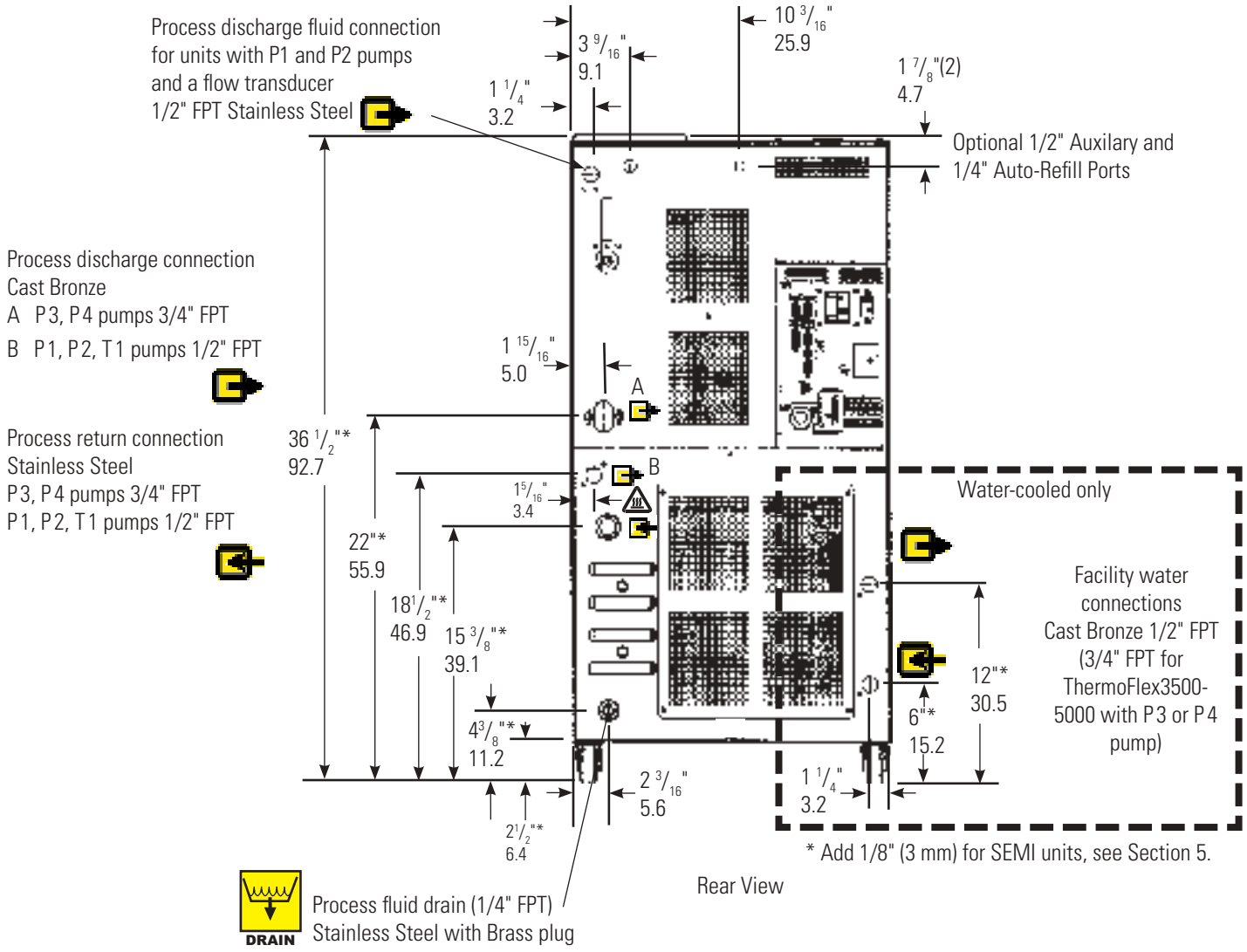
Front View

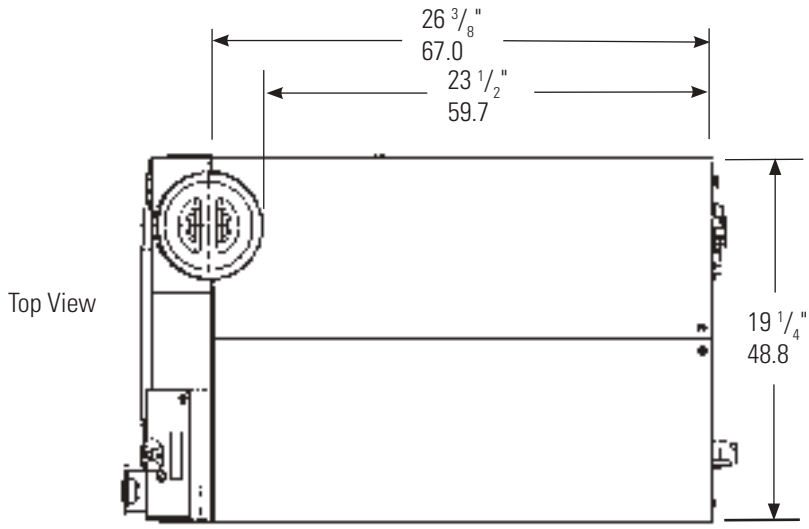


* Add 1/8" (3 mm) for SEMI units, see Section 5.

Side View







Shipping crate dimensions (approximate):

26" (66 cm) wide

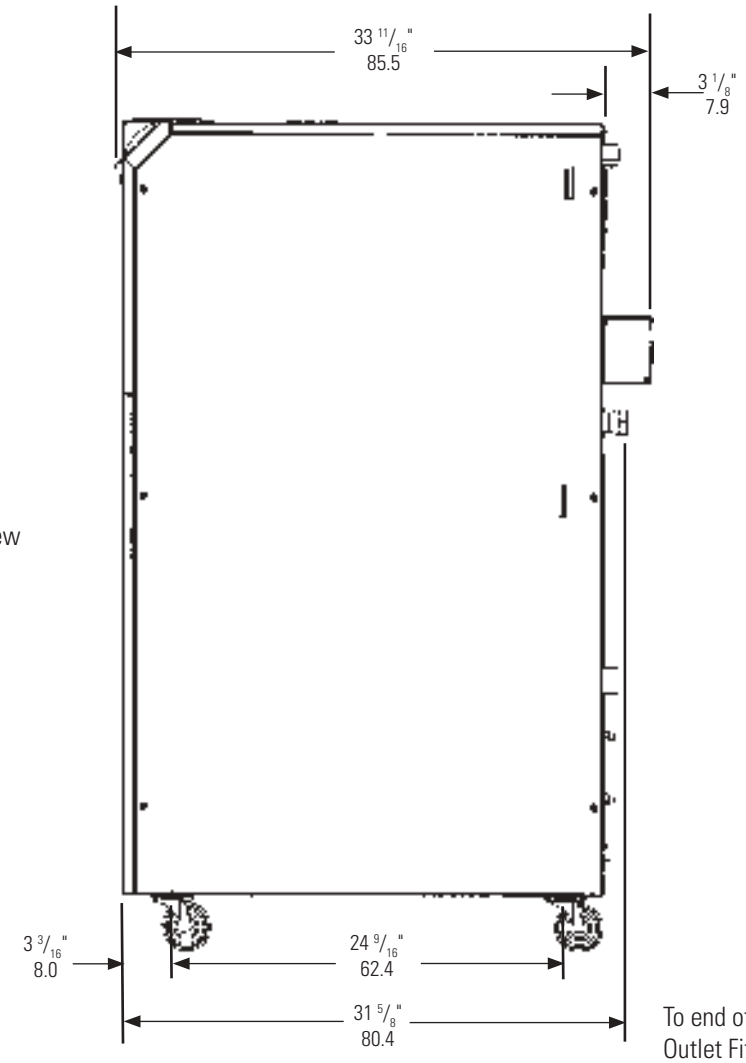
48" (122 cm) tall

47" (119 cm) deep

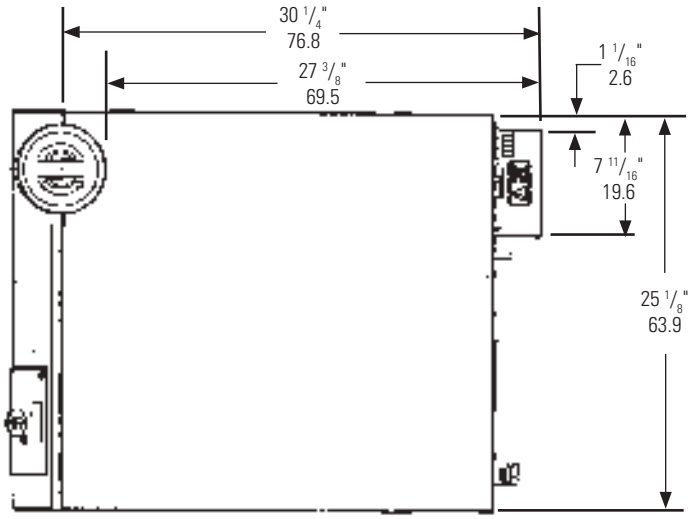
- Thermo Fisher Scientific reserves the right to change specifications without notice.

ThermoFlex7500/10000
Dimensions
(inches/centimeters)

Side View



Top View



Air-cooled shipping crate dimensions (approximate):

35 3/4" (91 cm) wide

61 1/2" (156 cm) tall

46 3/8" (118 cm) deep

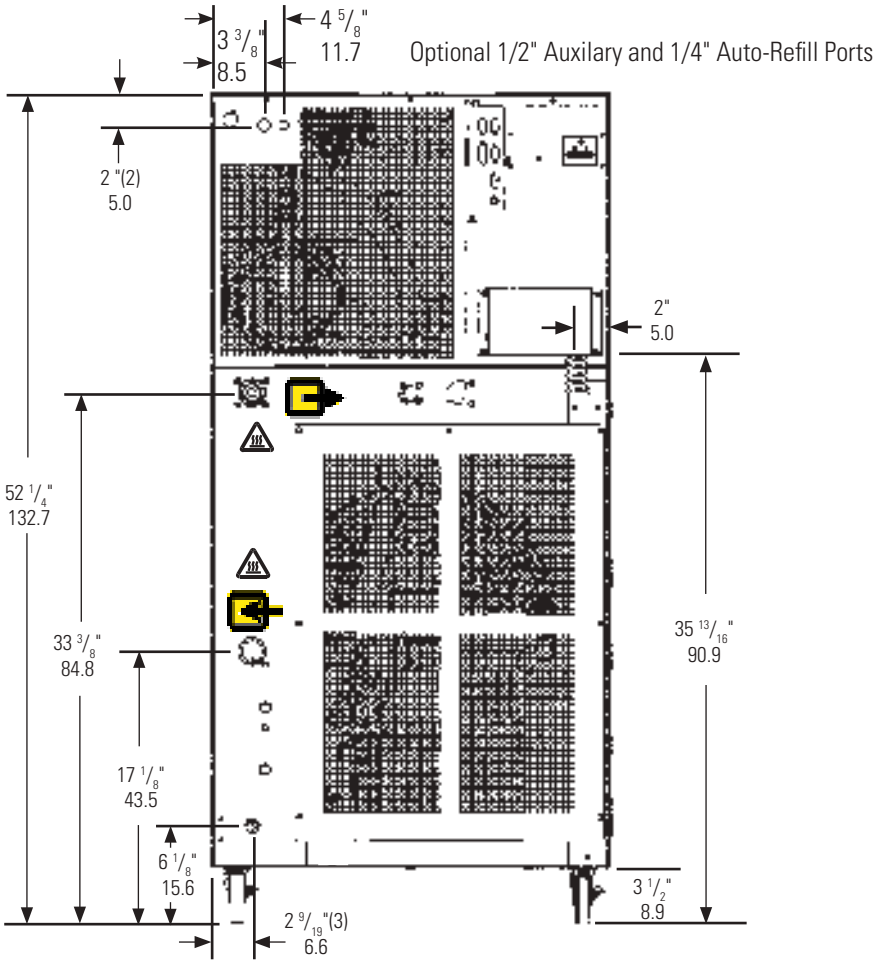
Water-cooled shipping crate dimensions (approximate):

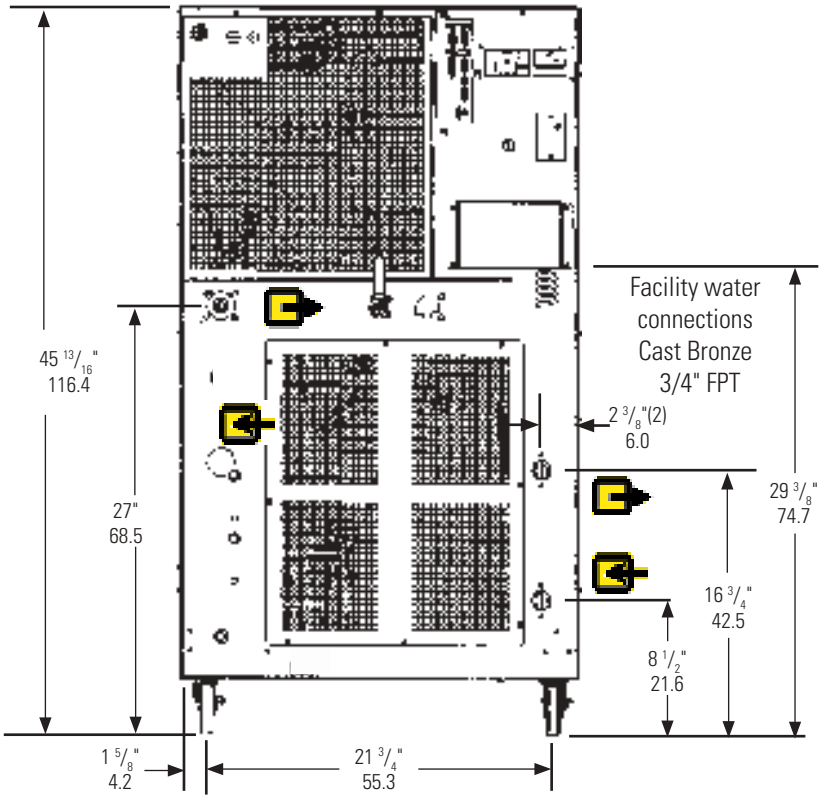
35 3/4" (91 cm) wide

55 1/2" (141 cm) tall

46 3/8" (118 cm) deep

- Thermo Fisher Scientific reserves the right to change specifications without notice.


3 3/8"
8.5
4 5/8"
11.7
Optional 1/2" Auxilary and 1/4" Auto-Refill Ports
2 "(2)
5.0
Process Discharge
P2 = 1/2" FPT
Cast Bronze
P3 - P5 = 1" FPT
Wrought Copper
2"
5.0
Rear View
(Air-Cooled)
52 1/4"
132.7
Process Return
Stainless Steel
P2 = 1/2" FPT
P3 - P5 = 1" FPT
33 3/8"
84.8
35 13/16"
90.9
See Section 3 for
additional plumbing
information.
17 1/8"
43.5
6 1/8"
15.6
DRAIN
Process fluid drain (1/4" FPT)
Stainless Steel with Brass plug
3 1/2"
8.9
2 9/19"(3)
6.6


Rear View
(Water-Cooled)
Facility water
connections
Cast Bronze
3/4" FPT
45 13/16"
116.4
2 3/8"(2)
6.0
29 3/8"
74.7
27"
68.5
16 3/4"
42.5
8 1/2"
21.6
1 5/8"
4.2
21 3/4"
55.3

Section 3 Installation

Site Requirements

Ambient Temperature Range*	10°C to 40°C (50°F to 104°F)
Relative Humidity Range	10% to 80% (non-condensing)
Operating Altitude*	Sea Level to 8000 feet (2438 meters)
Overvoltage Category	II
Pollution Degree	2
Degree of Protection	IP 20

*Because of the decrease in air density, maximum temperature for the air entering an air-cooled ThermoFlex is reduced by 1°C per 1,000 feet above sea level. In addition, cooling capacity is reduced 1.2% per 1,000 feet above sea level.

Never place the unit in a location where excessive heat, moisture, inadequate ventilation, or corrosive materials are present. ▲

Air-cooled units retain their full rated capacity at 20°C setpoint in ambient temperatures up to 25°C (77°F). For ambient temperatures above 25°C please de-rate the cooling capacity 3% for every 1°C above 25°C (77°F), up to a maximum ambient temperature of 40°C (104°F). Please note that when operating at a process temperature lower than 20°C the de-rate percentage may increase due to additional gains from losses to ambient.

NOTE Depending on the setpoint and ambient temperatures, there may be a heat gain or loss through the plumbing resulting in a variation from setpoint temperature at the application inlet. Applications with large temperature variations between ambient and setpoint temperatures, and/or long plumbing lengths, may require additional insulation. ▲

ThermoFlex2500 air-cooled units are equipped with a two-speed fan. Should the unit's internal ambient temperature reach 50°C for 30 seconds, or reach 53°C, the fan speed will switch from slow speed to high speed to maintain internal temperatures within acceptable limits. When the temperature reaches 44°C or below for at least 15 minutes the speed will return to low. When in high speed the unit's decibel level increases significantly.

NOTE High speed is required for the unit to achieve its 2500 watt cooling capacity. At high-end operating conditions the fan can be set to run at high speed all the time using the controller's **SETTINGS** display, see Section 4. ▲

Units installed below the end-user application may enable system fluid to drain back into the chiller and cause spillage. Thermo Fisher offers an anti-drainback kit to prevent any spillage, see Section 5.

Air-cooled units can be installed with both sides blocked, or one side and the rear. See Figure 3-1. The front of the unit needs a minimum clearance of 24". Air will enter the front of the system and exit through the sides and rear.

Having two sides blocked can impact the unit's performance due to changes in air flow. If your installation requires two blocked sides please ensure that the following requirements are met:

Process Setpoint Temperature: Below 30°C (86°F)

Ambient: Below 40°C (104°F)

Before operating the unit in conditions outside any of those listed on this page please contact Thermo Fisher Scientific's Sales, Service and Customer Support to review your installation.

Figure 3-1 Minimum Clearance

Electrical Requirements

The unit construction provides protection against the risk of electrical shock by grounding appropriate metal parts. The protection may not function unless the power cord is connected to a properly grounded outlet. It is the user's responsibility to assure a proper ground connection is provided. ▲

The user is responsible to ensure that the power cord provided meets local electrical codes. If not, contact qualified installation personnel.

The unit is intended for use on a dedicated outlet. The ThermoFlex has an internal circuit protection that is equivalent (approximately) to the branch circuit rating. This is to protect the ThermoFlex, and is not intended as a substitute for branch circuit protection.

Electrical Service Requirements (Standard temperature units):

ThermoFlex900	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	100 VAC	50 Hz	1Ø	15A	5-15P
	115 VAC	60 Hz	1Ø	15A	5-15P
	200 VAC	50 Hz	1Ø	15A	6-15P
	208-230 VAC	60 Hz	1Ø	15A	6-15P
	230 VAC	50 Hz	1Ø	*16A[1], 15A[2], 13A[3]	-

ThermoFlex1400	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	100 VAC	50 Hz	1Ø	20A	5-20P
	115 VAC	60 Hz	1Ø	20A	5-20P
	200 VAC	50 Hz	1Ø	15A	6-15P
	208-230 VAC	60 Hz	1Ø	15A	6-15P
	230 VAC	50 Hz	1Ø	*16A[1], 15A[2], 13A[3]	-

ThermoFlex2500	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC P 1 P 2 Pump	50 Hz	1Ø	15A	6-15P
	208-230 VAC P 1 P 2 Pump	60 Hz	1Ø	15A	6-15P
	200 VAC T 1 Pump	50 Hz	1Ø	20A	6-20P
	208-230 VAC T 1 Pump	60 Hz	1Ø	20A	6-20P
	230 VAC	50 Hz	1Ø	*16A[1], 15A[2], 13A[3]	-

ThermoFlex3500/5000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC P 1 P 2 Pump	50 Hz	1Ø	15A	6-15P
	200 VAC T 1 P 3 Pump	50 Hz	1Ø	20A	6-20P
	200 VAC P 4 Pump	50 Hz	1Ø	30A	6-30P
	208-230 VAC P 1 P 2 Pump	60 Hz	1Ø	15A	6-20P
	208-230 VAC T 1 P 3 Pump	60 Hz	1Ø	20A	6-20P
	208-230 VAC P 4 Pump	60 Hz	1Ø	30A	6-30P
	230 VAC P 1 - P 4 Pump	50 Hz	1Ø	*16A[1], 15A[2], 13A[3]	-

ThermoFlex7500/10000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC P 2 P 3 Pump	50 Hz	3Ø	20A	L15-20P
	208-230 VAC P 2 P 3 Pump	60 Hz	3Ø	20A	L15-20P
	200 VAC P 5 Pump	50 Hz	3Ø	30A	L15-30P
	208-230 VAC P 5 Pump	60 Hz	3Ø	30A	L15-30P
	400 VAC	50 Hz	3Ø	16A	IEC309

* Refer to Appendix A for country specific ratings.

Electrical Service Requirements (Variable voltage units):

ThermoFlex900	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	115 VAC	60 Hz	1Ø	15A	5-15P*
	100 VAC	50/60 Hz	1Ø	15A	5-15P*

ThermoFlex1400	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	115 VAC	60 Hz	1Ø	20A	-
	100 VAC	50/60 Hz	1Ø	20A	-

* United States and Japan only. All other plugs are country specific.

Electrical Service Requirements (Global voltage units):

ThermoFlex900	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200/208/230 VAC	60 Hz	1Ø	15A	-
	200/230 VAC	50 Hz	1Ø	**16A[1], 15A[2], 13A[3]	-

ThermoFlex1400	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200/208/230 VAC	60 Hz	1Ø	15A	-
	200/230 VAC	50 Hz	1Ø	**16A[1], 15A[2], 13A[3]	-

ThermoFlex2500	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC T 1 Pump	60 Hz	1Ø	15A	-
	208-230 VAC T 1 Pump	60 Hz	1Ø	20A	-
	230 VAC	50 Hz	1Ø	*16A[1], 15A[2], 13A[3]	-

ThermoFlex3500/5000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200/208-230 VAC P 1 P 3 Pump	50/60 Hz	1Ø	15A	-
	200/208-230 VAC T 1 P 3 Pump	50/60 Hz	1Ø	20A	-
	200/208-230 VAC P 4 Pump	50/60 Hz	1Ø	30A	Hard wired

ThermoFlex7500/10000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	400 VAC	60 Hz	3Ø	20A	Hard wired
	460 VAC	60 Hz	3Ø	20A	Hard wired

** Units selected for 230 VAC operation have a range of -10% to +7%. Refer to Appendix A for country specific ratings.

For installation information on Variable Voltage and Global Voltage units refer to Appendix B.

Refer to the nameplate label located on the rear of the unit for specific electrical requirements.

Electrical Service Requirements (High temperature units):

ThermoFlex1400	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC 1KW	50 Hz	1Ø	20A	6-20P
	200-230 VAC 1KW	60 Hz	1Ø	20A	6-20P
	200 VAC 2KW	50 Hz	1Ø	30A	6-30P
	208-230 VAC 2KW	60 Hz	1Ø	30A	6-30P
	230 VAC 2KW	50 Hz	1Ø	32A	-
	230 VAC 1KW	50 Hz	1Ø	*16A[1], 15A[2], 13A[3]	-

ThermoFlex2500	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC P1 P2 Pump	50 Hz	1Ø	30A	6-30P
	208-230 VAC P1 P2 Pump	60 Hz	1Ø	30A	6-30P
	200 VAC T1 Pump	50 Hz	1Ø	30A	Hard wire
	208-230 VAC T1 Pump	60 Hz	1Ø	30A	Hard wire
	230 VAC	50 Hz	1Ø	32A	-

ThermoFlex3500/5000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC P1 P2 Pump	50 Hz	1Ø	30A	6-30P
	200 VAC T1 P3 P4 Pump	50 Hz	1Ø	40A	Hard wire
	208-230 VAC P1 P2 Pump	60 Hz	1Ø	30A	6-30P
	208-230 VAC T1 P3 P4 Pump	60 Hz	1Ø	40A	Hard wire
	230 VAC P1- P4, T1 Pump	50 Hz	1Ø	32A	IEC309

ThermoFlex7500/10000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200 VAC P2 P3 Pump	50 Hz	3Ø	40A	Hard wire
	208-230 VAC P2 P3 Pump	60 Hz	3Ø	40A	Hard wire
	200 VAC P5 Pump	50 Hz	3Ø	50A	Hard wire
	208-230 VAC P5 Pump	60 Hz	3Ø	50A	Hard wire

* Refer to Appendix A for country specific ratings.

Electrical Service Requirements (High temperature global voltage units):

ThermoFlex1400	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200/208/230 VAC 1KW	60 Hz	1Ø	20A	6-20P
	200/208/230 VAC 2KW	60 Hz	1Ø	30A	Hard wire
	200/230 VAC 2KW	50 Hz	1Ø	32A	Hard wire
	200/230 VAC 1KW	50 Hz	1Ø	**16A[1], 15A[2], 13A[3]	Hard wire

ThermoFlex2500	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200/208/230 VAC P1 P2 Pump	60 Hz	1Ø	30A	Hard wire
	200/208/230 VAC T1 Pump	60 Hz	1Ø	40A	Hard wire
	200/230 VAC	50 Hz	1Ø	32A	Hard wire

ThermoFlex3500/5000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	200/208-230 VAC P1 P2 Pump	50/60 Hz	1Ø	30, 32A	Hard wire
	200/208-230 VAC T1 P3 P4 Pump	50/60 Hz	1Ø	32, 40A	Hard wire

ThermoFlex7500/10000	Voltage	Frequency	Phase	Branch Circuit Requirements	Line Cord Plug
	400 VAC	50 Hz	3Ø	32A	Hard wire
	460 VAC	60 Hz	3Ø	30A	Hard wire

** Units selected for 230 VAC operation have a range of -10% to +7%. Refer to Appendix A for country specific ratings.

For installation information Global Voltage units refer to Appendix B.

Refer to the nameplate label located on the rear of the unit for specific electrical requirements.

Hard Wire Installation

For personal safety and equipment reliability, only a qualified technician should perform the following procedure. ▲

- Remove the six screws securing the electrical box cover to the rear of the unit.

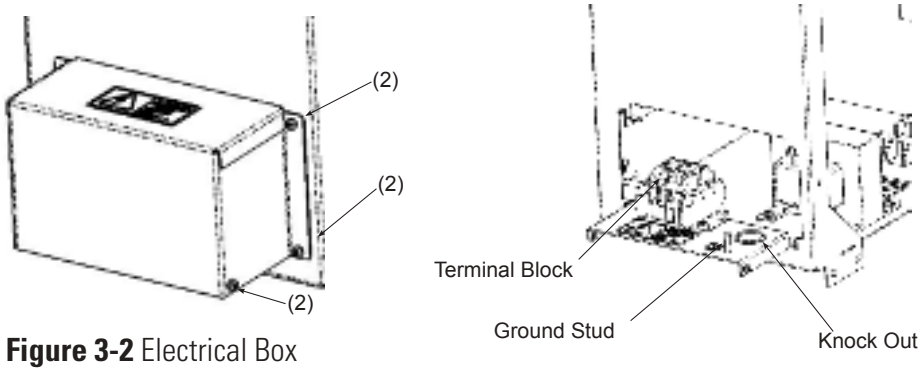


Figure 3-2 Electrical Box

- Remove the double knock out ($^{7}/_{8}$" and 1 $^{3}/_{32}$").
- Insert the cable through the hole.
- Refer to the label in the electrical box to configure your unit, see Figure 3-3.
- Secure the cable's ground wire to the ground stud.
- Reinstall the cover.

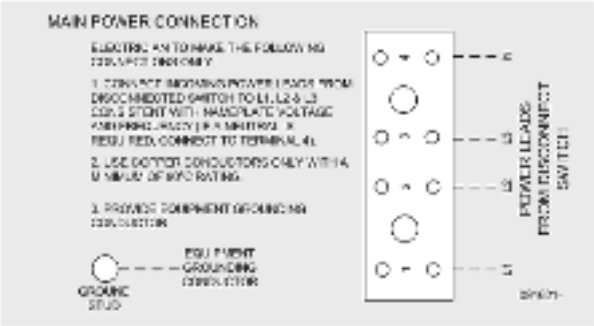


Figure 3-3 Sample Label

Plumbing Requirements

Ensure that all shipping plugs are removed before installation.

Never connect the process fluid lines to your facility water supply or any pressurized liquid source. ▲

To prevent damage to the unit's plate exchanger, centrifugal pumps require a 4.0 gpm (15.1 lpm) minimum flow rate. ▲

P1 and P2 pumps are capable of producing 185 psig. Ensure your plumbing is rated to withstand this pressure at your operating temperature. An external pressure relief valve is available, see Section 5. ▲

NOTE Ensure your plumbing installation will develop a back pressure to the ThermoFlex greater than 3 PSIG. A lack of back pressure will shut down the unit. ▲

The process fluid connections are located on the rear of the unit and are labeled (PROCESS OUTLET) and (PROCESS INLET). Connect the PROCESS OUTLET to the fluid inlet on your application. Connect the PROCESS INLET to the fluid outlet on your application. Ensure all connections are secure and that the proper sealant/lubricant for the fitting material is used. (If Teflon® tape is used, ensure the tape does not cover the connection's starting-end thread .)

Process Fluid Connections (FNPT)		
Outlet		
ThermoFlex900 - 10000	P1 P2 T1	1/2" cast bronze
ThermoFlex3500 - 5000	P3 P4	3/4" cast bronze
ThermoFlex7500 - 10000	P3 P5	1" wrought copper
Inlet - Same size as outlet		all units stainless steel

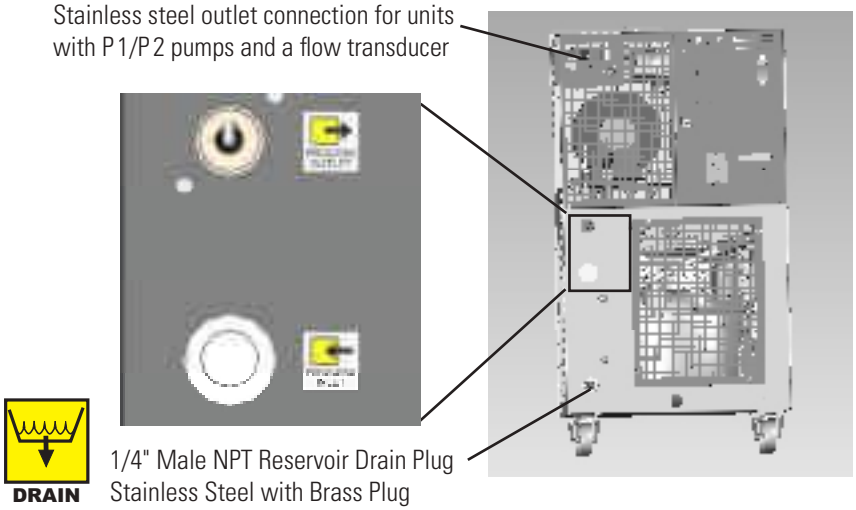
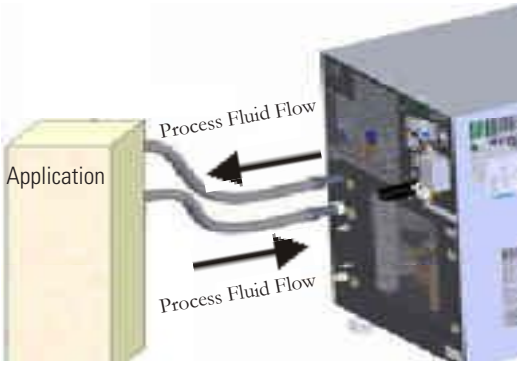


Figure 3-4 Plumbing Connections (1 of 2)



Keep the distance between the unit and the instrument being cooled as short as possible. Ensure tubing is straight and without bends. If diameter reductions are required, make them at the inlet and outlet of your application, not at the ThermoFlex.

Figure 3-4 Plumbing Connections (2 of 2)

Water-cooled Units

For water-cooled units the facility water plumbing connections are also located on the rear of the unit and are labeled FACILITY INLET and FACILITY OUTLET. The connections are ½" Female NPT for ThermoFlex900 - 5000, ¾" Female NPT for ThermoFlex7500 - 10000. For all units, both connections are cast bronze.

Connect the FACILITY INLET to your facility water supply. Connect the FACILITY OUTLET to your facility water return or drain. Ensure all connections are secure and that the proper sealant/lubricant for the fitting material is used. (If Teflon® tape is used, ensure the tape does not overhang the first thread as it could shred and get into the fluid.)

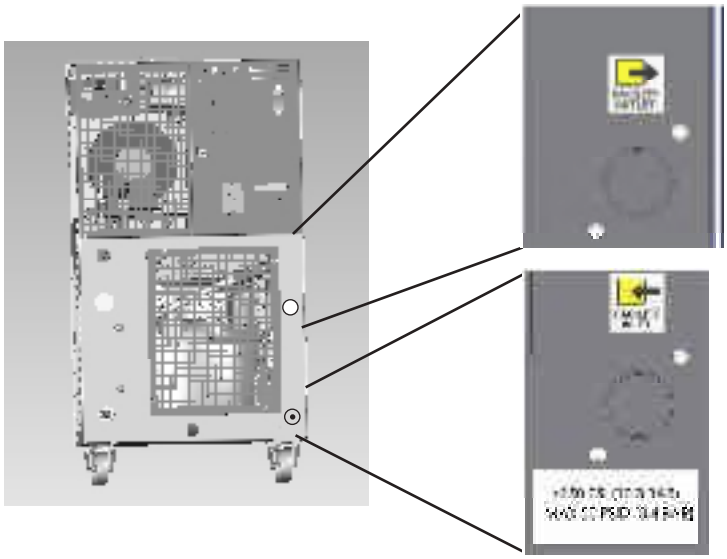


Figure 3-5 Plumbing Connections, Water-cooled Units

Process Fluid Requirements

NEVER use flammable or corrosive fluids with this unit. Do not use automotive antifreeze. Commercial antifreeze contains silicates that can damage the pump seals. Use of any fluid not listed below will void the manufacturer's warranty. ▲

Acceptable fluids are:	
Standard Temp Units	**High Temp Units**
Filtered/Single Distilled water	Filtered water*
0 - 75% Ethylene Glycol/Water	0 - 50% Ethylene Glycol/Water*
0 - 75% Propylene Glycol/Water	0 - 50% Propylene Glycol/Water*
Deionized water (1 - 3 MΩ- cm, compensated)	*to 88°C for units with P1 and P2 pumps to 90°C for units with other pumps (when fluid properly maintained)

Before using any fluid or performing maintenance where contact with the fluid is likely refer to the manufacturer's MSDS for handling precautions. ▲

To prevent freezing/glazing of the plate exchanger, all ThermoFlex7500 and 10000 units require the use of 50/50 EG/water or 50/50 PG/water below 10°C process temperature. ▲

When using a process fluid mixture of ethylene glycol and water or propylene glycol and water, check the fluid concentration and pH on a regular basis. Changes in concentration and pH can impact system performance. ▲

Ethylene glycol (EG) is hygroscopic, it will absorb water from its environment. This can affect the freezing point and boiling point of the fluid over time and may result in system failure. ▲

When using EG/water or PG/water, top-off with plain water. After top-off check the fluid concentration. ▲

Do not use a Deionization (DI) filter cartridge with Inhibited EG or Inhibited PG. A DI filter will remove inhibitors from the solution rendering the fluid ineffective against corrosion protection. Also, inhibitors increase fluid conductivity. ▲

Compatibility with Acceptable Fluids

Filtered/Single Distilled Water
This fluid is acceptable primarily because it has all microorganisms that cause biological fouling removed through vaporizing and condensing the water. However, distilled water does not remain pure for very long when exposed to the atmosphere. Air-born spores can contaminate the water and activate algae growth. An effective maintenance plan would include switching out the fluid with newly distilled water every six months. The particulates that have been filtered out in the process are also preventive in keeping the system "clean" of contaminants.

Uninhibited Ethylene Glycol/Water
Ethylene glycol is used to depress the freezing point of water as a coolant. We recommend not using the uninhibited (no corrosion additives) ethylene glycol. It is more corrosive to copper than plain water so it is not recommended unless required for the application.

Inhibited Ethylene Glycol/Water
Inhibited glycol can be used to increase the operating temperature range of the fluid but not as a "pre-mixed anticorrosive" solution. Industry standards use a pH standard of 8 to determine when the fluid has become corrosive. Dowtherm® is an ethylene based product that contains dipotassium phosphates in a 4% concentration. The recommended use of Dowtherm® is mixing with distilled or deionized water or water that contains less than 25 ppm chloride and sulfate and less than 100 ppm total hardness of CACO3.

The general term, inhibited glycol/water, is too close to meaning inhibited water. Inhibited water can have many types of additives including chromate that will quickly foul the cooling system. Some inhibitor additives can release the bonding agent in the carbon graphite in P1 and P2 pumps so they are incompatible, such as Sodium Hydroxide.

Uninhibited Propylene Glycol/Water
Although the use of propylene glycol is similar to ethylene glycol, propylene glycol is considered "safe" to use in the food industry.

Inhibited Propylene Glycol/Water
Same issues as with uninhibited propylene and inhibited ethylene glycol.

Process Water Quality and Standards

Process Fluid	Permissible (PPM)	Desirable (PPM)
Microbiologicals		
(algae, bacteria, fungi)	0	0
Inorganic Chemicals		
Calcium	<25	<0.6
Chloride	<25	<10
Copper	<1.3	<1.0
0.020 ppm if fluid in contact with aluminum		
Iron	<0.3	<0.1
Lead	<0.015	0
Magnesium	<12	<0.1
Manganese	<0.05	<0.03
Nitrates\Nitrites	<10 as N	0
Potassium	<20	<0.3
Silicate	<25	<1.0
Sodium	<20	<0.3
Sulfate	<25	<1
Hardness	<17	<0.05
Total Dissolved Solids	<50	<10
Other Parameters		
pH	6.5-8.5	7-8
Resistivity	0.01*	0.05-0.1*

* MΩ-cm (compensated to 25°C)

Unfavorably high total ionized solids (TIS) can accelerate the rate of galvanic corrosion. These contaminants can function as electrolytes which increase the potential for galvanic cell corrosion and lead to localized corrosion such as pitting. Eventually, the pitting will become so extensive that refrigerant will leak into the water reservoir.

As an example, raw water in the United States averages 171 ppm (of NaCl). The recommended level for use in a water system is between 0.5 to 5.0 ppm (of NaCl).

Recommendation: Initially fill the tank with distilled or deionized water. Do not use untreated tap water as the total ionized solids level may be too high. This will reduce the electrolytic potential of the water and prevent or reduce the galvanic corrosion observed.

Initial Filling

Ensure the reservoir drain plug on the back of the unit is in place and that all plumbing connections are secure.

Before using any fluid refer to the manufacturer's MSDS for handling precautions. ▲

Figure 3-6 Reservoir Cap

Locate and remove the reservoir cap by unscrewing it counterclockwise.

To prevent the introduction of particulates into the system, fill the unit with the reservoir bag filter in place. Units are shipped with a bag filter in place. For information on changing the bag filter, see Section 6.

The reservoir has a sight tube and ball for easy fluid level monitoring. *Slowly* fill the reservoir with clean process fluid through the funnel only, failure to comply may result in internal spillage.

NOTE Filling the reservoir above MAX LEVEL fill line will result in a unit over flow error (**Over Flow**) causing the unit to shut down. Also, fluids expand when heated. ▲

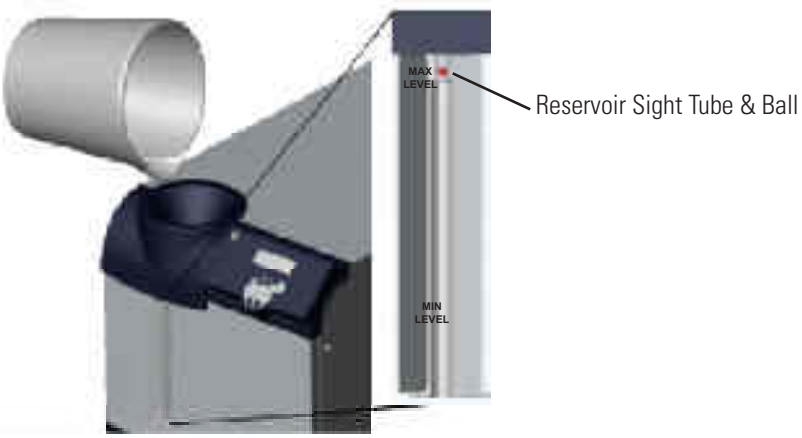


Figure 3-7 Reservoir Sight Tube & Ball

Since the reservoir capacity may be small compared to your application and air may need to be purged from the lines, have extra cooling fluid on hand to keep the system topped off when external circulation is started.

Replace the reservoir cap by screwing it clockwise. Cap should be hand tight.

Fluid Top Off

Ensure the reservoir cap is at a safe handling temperature before removing. ▲

Remove the reservoir cap by unscrewing it counterclockwise.

To prevent the introduction of particulates into the system, fill the unit with the reservoir bag filter in place. Units are shipped with a bag filter in place. For information on changing the bag filter, see Section 6.

The reservoir has a sight tube and ball for easy fluid level monitoring. *Slowly* fill the reservoir with clean process fluid through the funnel only, failure to comply may result in internal spillage.

NOTE Filling the reservoir above MAX LEVEL fill line will result in a unit over flow error (**Over Flow**) causing the unit to shut down. Also, fluids expand when heated. ▲

NOTE Adding fluid that has a temperature differential with the fluid already in the reservoir will temporarily affect unit stability performance.

Water Treatment Kit (North America Only)

A Thermo Fisher Treatment Kit is available and is designed to minimize the effects of corrosion, scale, fouling, and microbial contamination. It allows the system to continue providing reliable service with optimal efficiency for the life of the unit.

The kit includes a biocide and corrosion inhibitor capable of treating up to ten gallons of application water and is designed to provide protection for a period of six months. This kit is compatible with the following fluids:

- Filtered/Single Distilled Water
- Uninhibited Ethylene Glycol/Water
- Uninhibited Propylene/Water
- Deionized (DI) Water*
- Reverse Osmosis (RO) Water

*Do not use the Thermo Fisher Water Treatment Kit with a DI filtered system; the filter will remove a portion of the reagent's active ingredients limiting its effectiveness.

Facility Water Requirements (water-cooled units)

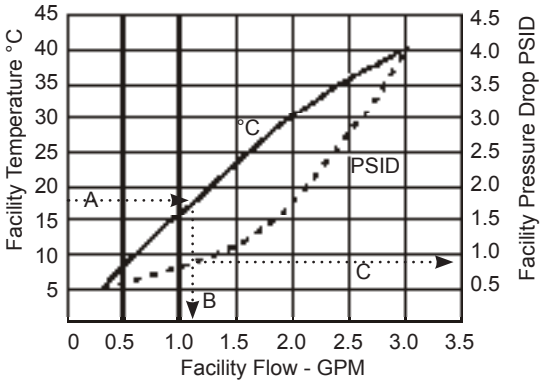
Facility Water Maximum Inlet Pressure must not exceed 150 PSIG.

Facility Water Maximum Pressure Differential must not exceed 50 PSID under any condition.
(Pressure Differential = Inlet Pressure - Outlet Pressure)

NOTE Before using facility water that is above 35°C contact Thermo Fisher Scientific.

ThermoFlex1400

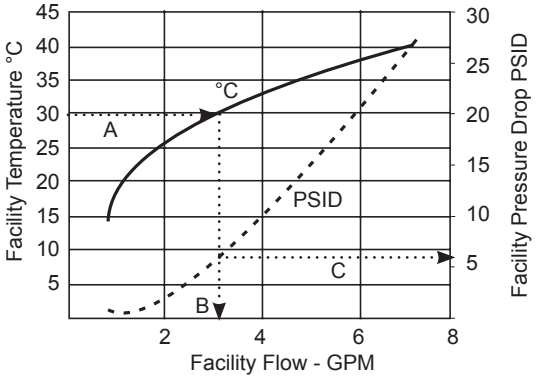
The facility water must meet the following conditions for the units to maintain their full rated capacity.



Example:
Follow the ·····► lines.
Start with a known, i.e. facility water temperature.
A - go across to temperature curve
B - drop down to determine the minimum required facility flow.
C - Where B crosses the PSID curve, go across to determine the minimum required PSID.

ThermoFlex2500

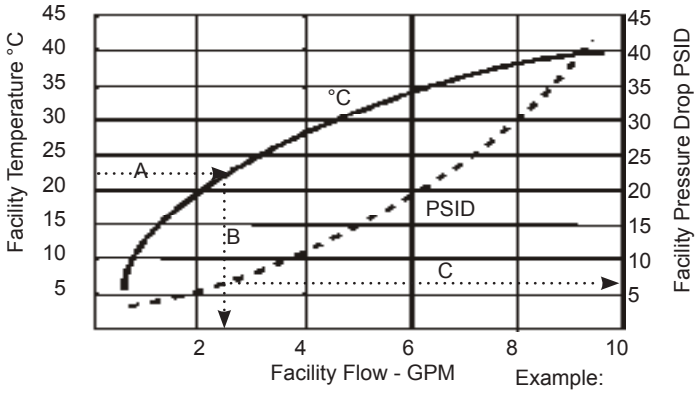
The facility water must meet the following conditions for the units to maintain their full rated capacity.



Example:
Follow the ·····► lines.
Start with a known, i.e. facility water temperature.
A - go across to temperature curve
B - drop down to determine the minimum required facility flow.
C - Where B crosses the PSID curve, go across to determine the minimum required PSID.

ThermoFlex3500/5000

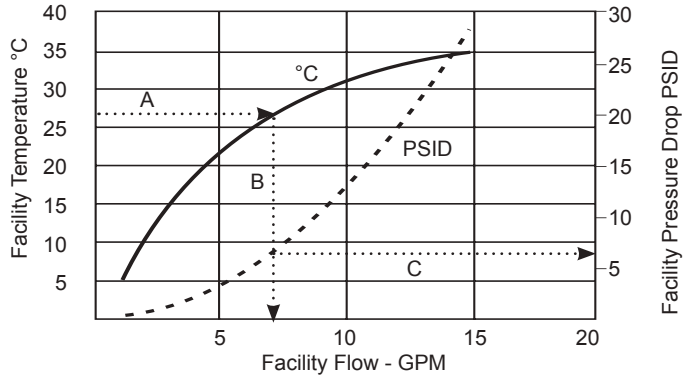
The facility water must meet the following conditions for the units to maintain their full rated capacity.



Example:
Follow the ·····► lines.
Start with a known, i.e. facility water temperature.
A - go across to temperature curve
B - drop down to determine the minimum required facility flow.
C - Where B crosses the PSID curve, go across to determine the minimum required PSID.

ThermoFlex7500/10000

The facility water must meet the following conditions for the units to maintain their full rated capacity.



Example:
Follow the ·····► lines.
Start with a known, i.e. facility water temperature.
A - go across to temperature curve
B - drop down to determine the minimum required facility flow.
C - Where B crosses the PSID curve, go across to determine the minimum required PSID.

Facility Water Quality and Standards (water-cooled units)

Facility Water	Permissible (PPM)	Desirable (PPM)
Microbiologicals		
(algae, bacteria, fungi)	0	0
Inorganic Chemicals		
Calcium	<40	<0.6
Chloride	<250	<25
Copper	<1.3	<1.0
0.020 ppm if fluid in contact with aluminum		
Iron	<0.3	<0.1
Lead	<0.015	0
Magnesium	<12	<0.1
Manganese	<0.05	<0.03
Nitrates\Nitrites	<10 as N	0
Potassium	<20	<0.3
Silicate	<25	<1.0
Sodium	<20	<0.3
Sulfate	<250	<50
Hardness	<17	<0.05
Total Dissolved Solids	<50	<10

NOTE A corrosion inhibitor is recommended if mixed metals are in the facility water loop. ▲

Section 4 Operation

Deluxe Controller

The controller changes temperature using a Proportional-Integral-Derivative (PID) algorithm, and is designed with easy to use operator interface.

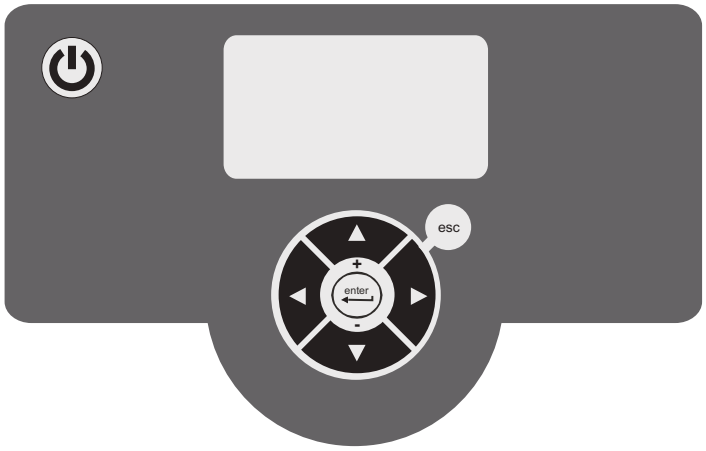


Figure 4-1 Deluxe Controller

This button is used to start and stop the unit.

This button is used to navigate through the displays and to increase adjustable values.

This button is used to navigate through the controller displays and to decrease adjustable values.

These buttons are used to navigate through the controller displays.

This button has four functions. Pressing it once allows changes to be made to the display, pressing it again saves the change and allows you to continue to other displays. It is also pressed to clear messages.

Depressing and holding the enter button for two seconds before starting the unit allows you to view and to make changes to the controller settings.

This button is used to abort any changes and at the same time return the controller to its previous display. Aborting a change can only be made before the change is saved.

Setup

Before starting the unit, double check all electrical and plumbing connections. Have extra recirculating fluid on hand. If the unit will not start refer to Section VII Troubleshooting.

Do not run the unit until fluid is added.

Ensure the unit's castors are locked. ▲

If the unit is equipped with a deionization filter cartridge refer to Section 5 for installation.

Initial Start Up

- Place the circuit protector located on the rear of the unit to the up position.
- Press the button on the controller.

The Controller will display the quick start screen that will allow you to configure the unit. Refer to the Quick Start Guide supplied with the unit or the copy located after the Table of Contents.

Use the arrow buttons to scroll through and highlight each line of the display. If a change is needed from the factory default value press the enter button.

If the auto restart is enabled and the unit shuts down as a result of a power failure, when power is restored the unit will automatically restart. ▲

If satisfied with all the entries, press enter when the last line - **Quick Start Done** - is highlighted. If not satisfied, press the left arrow or esc button to leave the quick start display.

In either case the screen will go blank.

If enter was pressed, press the button on the controller to bring up the **Daily Start Up** displays and start the unit. See next page.

NOTE After start up, check the plumbing connections for leaks. ▲

Daily Start Up

- Ensure the circuit protector located on the rear of the unit is in the up position.
- Press the button on the controller, the pump and the refrigeration system will automatically start.

The controller automatically sequences through the following displays:

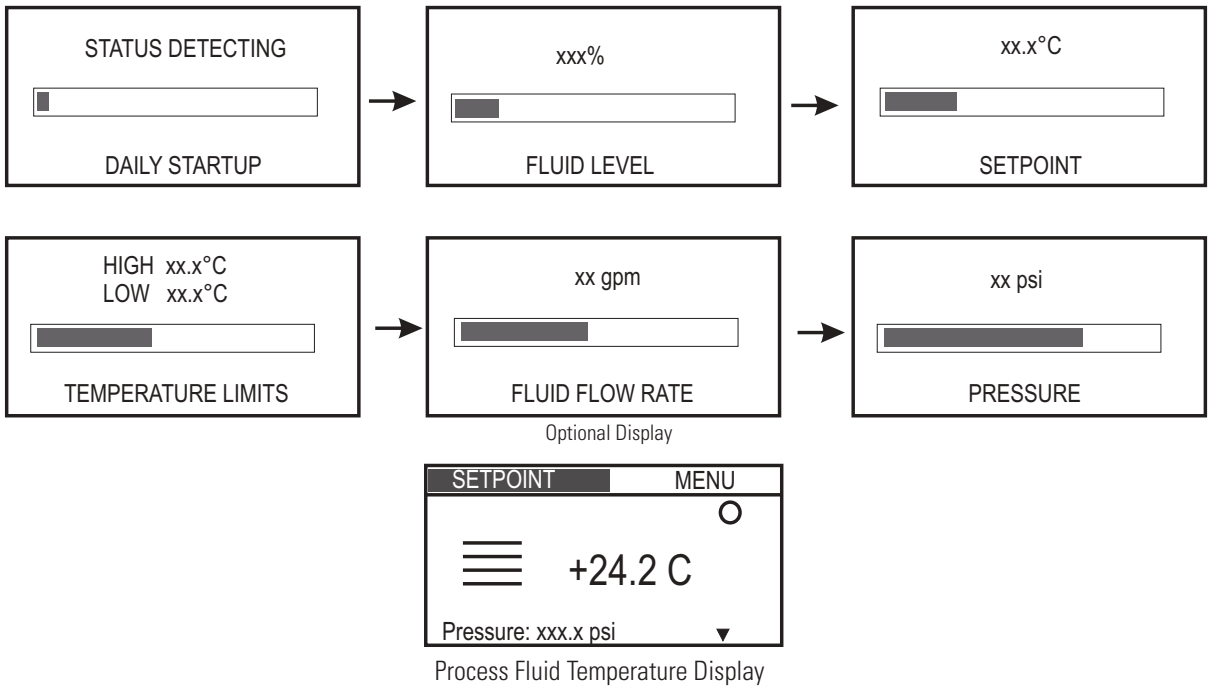


Figure 4-2 Daily Start Up Displays

Process Fluid Temperature Display

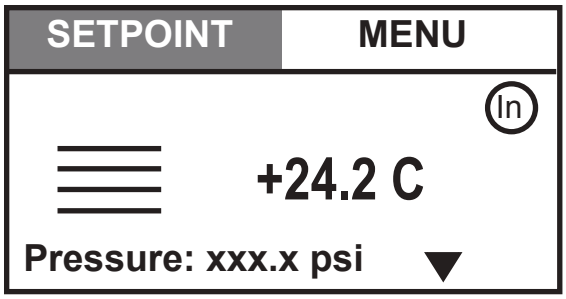


Figure 4-3 Process Fluid Temperature Display

The **SETPOINT** and **MENU** portions on the top of the display are used to view and/or change the controller's settings. They are explained in detail later in this Section.

The bars on the left of the display indicate the unit's operating status.

Indicates the unit is either not running or the ThermoFlex is at the desired setpoint.

Indicates the ThermoFlex is heating up to the setpoint.

Indicates the ThermoFlex is cooling down to the setpoint.

The small circle indicates which sensor is controlling the unit.

When displayed, indicates the ThermoFlex is responding to the unit's internal temperature sensor.

When displayed, indicates the ThermoFlex is responding to an external temperature sensor.

The unit is always in internal or external control. The default setting is internal.

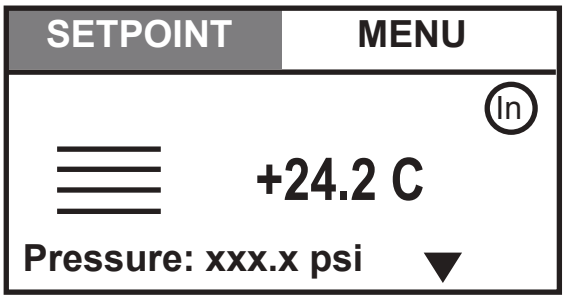
The temperature display indicates the current process fluid temperature.

The message on the bottom is used to display the unit's operational status. The status displays are explained later in this Section.

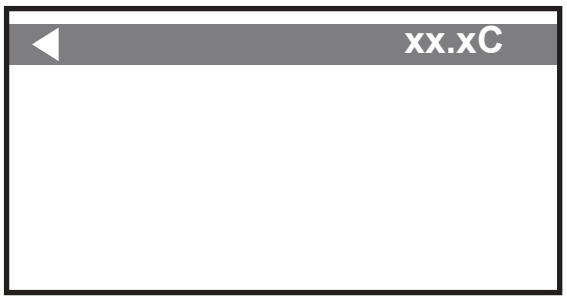
SETPOINT

NOTE Depressing and holding the enter button for two seconds before starting the unit allows you to view and to make changes to the setpoint. ▲

Use the arrow buttons to highlight **SETPOINT**.



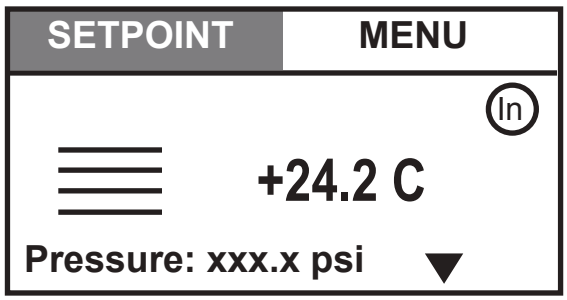
Press enter and the setpoint value will appear. If needed, press enter again and the value will start flashing indicating the setpoint can be changed.



The setpoint range for standard temperature units is +5°C to +40°C, the range for high temperature units is +5°C to +90°C. Use the up and down arrow buttons to change the setpoint to the desired value.

Once the desired value is displayed press the enter button again to accept the change and to stop the flashing.

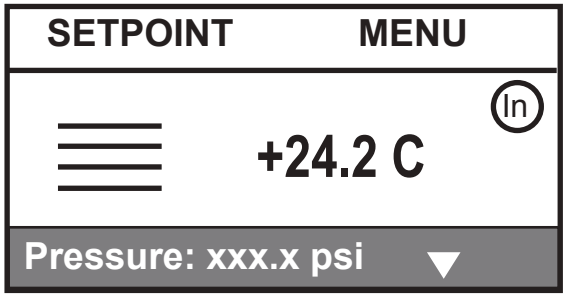
Return to the Process Fluid Temperature Screen by pressing the left arrow or esc button.



Status Displays

The controller can show up to four different messages. Use the down arrow button to highlight the bottom of the Temperature Display.

Press enter to get the displayed message to flash.



Use the arrow buttons to scroll through the available displays. Once the desired display is showing press enter again.

Available Displays:

Pressure: Indicates unit pump discharge pressure

Level %: Indicates reservoir fluid level

Flow: Indicates the process fluid flow rate (Optional)

Resistivity: Indicates the process fluid resistivity level (Optional)

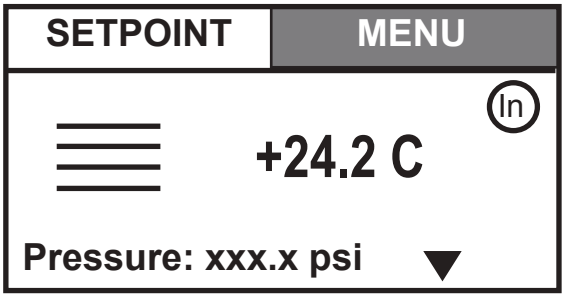
The arrow at the end of the display indicates which direction you can scroll to get to another display. A ▼ means you can only scroll down to the next display. A ▲ means you can only scroll up to the next display. ▲▼ means you can scroll up or down.

MENU Displays

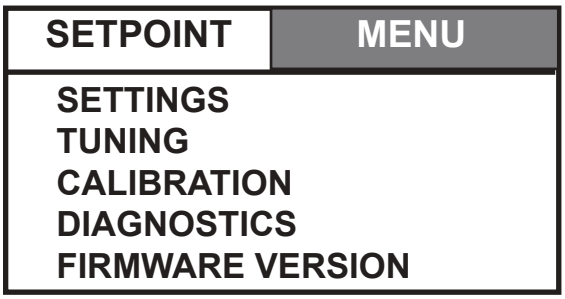
The ThermoFlex controller uses menus to view/change the unit's settings.

NOTE Depressing and holding the enter button for two seconds before starting the unit allows you to view and to make changes to the settings. ▲

1. Use the arrow buttons to highlight MENU.

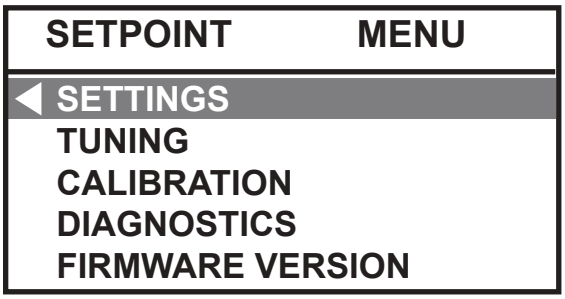


2. The controller brings up the Main Menu Display.

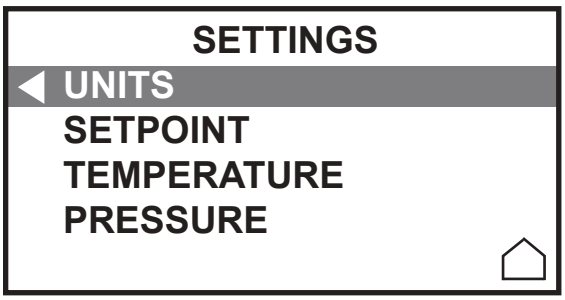


Main Menu Display

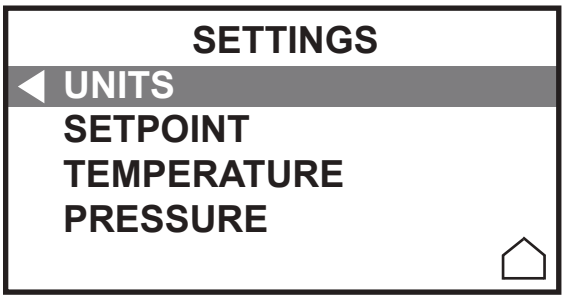
3. Use the up and down arrow buttons to highlight the desired option.



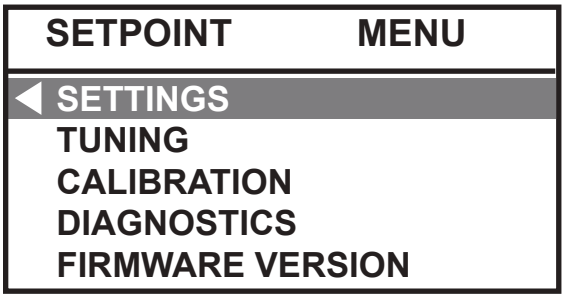
4. With the desired option highlighted, press enter to display various sub-menus.



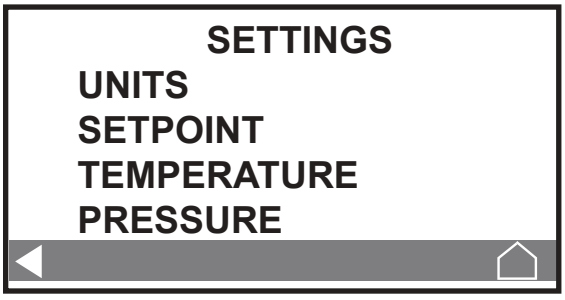
5. There are various ways to navigate through all the menu options.



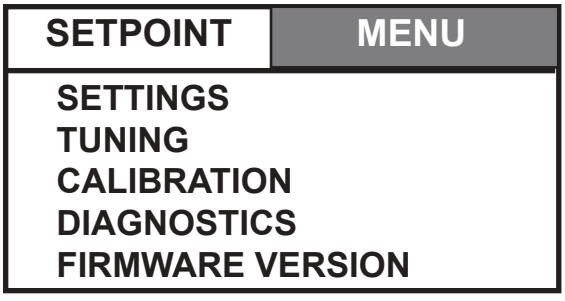
6. In the example in step 5, pressing the left arrow button or the esc button on the controller will return you to the previous display.



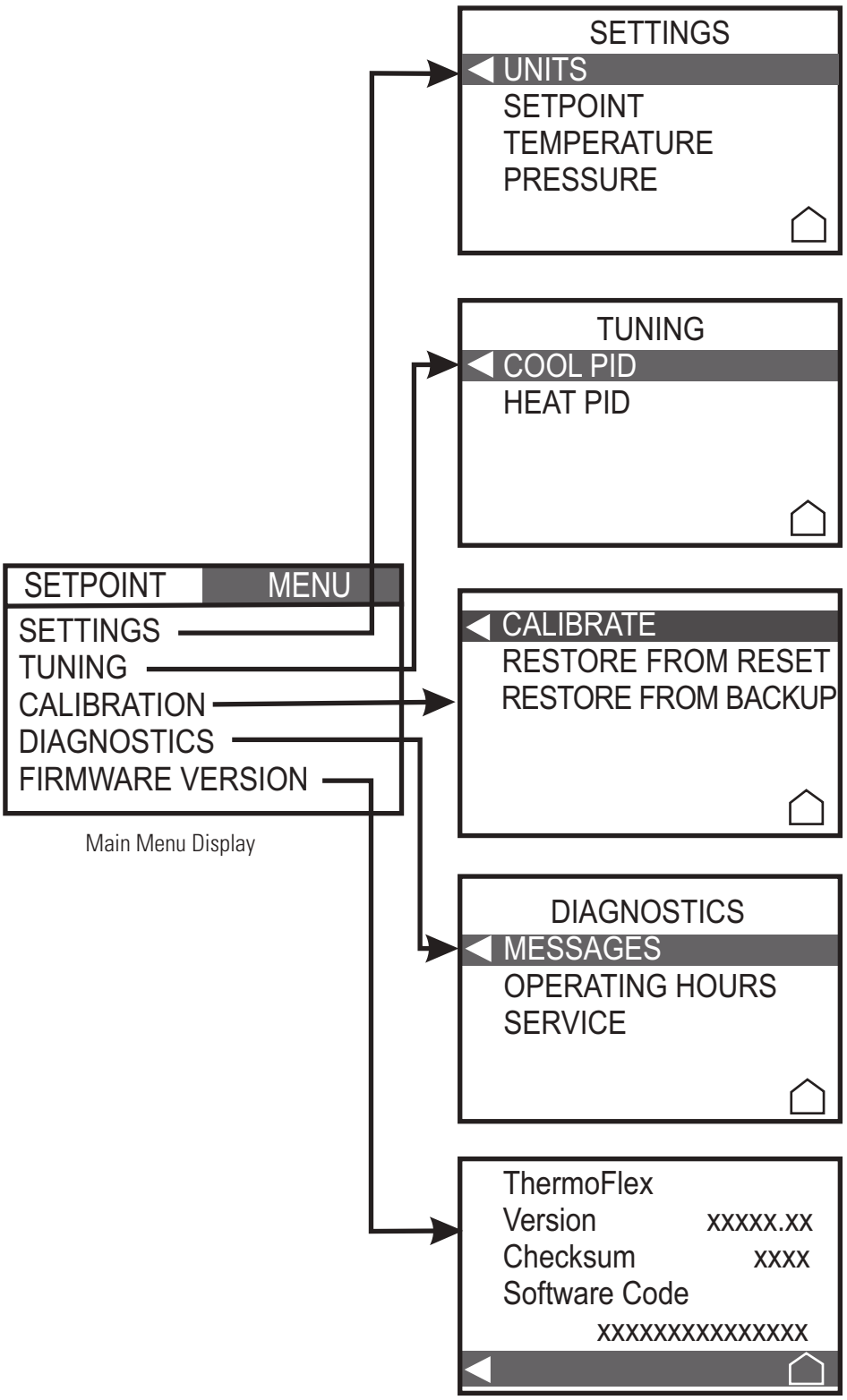
7. Or, highlight the home icon at the bottom of the display.



8. Then press enter to return to the Main Menu Display.



Main Menu Tree



Main Menu Display

SETTINGS allows you to view/change the more commonly used settings, see next page.

TUNING allows you to view/change the controller's **PID** values, see Section 7.

CALIBRATE calibrates the unit's temperature, pressure and optional fluid flow sensors, see Section 8.

DIAGNOSTICS is used to display alarm messages, see Section 7, and also to display the unit, filter and optional DI cartridge operating hours, see Section 6. **SERVICE** is used only by qualified technicians.

FIRMWARE VERSION is used to display the controller's firmware information. Press the esc button to return to the Main Menu Display.

SETTINGS

SETTINGS allows you to view/change the more commonly used settings.

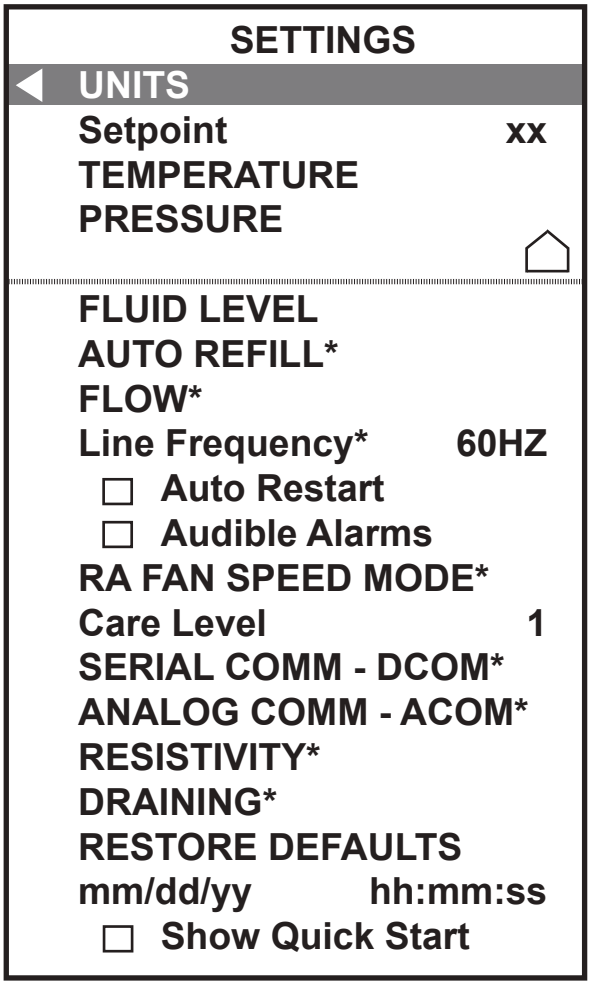
NOTE The controller can display only six lines at a time. Use the up and down arrow buttons to scroll through and highlight each line. ▲

If a change to a setting is needed, highlight the desired line and then press the enter button. The highlight will start to flash.

If the text on a line is all capital letters, i.e. **UNITS** and **TEMPERATURE**, the setting has a sub-menu. Pressing enter will bring up the sub-menu. The sub-menus, shown on the following pages, allow you to view/change the applicable settings.

Lines that are not all capital indicate the changes can be made directly on the **SETTINGS** display, i.e. **Setpoint** and **Line Frequency**.

If the line has a box, i.e. **Auto Restart**, pressing enter will turn the box black. A black box indicates the feature is enabled. Pressing enter again blanks the box and disables the feature.



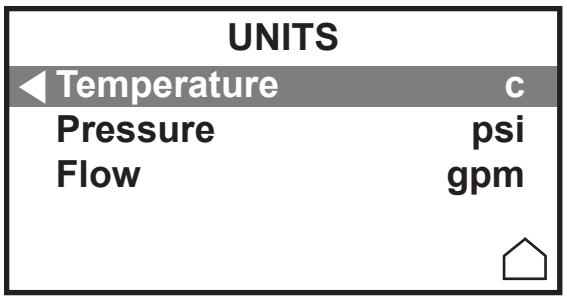
*Displays only on units equipped with the option.

UNITS

UNITS is used to view/change the controller's temperature, pressure and fluid flow (units with an optional flow transducer only) scales.

If a change to the setting is needed, highlight the desired scale and then press the enter button. The highlight will flash. Use the up/down arrow keys to bring up the desired scale. Once the desired scale is displayed press enter to accept the change and stop the flashing.

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



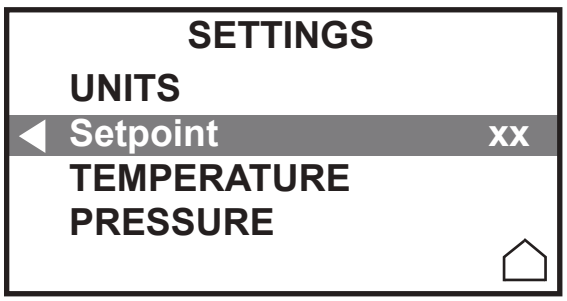
Scales: **°C** or **°F**
PSI, Bar or **kPa**
GPM or **LPM**

Defaults: **°C**
PSI
GPM

Setpoint

Setpoint can be used to view/change the controller's setpoint temperature.

If a change to the setpoint is needed, highlight **Setpoint** and then press the enter button. The highlight will flash. Use the up/down arrow keys to bring up the desired setpoint. Once the desired setpoint is displayed press enter to accept the change and stop the flashing.



Setpoint Range:
+5°C to **+40°C** for standard temperature units
+5°C to **+90°C** for high temperature units,
+5°C to **+88°C** for P1 and P2 high temp units

Setpoint Default:
+20°C for all units

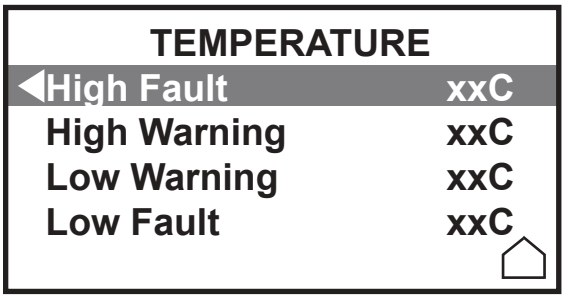
TEMPERATURE

TEMPERATURE is used to view/change the unit's high and low temperature fault and warning settings. If the unit exceeds the fault setting it will shut down, the controller will display a fault message and, if enabled, sound the alarm. If the unit exceeds the warning setting the unit will continue to run, the controller will display a warning message and, if enabled, sound the alarm.

If a change is needed, use the arrow keys to highlight the desired setting and then press the enter button. The highlight will flash. Use the up/down arrow keys to change the setting. Once the desired setting is displayed press enter to accept the change and stop the flashing.

NOTE You cannot set the **High Warning** value higher than the **High Fault** value. You cannot set the **Low Warning** value lower than the **Low Fault** value. ▲

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



High Fault/Warning Range:
+2°C to **+43°C** for standard temperature units
+2°C to **+93°C** for high temperature units
High Fault/Warning Default:
+42°C for standard temperature units
+92°C for high temperature units
Low Fault/Warning Range:
+2°C to **+43°C** for all units
Low Fault/Warning Default:
+3°C for all units

PRESSURE

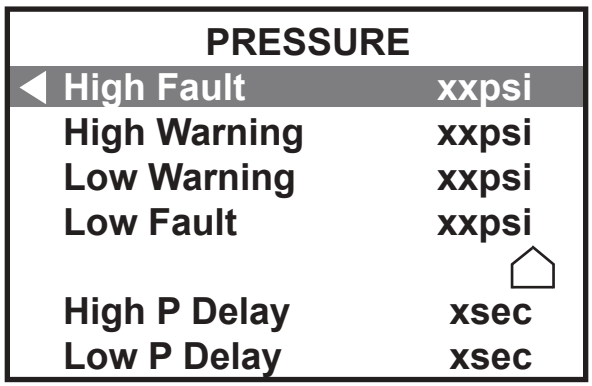
PRESSURE is used to view/change the unit's high and low pressure fault and warning settings and set a delay time. If the unit exceeds the fault setting it will shut down, the controller will display a fault message and, if enabled, sound the alarm. If the unit exceeds the warning setting the unit will continue to run, the controller will display a warning message and, if enabled, sound the alarm. The delay sets the length of time needed after a pressure fault before the unit shuts down.

NOTE Since the controller can only display six lines at a time, keep pressing the down arrow until the **High P Delay** and **Low P Delay** lines are visible. ▲

If a change to the setting is needed, use the arrow keys to highlight the desired pressure and then press the enter button. The highlight will flash. Use the up/down arrow keys to change the setting. Once the desired setting is displayed press enter to accept the change and stop the flashing.

NOTE You cannot set the **High Warning** value higher than the **High Fault** value. You cannot set the **Low Warning** value lower than the **Low Fault** value. ▲

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



High/Low Fault/Warning Range:
Pump dependent - see below

High/Low Pressure Time Delay Range:
0 to **30** seconds (**0** to **60** for P3 - P5 pumps)
High Time Pressure Delay Default:
0 seconds (**60** seconds for P3 - P5 pumps)
Low Time Pressure Delay Default:
10 seconds

Pump	Fault Range	High Default	Low Default
P1 P2 T1:	3 to 105 PSI	105 PSI	3 PSI
P3 60 Hz:	3 to 48 PSI	48 PSI	3 PSI
P3 50 Hz:	3 to 32 PSI	32 PSI	3 PSI
P4 60 Hz:	3 to 85 PSI	85 PSI	3 PSI
P4 50 Hz:	3 to 60 PSI	60 PSI	3 PSI
P5 60 Hz:	3 to 87 PSI	87 PSI	3 PSI
P5 50 Hz:	3 to 56 PSI	56 PSI	3 PSI

Pump	Warning Range	High Default	Low Default
P1 P2 T1:	4 to 100 PSI	100 PSI	4 PSI
P3 60 Hz:	4 to 48 PSI	48 PSI	4 PSI
P3 50 Hz:	4 to 32 PSI	32 PSI	4 PSI
P4 60 Hz:	4 to 85 PSI	85 PSI	4 PSI
P4 50 Hz:	4 to 60 PSI	60 PSI	4 PSI
P5 60 Hz:	4 to 87 PSI	87 PSI	4 PSI
P5 50 Hz:	4 to 56 PSI	56 PSI	4 PSI

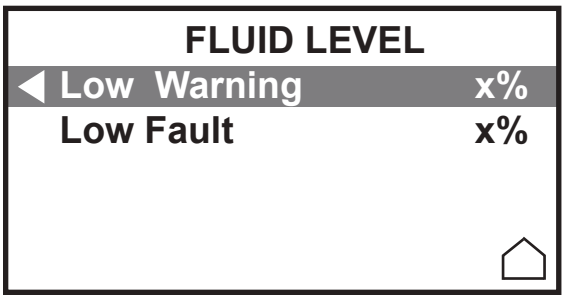
FLUID LEVEL

FLUID LEVEL is used to view/change the unit's reservoir level fault and warning settings. If the unit exceeds the fault setting it will shut down, the controller will display a fault message and, if enabled, sound the alarm. If the unit exceeds the warning setting the unit will continue to run, the controller will display a warning message and, if enabled, sound the alarm.

If a change to the setting is needed, use the arrow keys to highlight the desired line and then press the enter button. The highlight will flash. Use the up/down arrow keys to change the setting. Once the desired setting is displayed press enter to accept the change and stop the flashing.

NOTE You cannot set the **Low Warning** value lower than the **Low Fault** value. ▲

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



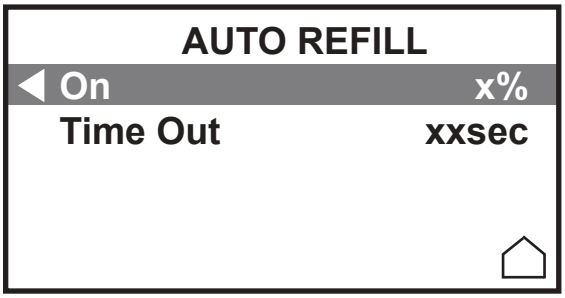
Low Warning/Fault Range/Default:
Heater dependent - see below

Heater	Warning Range	Default
None	6 - 100%	6%
1 kW:	58 - 100%	58%
2.3 kW:	93 - 100%	93%
5.0 kW:	87 - 100%	87%
4.6 kW:	72/87* - 100%	72/87%*
Heater	**Fault Range**	**Default**
None	0 - 100%	0%
1 kW:	52 - 100%	52%
2.3 kW:	87 - 100%	87%
5.0 kW:	81 - 100%	81%
4.6 kW:	66/81* - 100%	66/81%*

AUTO REFILL (Optional)

AUTO REFILL is used to view/change the unit's optional auto refill settings. **On** is the % of fluid level in the reservoir needed to turn the option on. **Time Out** is the maximum time the option will operate. Setting the time to **0** disables the option.

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



On % Default: Heater dependent - see below

Heater	Range	Default
None	6 - 100%	6%
1 kW:	58 - 100%	58%
2.3 kW:	93 - 100%	93%
5.0 kW:	87 - 100%	87%
4.6 kW:	72/87* - 100%	72/87%*

Time Out Range: 0 - 900 seconds
Time Out Default: 45 seconds
80 seconds for ThermoFlex7500/10000

*The lower value is for units which can display a continuous fluid level, the higher value is for units which display the fluid level in 3% increments.

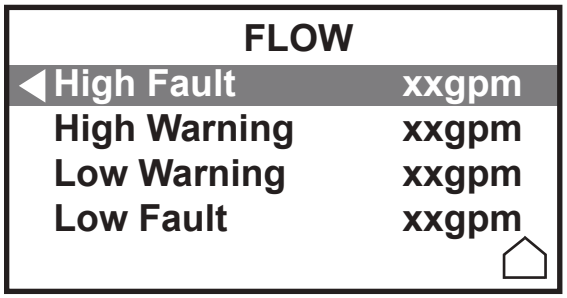
FLOW (Optional)

FLOW is used to view/change the unit's process fluid fault and warning settings. If the unit exceeds the fault setting it will shut down, the controller will display a fault message and, if enabled, sound the alarm. If the unit exceeds the warning setting the unit will continue to run, the controller will display a warning message and, if enabled, sound the alarm.

If a change to the setting is needed, use the arrow keys to highlight the desired line and then press the enter button. The highlight will flash. Use the up/down arrow keys to change the setting. Once the desired setting is displayed press enter to accept the change and stop the flashing.

NOTE You cannot set the **High Warning** value higher than the **High Fault** value. You cannot set the **Low Warning** value lower than the **Low Fault** value. ▲

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



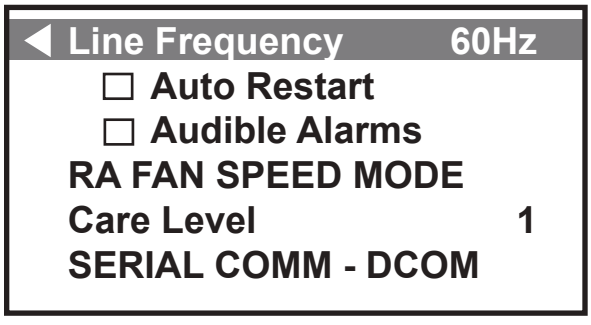
High/Low Flow Fault/Warning Range:
Pump dependent - see below

High/Low Flow Fault/Warning Default:
Pump dependent - see below

Pump	Range	High Default	Low Default
P1 P2 T1:	0.8 to 10.5 GPM	10.5 GPM	0.8 GPM
P3 P4 P5:	0.8 to 30.0 GPM	30.0 GPM	0.8 GPM

Line Frequency (Optional)

Line Frequency is used to identify the incoming frequency for units with a P3 - P5 pump and the capability to run on either **50 Hz** or **60 Hz**. The selected frequency automatically adjusts the firmware's *fixed* high pressure default setting.



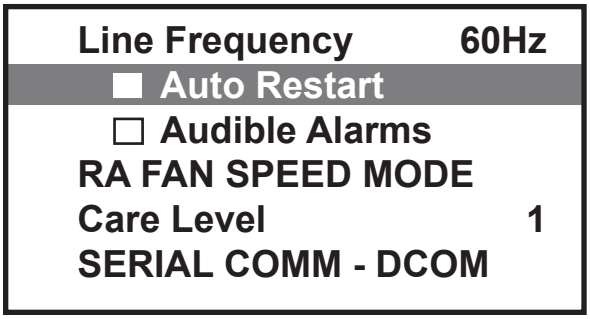
Frequency Range: 50 Hz or **60 Hz**

Frequency Default: 60 Hz

Auto Restart

Auto Restart is used to turn the auto restart feature on/off.

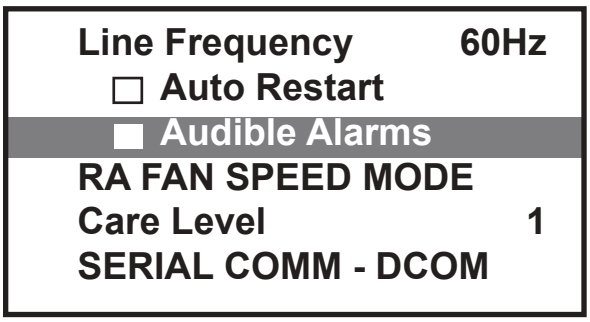
If the auto restart is enabled and the unit shuts down as a result of a power failure, when power is restored the unit will automatically restart and operate at the saved values. Consider any possible risks before enabling this mode of operation. ▲



With **Auto Restart** highlighted press enter. The box will turn black indicating the feature is enabled.

Audible Alarms

Audible Alarms is used to turn the audible alarm on/off



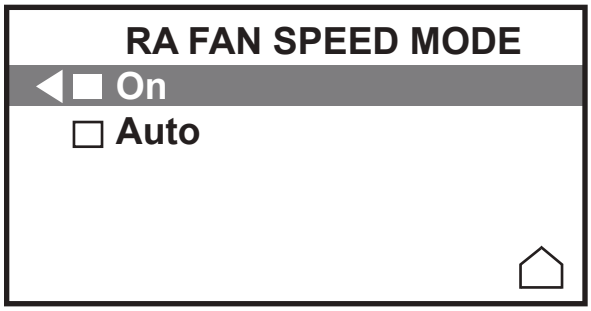
With **Audible Alarms** highlighted press enter. The box will turn black indicating the feature is enabled.

RA FAN SPEED MODE (ThermoFlex 2500 air-cooled units only)

RA FAN SPEED MODE controls the fan speed. **Auto** allows the fan to run under the conditions listed in Section 3. Selecting **On** allows the fan to run at high speed all the time.

NOTE On is required for the unit to achieve its full cooling capacity specification. ▲

When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.



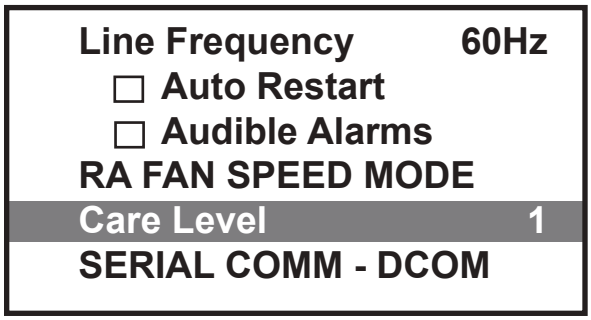
Fan Speed Range: On or **Auto**

Fan Speed Default: Auto

Care Level

Care Level sets the preventive care cleaning frequency reminder for the unit's air and fluid filters.

If a change to the level is needed, highlight **Care Level** and then press the enter button. The highlight will flash. Use the up/down arrow keys to bring up the desired level Once the desired level is displayed press enter to accept the change and stop the flashing.



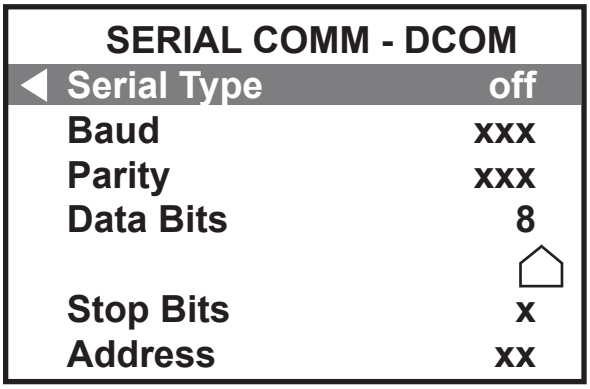
Care Level Range: **off**
1 (1000 hours)
2 (2000 hours)
3 (3000 hours)

Care Level Default: **1** (1000 hours)

SERIAL COMM - DCOM (Optional)

SERIAL COMM - DCOM is used to configure/enable the unit's optional serial communications feature. If a change to the setting is needed, use the arrow keys to highlight the desired line and then press the enter button. The highlight will flash. Use the up/down arrow keys to change the setting. Once the desired setting is displayed press enter to accept the change and stop the flashing.

NOTE None of the controller's other menu displays are available when serial comm is enabled. ▲



Serial Type: RS232, RS484, off

Baud Range: 9600, 4800, 2400, 1200, 600 or **300**

Parity: even, odd or **none**

Data Bits: Fixed at **8**

Stop Bits: 2 or **1**

Unit ID: 1 to **99** (RS 485 only)

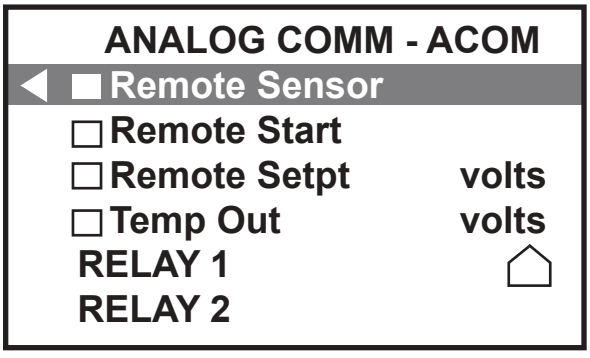
If serial communications is enabled a general message will appear.

Press enter to extinguish the message.

Refer to Appendix C for additional information.

ANALOG COMM - ACOM (Optional)

ANALOG COMM - ACOM is used to configure/enable the unit's optional analog communications feature. Use the arrow keys to highlight the desired option and then press the enter button. The box will turn black indicating that option is enabled. Press enter.



If **Remote Start** is enabled a general message will appear.

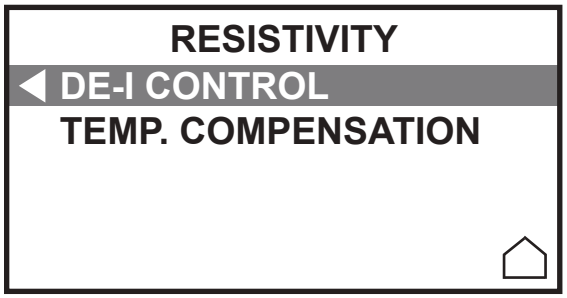
Press enter to extinguish the message.

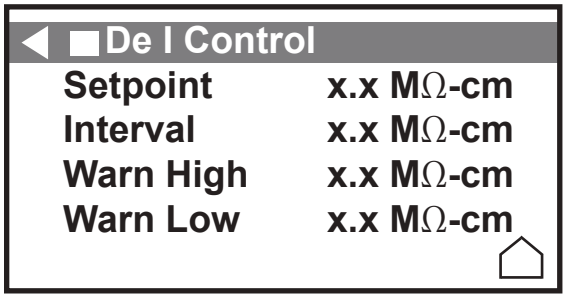
Refer to Appendix D for additional information.

RESISTIVITY (Optional)

RESISTIVITY enables/configures the resistivity option. With **DE-I CONTROL** highlighted press enter to enable the feature. Next set the limits to the desired values.

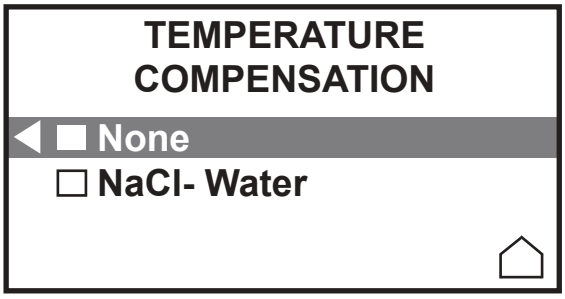
NOTE This option is not available on high-temp units. ▲





Resistivity	Range	Default
Setpoint:	**0.2** to **3.0**	**1.0 MΩ-cm**
Interval	**0.1** to **0.5**	**0.1 MΩ-cm**
Warning High:	**0.0** to **3.5**	**3.0 MΩ-cm**
Warning Low:	**0.0** to **3.5**	**0.5 MΩ-cm**

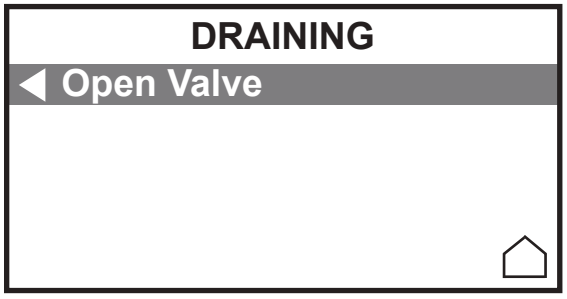
With **TEMP. COMPENSATION** highlighted press enter to turn compensation off or on.

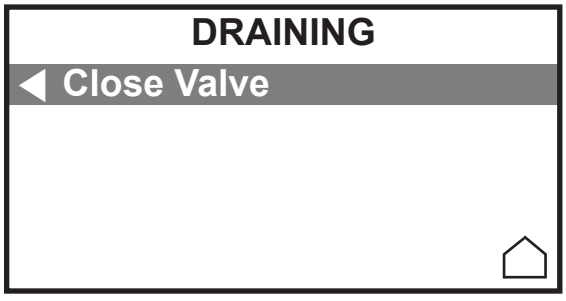


When the desired changes are made use the left arrow or esc key to return to the **SETTINGS** display.

DRAINING (Optional)

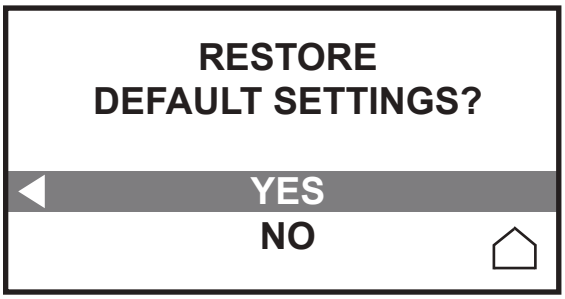
DRAINING opens/closes the optional anti drainback valve. The unit must be off to drain the valve. Press enter to start the draining. The display will change to **Close Valve**. When the draining is complete press enter again to close the valve.





RESTORE DEFAULTS

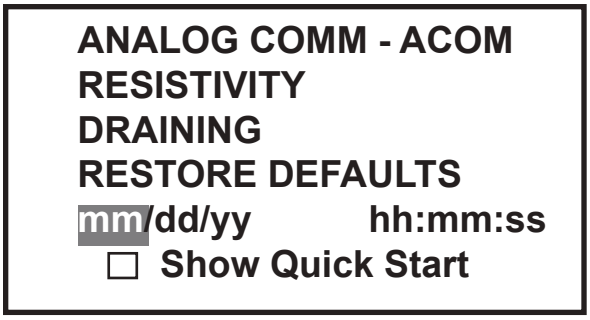
RESTORE DEFAULTS restores the controller back to factory default values. A reset is automatically performed whenever new firmware is installed.



Use the left arrow or esc key to return to the **SETTINGS** display.

mm/dd/yy hh:mm:ss

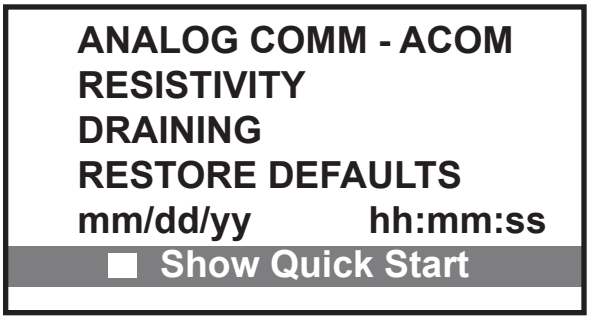
mm/dd/yy hh:mm:ss sets the date and time. Some error messages can display the date and time of occurrence, see Section 7.



Use the arrow keys to highlight the desired setting. Press enter to start the highlight flashing. Use the arrow keys to change the setting. Press enter to accept the change and stop the flashing.

Show Quick Start

Show Quick Start reruns the initial start up menu. The Quick Start menu will appear the next time the unit is started.

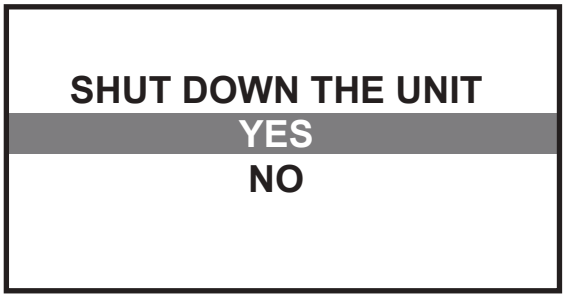


With **Show Quick Start** highlighted press enter. The box will turn black indicating the feature is enabled.

Shut Down

Press the button.

The controller will display.



With **YES** highlighted, press enter and the unit will enter a shut down cycle before the refrigeration system and pump shut down.

The display then goes blank.

Using any other means to shut the unit down can reduce the life of the compressor. ▲

Always turn the unit off and disconnect it from its supply voltage before moving the unit. ▲

The circuit protector located on the rear of the unit is not intended to act as a disconnecting means. ▲

Section 5 Options/Accessories

Auto Refill

The Auto Refill provides makeup fluid to replace any fluid lost to evaporation, etc. It requires a pressurized fluid source connection to the ¼" Female Pipe Thread fitting on the rear of the unit.

Figure 5-1 Auto Refill Fitting

The auto refill fluid must also meet water quality standards or the valve may fail to operate as designed, see Section 3.

The auto refill valve input pressure must be < 80 PSI to ensure the valve functions properly.

NOTE Adding fluid that has a temperature differential with the fluid already in the reservoir will temporarily affect unit stability performance. ▲

The auto refill operates when all of the following conditions are met:

- Fluid is available
- The unit is turned on
- The fluid reaches a low level condition.

The auto refill shuts off when:

- The fluid reaches the correct operating level.
- The delay timer exceeds user fill time entered in the Quick Start or **SETTINGS** menu.
- The unit shuts down for any reason.

NOTE Setting the fill time to 0 disables auto refill. ▲

Internal DI Cartridge

NOTE This option is not available on high-temp units. ▲

A partial flow DI filter cartridge is designed to provide between 1 and 3 MΩ-cm water resistivity.

NOTE The DI option results in a 0.5 gpm reduction of available flow. ▲

Do not use a Deionization (DI) filter cartridge with Inhibited EG or Inhibited PG. A DI filter will remove inhibitors from the solution rendering the fluid ineffective against corrosion protection. Also, inhibitors increase fluid conductivity. ▲

The Puralite sensor on the back of the unit turns red when the cartridge needs changing (< 1 MΩ-cm), see Section 6. **NOTE** The Puralite sensor that comes with the DI cartridge requires a separate power source. ▲

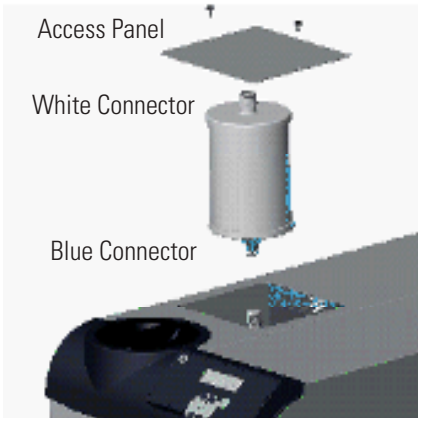


Figure 5-2 Internal DI Cartridge

Remove the two thumbscrews securing the DI access panel to the top of the unit. Remove the new cartridge from the shipping bag. The cartridge has a blue and a white connector. Lower the cartridge into the unit with the blue connector facing downward. Press down on the cartridge lightly to engage and then rotate it ¼ turn clockwise (do not over rotate) or until you feel the filter click into place.

If there is a cartridge in place, first undo the hose fitting by pressing on the quick disconnect located on the top white connection.

The DI Cartridge will overpressurize if it is removed from the unit before removing the hose fitting. ▲

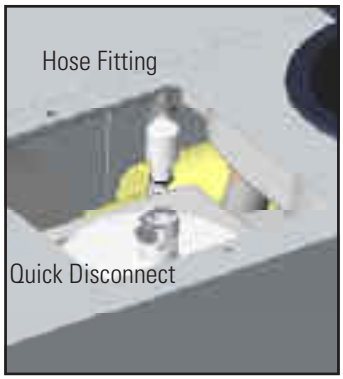


Figure 5-3 DI Fittings

Next rotate the cartridge ¼ turn counter-clockwise and then pull the cartridge straight up to remove it. Push the hose fitting into the quick disconnect located on the white end of the cartridge. Replace the access panel and thumbscrews.

NOTE The cartridge can be changed with the unit running, however, since the cartridge runs in a parallel arrangement, disconnecting the cartridge adds 0.5 gpm to the main flow. The additional flow will cause an increase in system pressure which may cause a high fluid pressure fault. ▲

P1 P2 T1 Pump Pressure Relief Valve (Internal Configuration)

The pressure relief valve, located on the top left rear of the unit, is used to set the desired system back pressure to your application. The valve is factory preset to 80 ± 5 psi (5.5 ± 0.4 bar).

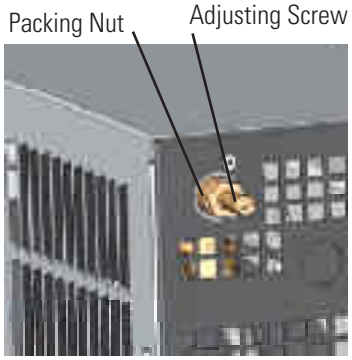


Figure 5-4 Nut and Screw

If the unit is not plumbed to an application, set the pressure by installing a loop of hose equipped with a shut-off valve between the supply and return fittings. Start the unit and allow it to prime, then close the valve.

Use the Status Display to display P1, it should display 80 ± 5 psi.

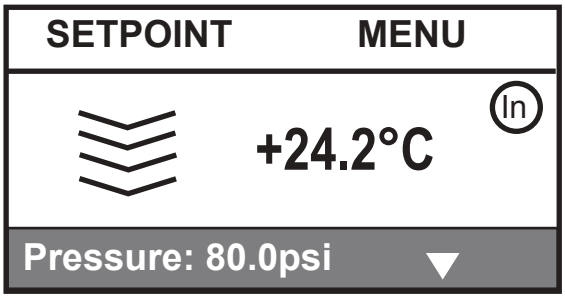


Figure 5-5 Pressure Status Display

Use a screwdriver to turn the adjusting screw (counterclockwise to reduce pressure) until the controller displays the desired setting.

NOTE Due to internal back pressure, the minimum pressure setting for a deadheaded pump is 32 psi (2.2 bar) for a P2 pump, and 8 psi (0.6 bar) for a P1 (these settings prohibit external flow from the unit). ▲

If the unit is plumbed to an application, ensure the unit is off. Then back out the adjusting screw counterclockwise to reduce pressure. Turn the unit on. Ensure that there is back pressure in the system. Turn the adjusting screw until the controller displays the desired setting.

Do not exceed 100 psi (6.9 bar). ▲

When complete, inspect the area around the $^{5}/_{8}$" packing nut for fluid. If fluid is present, slightly tighten the nut and reinspect.

NOTE Should the unit start to vibrate the valve setting may be the cause. Changing the pressure setting ± 5 psi (0.3 bar) will eliminate the vibration. ▲

P1 P2 T1 Pump Pressure Relief Valve (External Configuration)

The pressure relief valve is used to set the desired system back pressure (P1) to your application. The valve is factory preset to 80 ± 5 psi (5.5 ± 0.4 bar).

The valve's inlet/outlet connections are ½"FNPT.

Figure 5-6 Nut and Screw

If the unit is not plumbed to an application, set the pressure by installing a loop of hose equipped with a shut-off valve between the supply and return fittings. Start the unit and allow it to prime, then close the valve.

Use the Status Display to display P1, it should display 80 ± 5 psi.

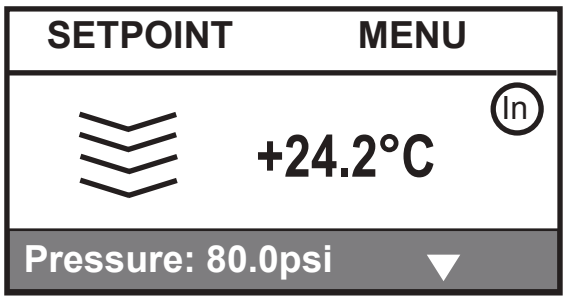


Figure 5-7 Pressure Status Display

Use a screwdriver to turn the adjusting screw (counterclockwise to reduce pressure) until the controller displays the desired setting.

NOTE Due to internal back pressure, the minimum pressure setting for a deadheaded pump is 40 psi (2.8 bar) for a P2 pump, and 22 psi (1.5 bar) for a P1 (these settings prohibit external flow from the unit). ▲

If the unit is plumbed to an application, ensure the unit is off. Then back out the adjusting screw counterclockwise to reduce pressure. Turn the unit on. Ensure that there is back pressure in the system. Turn the adjusting screw until the controller displays the desired setting.

Do not exceed 100 psi (6.9 bar). ▲

When complete, inspect the area around the $^{5}/_{8}$" packing nut for fluid. If fluid is present, slightly tighten the nut and reinspect.

Flow Control with Flow Readout

Flow control for P1, P2 and T1 pumps on ThermoFlex900 - 5000 units is achieved using a 3-way valve plumbed between the standard process outlet and the process inlet on the rear of the unit. Use the auxiliary process outlet at the top left of the rear of the unit as a connection point. The connections are ½" FNPT. See Figure 5-8.

ThermoFlex3500 and 5000 units with P3 and P4 pumps use a 2-way valve located on the rear of the unit. The connections are 3/4" FNPT. See Figure 5-9.

ThermoFlex7500 and 10000 units with P2 - P5 pumps use a valve located on the rear of the unit. The connections are 1/2" for P2, 1" FNPT for P3 and P5. See Figure 5-9.

Use the controller's Status Display to view the flow rate. Turn the valve handle until the desired rate is displayed.

NOTE The valve is sensitive to slight adjustments. ▲

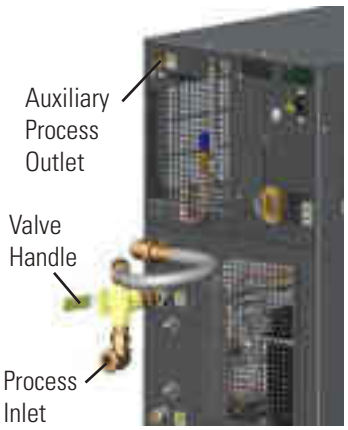


Figure 5-8 Flow Control

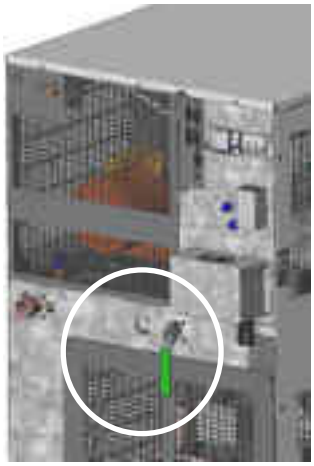


Figure 5-9 Flow Control Handle (Typical)

P1 P2 T1 Pump Pressure Relief with Flow Readout

The Pressure Relief with Flow Readout works just like the Pressure Relief Valve discussed on the previous page. It allows you to control the pressure going to your application.

This valve is plumbed into the unit's auxiliary port, allowing you to also monitor the flow rate to your application using the controller's Status Display.

The valve's outlet connection is ½" FNPT. See Figure 5-10.

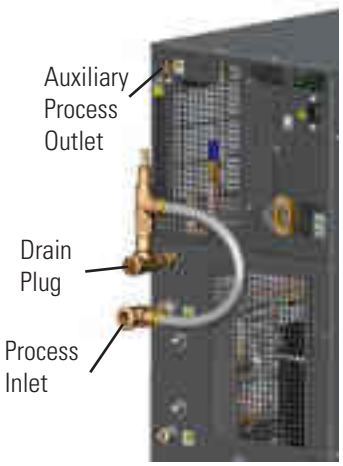


Figure 5-10 Pressure Relief

Anti Drainback

Units installed below the end-user application may allow system fluid to drain back into the chiller and cause spillage. The anti-drainback valve is designed to prevent any such spillage.

The valve opens just before the pump is turned on and it closes just after the pump shuts off.

This option is required if your unit is more than 24 feet below your application, or if there is a possibility of drain back due to the occasional opening of the process lines for either application swaps or unit servicing.

Semiconductor Equipment and Materials International (SEMI) Units

Compliance

SEMI units are compliant with:

SEMI S2-0703 Product Safety Assessment

SEMI S8-0705 Ergonomic Assessment

SEMI S14-0704 Fire Risk Assessment

SEMI F47-0706

Emergency Off (EMO)

A guarded red mushroom shaped push-button switch with twist-to-reset is provided on the unit's front to turn it off in case of an emergency. The button head is engraved with "EMO" in large white filled letters.

NOTE The EMO is controlled by a safety circuit and is not influenced by the unit's firmware/software. ▲

Activation of the EMO button will remove power from the main contactor coil stopping operation of the unit. The controller will display **External EMO**.

Resetting the EMO button will not restart the unit. After all hazards have been removed reset the unit by pushing the enter key on the controller. In the local mode, the unit will restart by pressing the START STOP button again. In the serial communications mode, send the appropriate start command. In the analog I/O mode, the unit starts when the error is cleared.

Unit Circuit Breaker Interrupt Rating

The main power circuit breaker located on the rear of the unit has an Interrupting Capacity (AIC) of 10,000 amps.

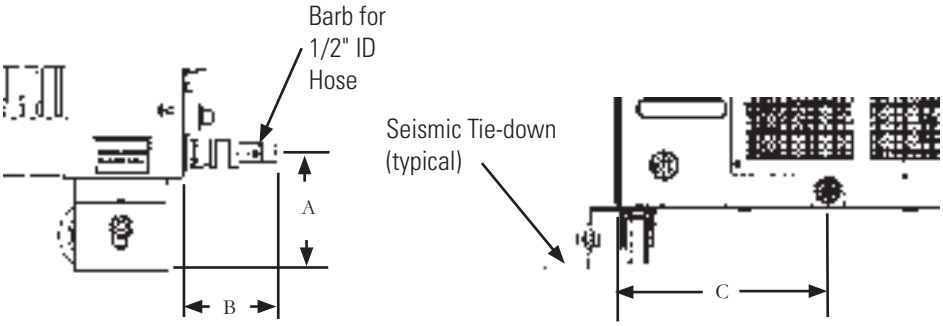
Lockout/Tagout (LOTO)
Before performing Chiller maintenance, the energy sources associated with the Chiller system must be lockedout and tagged out (LOTO). Hazard control features added to the system (e.g., safety interlocks, EMO) are not a substitute for turning off and locking out electrical or fluid energy.

For units rated 20 Amps or less, electrical LOTO is accomplished by removing the power cord on the rear of the unit then closing and locking the power receptacle locking device. For other units, electrical LOTO is the responsibility of the user and can be provided by:

- Using the main disconnect (knife switch at system control cabinet).
- Disconnecting main power at the facility power source prior to the system controller cabinet.
- In addition, follow all OSHA and local facility LOTO directives.

Drip Pan and Drain
The unit is equipped with a secondary containment (drip pan) in case there is a leak. The drip pan drain is located on the rear of the unit. Install the supplied nylon 1/4 turn quick disconnect (QD) fitting into the drain fitting. The QD is barbed for a 1/2" ID hose.

Since the drip pan will not hold more than 110% of the reservoir volume, connect the drain to guide the fluid to an appropriate spillage location.



1/4 Turn Quick Disconnect Drip Pan Drain Fitting

Figure 5-11 Drip Pan Drain

	900/1400		2500		3500/5000		7500/10000	
A	3 1/2"	8.8 cm	4"	10.1 cm	3 3/8"	11.3 cm	4 1/4"	10.8 cm
B	2 3/4"	7.0 cm	2 11/16"	6.8 cm	2 3/4"	7.1 cm	2 5/8"	6.6 cm
C	6 15/16"	17.7 cm	6 9/16"	16.7 cm	9 9/16"	24.3 cm	7 11/16"	19.5 cm

Seismic Tie-Downs

Install the seismic tie-downs to the unit as shown below. Then secure the unit to the floor with user-supplied hardware.

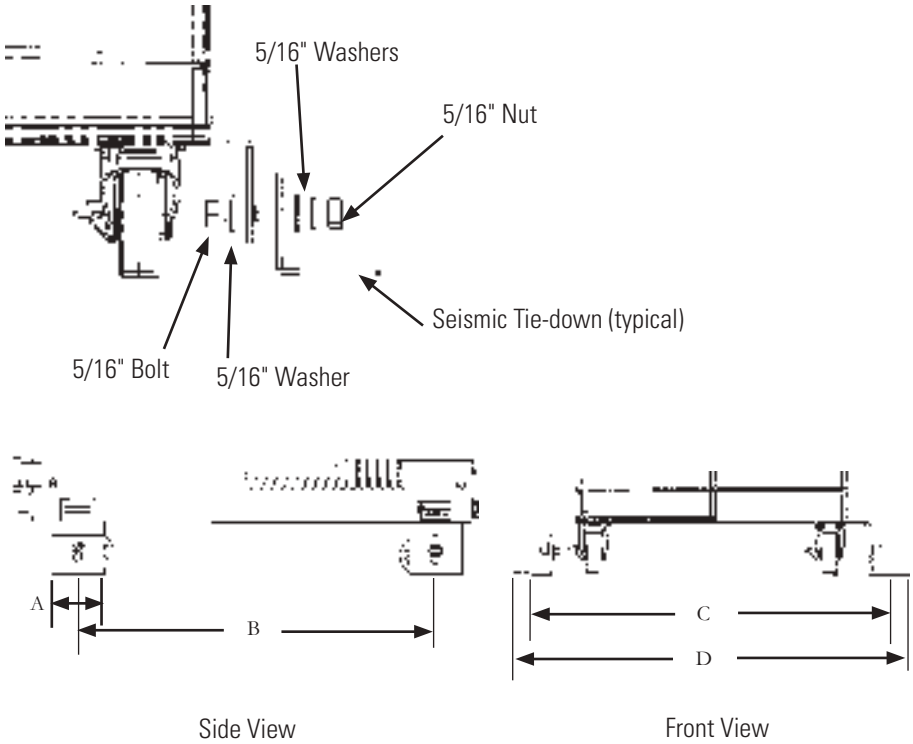


Figure 5-12 Seismic Tie-Downs

	900/1400		2500		3500/5000		7500/10000	
A	2 11/16"	6.8 cm	2 11/16"	6.8 cm	2 11/16"	6.8 cm	2"	5.1 cm
B*	18 ½ "	47.0 cm	20 1/16"	51.0 cm	24 ½"	62.2 cm	17"	43.1 cm
C*	19 1/16"	48.4 cm	22 1/16"	56.1 cm	24 1/8"	61.3 cm	27 7/16"	69.6
D	20 9/16"	52.2 cm	23 1/16"	59.9 cm	25 5/8"	65.1 cm	28 15/16"	73.4

* Distance between Ø.53 Seismic mounting holes

Center of Gravity ± ½", P2 pump (P3 for 7500/10000), air-cooled unit, no fluid in tank

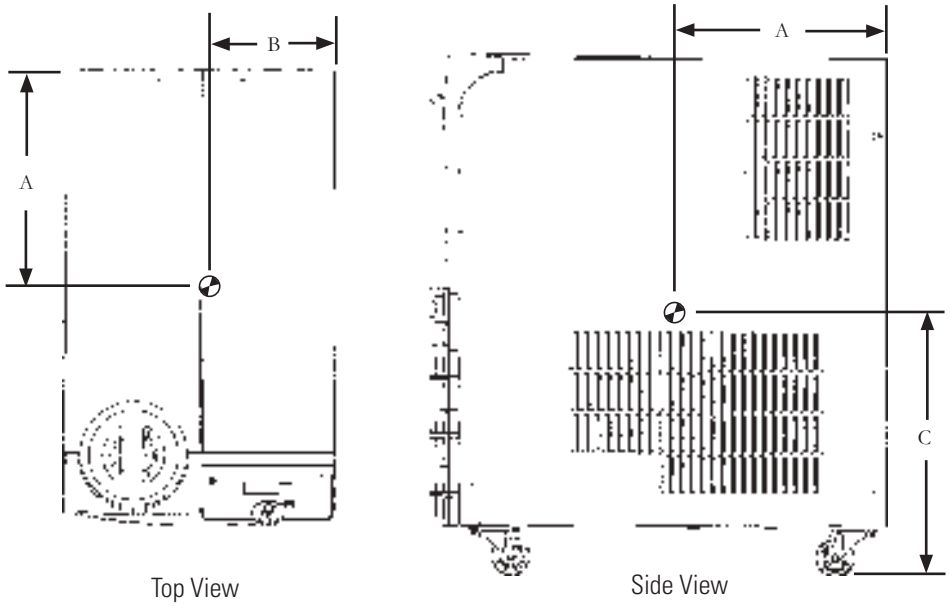


Figure 5-13 Center of Gravity

	900/1400		2500		3500/5000		7500/10000	
A	10 3/4"	27.3 cm	12"	30.5 cm	13 3/8"	34.0 cm	14 7/8"	37.8 cm
B	6 3/4"	17.2 cm	8 3/8"	21.3 cm	9"	22.9 cm	12 5/8"	32.1 cm
C	13 1/2"	34.3 cm	13 1/2"	34.3 cm	16"	40.6 cm	25 1/4"	64.1 cm

Weight Distribution

	900/1400		2500		3500/5000		7500/10000	
Left Front	29.5 lbs	13.4 kg	42.8 lbs	19.5 kg	56.6 lbs	25.7 kg	99.3 lbs	45.0 kg
Left Rear	28.8 lbs	13.1 kg	43.6 lbs	19.8 kg	66.4 lbs	30.1 kg	101.9 lbs	46.2 kg
Right Front	34.3 lbs	15.6 kg	46.9 lbs	21.3 kg	64.9 lbs	29.4 kg	98.2 lbs	44.5 kg
Right Rear	33.4 lbs	15.1 kg	47.7 lbs	21.6 kg	76.1 lbs	34.6 kg	100.7 lbs	45.7 kg

Other Accessories

Installation kit - includes replacement air and fluid filters

Maintenance kit - includes a set of hoses, adaptor fittings and Teflon® tape

Fluids

Fluid treatment kit

Please contact Thermo Fisher Scientific's Sales, Service and Customer Support to assist you with questions that you may have regarding accessories for your ThermoFlex, see inside front cover for contact information.

Section 6 Preventive Maintenance

Preventive Maintenance Timer (Care Level)

The ThermoFlex chiller has an integrated preventive maintenance timer that will alert you when it is time to perform preventive maintenance. This unique feature will remind you to change your air and fluid filters.

Based on the environment in which your chiller is located, you can choose from four levels of preventive maintenance off, L1, L2, and L3:

- off – Disables the alert
- L1 – 1,000 hours - default setting
  - · Heavy manufacturing environment
  - · Airborne particulate created during manufacturing process
- L2 – 2,000 hours
  - · Typical production environment
- L3 – 3,000 hours
  - · Clean environment – filtered air
  - · Typically laboratory or research environment

Change/set the level using the controller's **DIAGNOSTICS** menu, see next page. When the unit exceeds the chosen limit, the controller will flash **Filter PM** and, if enabled, an audible alarm will sound.

To clear this message press . This will automatically restart the preventive maintenance timer for your filters. Each time the unit exceeds the chosen time, the controller will remind you that it is time to change your filters.

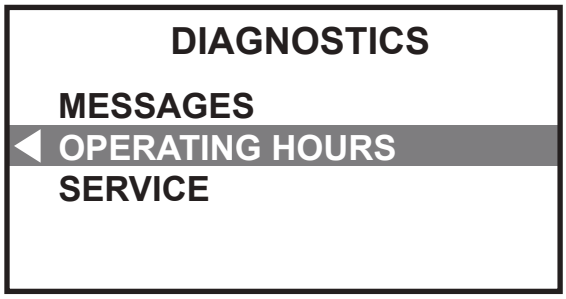
If you change your filters before the preventive timer trips, you can clear the timer by using the controller's **DIAGNOSTICS** menu, see next page.

NOTE For air-cooled units, both the air and fluid filters in the ThermoFlex can be changed while the unit is running. For water-cooled units, only the fluid filter can be changed while the unit is running. ▲

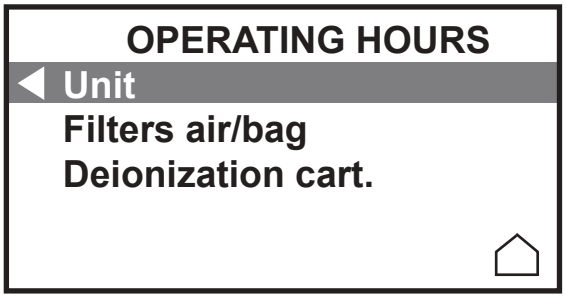
DIAGNOSTIC - OPERATING HOURS

OPERATING HOURS displays the unit, filter and optional DI cartridge operating hours. The display is also used to select the preventive maintenance schedule (**Care Level** and optional **De-I Period**).

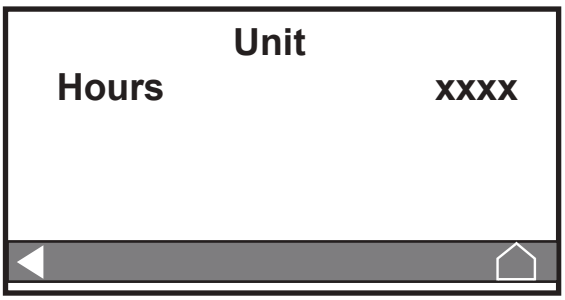
1. Use the arrow buttons to highlight **OPERATING HOURS**.

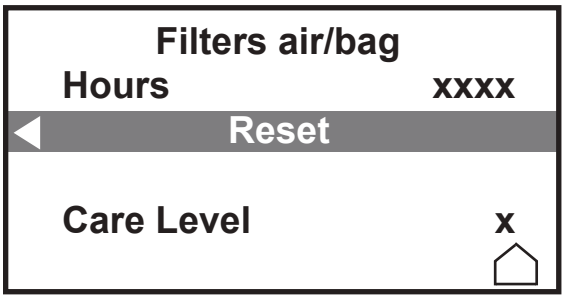


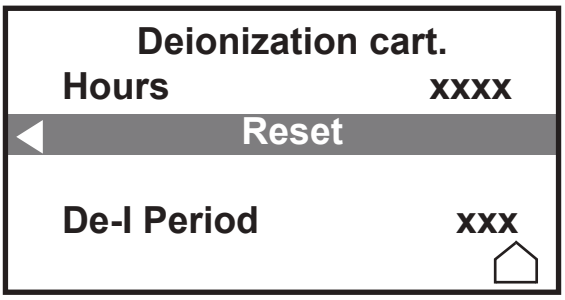
2. Press enter to display:



3. Highlight the desired item and press enter to bring up one of the displays shown on the right:







(Optional Display)

4. With **Reset** highlighted, pressing enter resets the filter and cartridge operating hours back to zero. You can not reset the unit's operating hours.

5. Use the arrow buttons to highlight **Care Level**. Press enter and the display will flash. Use the arrow buttons to display the desired care level and then press enter again to stop the flashing and accept the new value.

6. The optional **De-I Period** is the operating time needed to display the **DI** preventive message. Use the arrow buttons to highlight **De-I Period**. Press enter and the display will flash. Use the arrow buttons to display the desired time, from 0 to 9999 hours. Press enter again to stop the flashing and accept the new value.

Fluid Filter Bag

The reservoir has a fluid bag filter designed to prevent the introduction of particulates into the system. Units are shipped with a bag filter in place.

NOTE The fluid bag filter can be removed with the unit operating. ▲

Before using any fluid or performing maintenance where contact with the fluid is likely refer to the manufacturer's MSDS for handling precautions. ▲

For high-temperature units, ensure the fluid is at a safe temperature (below 55°C) before handling. ▲

When it is time to replace the bag, gently pull up on the plastic funnel housing to remove it and simply pull the bag out of the unit. Replacement bags are available from Thermo Fisher Scientific.

Figure 6-1 Fluid Filter Bag

Fluid Diffuser

When you remove the bag you will notice a wire mesh fluid diffuser inside the reservoir supply line, see Figure 6-2. The diffuser is used to help streamline the flow into the reservoir. After several bag replacements turn the unit off and remove the diffuser to inspect it for debris/damage.

The fluid velocity into the reservoir will rapidly increase with the diffuser removed and cause splashing. Turn the unit off before removing the diffuser. This is especially critical when using ethylene or propylene glycol. ▲

NOTE To prevent particulates from entering the reservoir, ensure the fluid bag filter is in place before removing the diffuser. ▲

Do not operate the unit unless the diffuser is installed. ▲

Reservoir Cleaning

The user is responsible for maintaining reservoir fluid quality. Check the fluid on a regular interval. Start with frequent checks until a regular interval (based on your application) is established.

If cleaning is necessary, flush the reservoir with a fluid compatible with the process fluid and the unit's wetted parts, see Section 8.

Before using any fluid or performing maintenance where contact with the fluid is likely refer to the manufacturer's MSDS for handling precautions. ▲

For high-temperature units, ensure the fluid is at a safe temperature (below 55°C) before handling. ▲

Reservoir Sight Tube
Clean the sight tube by gently pulling up on the plastic funnel housing to remove it (see illustration on previous page) and then gently pulling out the black sight ball stopper from the tube. Use a long soft-bristle ¼" brush. Use caution not to scratch the glass.

For easier replacement, wet the stopper first and then use a twisting motion to install it in the sight tube.

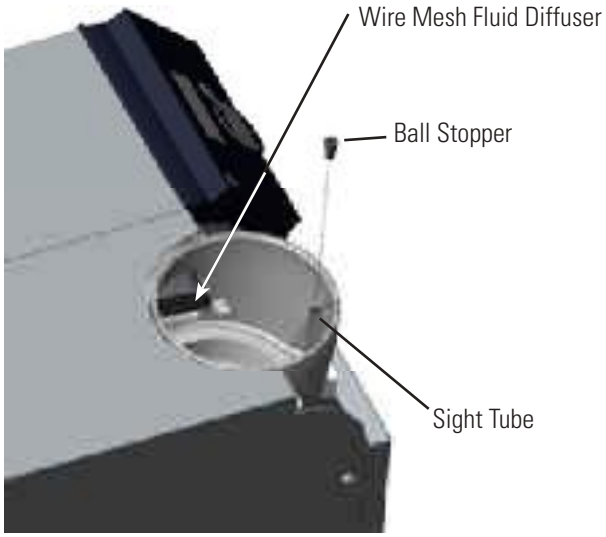


Figure 6-2 Reservoir Cleaning and Diffuser

Condenser Filter

Failure to clean/replace the condenser filter will cause a loss of cooling capacity and lead to premature failure of the cooling system. ▲

ThermoFlex900 - 5000
Clean the filter through the grill using a vacuum with a soft-bristle brush.

When it is time for a more thorough cleaning, remove the one-piece grill assembly by first pulling the bottom of the assembly away from the unit and then pulling it away from the top.

The condenser framing and fins located behind the grill assembly are very sharp. Use caution when removing the assembly. ▲

NOTE ThermoFlex900 - 5000 water-cooled units have an embedded screw(s) located at the top (and bottom) of the grill securing it to the unit. Loosen the screw(s) to remove the grill. ▲

Water-cooled units also have a fan with sharp blades, ensure the unit is off before removing the assembly. ▲

Shake off as much of the excess water as possible before reinstalling. Press the grill back into place.

For water-cooled units, tighten the screw(s) at the top (and bottom) of the grill.

Replacement grill assemblies are available from Thermo Fisher.

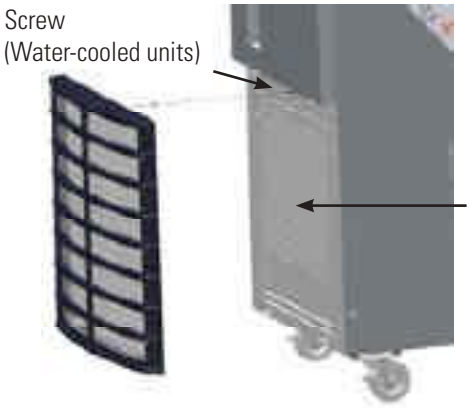


Figure 6-3 ThermoFlex900 - 5000 Condenser Grill Removal

ThermoFlex7500 - 10000
For air-cooled units, remove the one-piece grill assembly by pulling the assembly away from the unit.

Water-cooled units do not have a filter.

The filter goes over four studs and plastic "fast nuts" hold it in place.

Replace it or vacuum the old filter with a soft-bristle brush, or wash it. Shake off as much of the excess water as possible before reinstalling.

Tuck the filter around the perimeter of the grill and over the four studs, use the plastic "fast nuts" to hold it in place.

Replacement grills are available from Thermo Fisher.

Figure 6-4 Filter Removal/Replacement ThermoFlex7500 - 10000 Air-Cooled

DI Filter (Optional)

Establish a preventive maintenance schedule for the DI filter cartridge based on your specific application.

The Puralite sensor located on the back of your chiller will illuminate red when it is time to change the DI filter cartridge (< 1 MΩ-cm).

Figure 6-5 Puralite

NOTE When the unit is initially powered, or has been sitting idle for a period of time, the sensor may illuminate. The length of time it will be on varies with your application. ▲

Although the Puralite sensor is the primary indicator that the cartridge needs changing, the unit also has a *separate* integrated alarm that works independently of the Puralite. The alarm is based on unit run hours that will alert you when it is time to change your filter. The alarm is enabled using the controller's **DIAGNOSTICS** menu.

If you already know how often your DI filter needs changing, you can input the number of hours into the menu. When the time is reached, the controller will flash **DEI PM** and the audible alarm, if enabled, will sound.

When alerted, check the Puralite sensor on the back of the unit to see if it is illuminated. If it is not illuminated reset the timer and then check the Puralite periodically.

To clear this message and stop the audible alarm press .

If the Puralite has turned red and the controller alarm has not gone off, access the **DIAGNOSTICS** menu. Check the system run hours, this will give you an accurate DI replacement time. Adjust the **De-I Period** time to match the time needed between filter cartridge changes.

NOTE It may be necessary to monitor the Puralite three or four times to establish an accurate changing schedule. Also, filter operating time is reduced every time new fluid is added. ▲

Preventive Maintenance Messages

The controller also displays Preventive Maintenance Messages. These messages are based on the component run time and are established to avoid unplanned failures. The unit will continue to run.

Figure 6-6 Sample PM Message

Filter PM	**Fluid Filter Bag and Condenser Filter**
DEI PM	**Optional DI Filter**
XXXXX Run Hours	**Unit operating hours (appears every 20,000 hours)**

You can press the enter key to clear any message Note the message because once the Filter or DEI PM message is cleared it will not reappear.

Section 7 Troubleshooting

Messages

WARNING and FAULT Messages are a result of exceeding one of the controller's SETTINGS, see Section 4, exceeding a sensor factory preset safety value. or a safety switch is activated. An ERROR Message indicates an unusual condition. In the case of an ERROR or WARNING Message the unit, if running, will continue to run. Press **enter** to see if the message clears, a limit may have been only temporarily exceeded. In the case of a FAULT Message the unit will shut down and the controller will continue to flash the message. Press **enter** to clear the display and, if enabled, silence the alarm. Once the cause of the shut down is identified and corrected, start the unit. If the cause was not corrected the message will reappear.

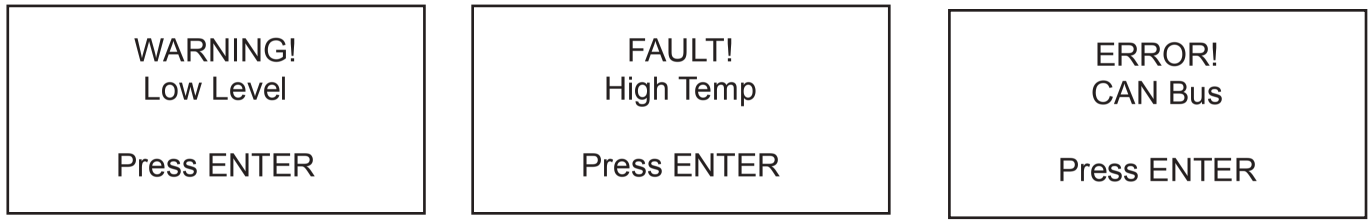


Figure 7-1 Sample Messages

Faults and Warnings

Message	Reaction	Cause	Actions
Auto Refill	The unit will continue to run. Auto refill, if installed, will shut down. (Optional display - only units equipped with auto refill)	The auto refill did not reach the minimum operating level within the time chosen for the customer adjustable *fill* setting. The auto refill successfully filled within the time frame chosen for the customer adjustable *fill* setting, but the unit tries to refill 5 times in 40 hours.	•Check for leaks. •Check the supply pressure on the auto refill supply line. With low pressure the auto refill time span setting may be set too low and the reservoir does not have time to fill. Verify controller's **SETTINGS**, see Section 4. •Add fluid to the tank. •Contact our Sales, Service and Customer Support.
Bad Calibration Data	Unit continues to run.	Bad sensor calibration detected several seconds after performing a calibration.	•Redo calibration, see Section 8. •Contact our Sales, Service and Customer Support.

Faults and Warnings

Message	Reaction	Cause	Actions
Drip Pan	Unit will shut down. (SEMI units only)	Fluid in the drip pan.	•Check for leaks. •Remove the fluid from the drip pan and reset the fault. •Contact our Sales, Service and Customer Support.
External EMO	Unit will shut down. (SEMI units only)	External EMO depressed.	•When able, reset external EMO..
Fan Motor Overload	Unit will shut down. (3-Φ units only)	Fan motor overload activated.	•Allow unit to cool down. •For air-cooled units, claen air filter, see Section 6. •Contact our Sales, Service and Customer Support.
High Fixed Flow	Unit will shut down. (Optional display - only units equipped with a flow transducer)	The process fluid flow exceeded the *factory preset* high value.	•Check all application and plumbing shut off valves for correct position. •Adjust flow, if unit is equipped with an optional flow control valve, see Section 5. •If flow transducer was recently calibrated double check calibration, see Section 8. •Contact our Sales, Service and Customer Support.
High Fixed Pressure	Unit will shut down. This error code has priority over **High Pressure** error code.	Process pressure (P1) exceeded *factory preset* value for greater than 30 seconds. Preset Values: P1, P2 and T1- 105 psi P3 60 Hz - 48 psi P3 50 Hz - 32 psi P4 60 Hz - 85 psi P4 50 Hz - 60 psi P5 60 Hz - 87 psi P5 50 Hz - 56 psi	•Check application valves and ensure that they have not changed or been closed. **NOTE:** If routine shut-off of the process flow is required then an external pressure regulator accessory should be added - contact Thermo Fisher. ▲ •May occur as a result of changing the internal DI cartridge. Disconnecting the cartridge adds an additional 0.5 GPM to the main flow, see Section 5. •Check for debris in the application or clogged external filters. •Double check fluid lines. Excessive bends, long tubing and diameter reductions can affect the pump's discharge pressure. **NOTE:** If diameter reductions must be made, they should be made at the inlet and outlet of your application, not the chiller. ▲ •Contact our Sales, Service and Customer Support.

Faults and Warnings

Message	Reaction	Cause	Actions
High Fixed Temp	Unit will shut down. This error code has priority over **High Temp** error code. **NOTE** Unit will not restart until process fluid temperature is below +43°C (+93°C for high-temp units). ▲	Reservoir fluid temperature exceeded the *factory preset* value of +43°C (+93°C for high-temp units).	•Ensure the unit meets all environmental requirements, see Section 3. •Ensure unit has adequate ventilation, see Section 3. •Clean air filter. Dirt and debris on filter can prevent the unit from functioning at full capacity, see Section 6. •Ensure that the heat load being applied to the chiller is not too high. Contact Thermo Fisher for assistance on calculating heat loads. •Bring cooler air in from another area or exhaust the hot air into another location using an auxiliary fan. •Verify/adjust controller PID values, see **TUNING** in this Section. •Contact our Sales, Service and Customer Support.
High Flow	With a warning message the unit will continue to run. With a fault message the unit will shut down. (Optional display - only units equipped with a flow transducer)	The process fluid flow rate has exceeded the adjustable setting's high value.	•If the unit is still running press enter to see if the code clears, the limit may have been only temporarily exceeded. •Verify **SETTINGS**, see Section 4, and adjust setting if necessary. •Check all application and plumbing shut off valves for correct position. •Adjust flow, if unit is equipped with an optional flow control valve, see Section 5. •If flow transducer was recently calibrated double check calibration, see Section 8. •Contact our Sales, Service and Customer Support.

Faults and Warnings

Message	Reaction	Cause	Actions
High Level	With a warning message the unit will continue to run. With a fault message the unit will shut down.	The process fluid level has exceeded the adjustable setting's high value. Fluid expansion due to heating.	•Ensure the reservoir was not filled above the MAX LEVEL line. •Reduce fluid level to account for any expansion due to heating. •Check for clogged reservoir filter. •Contact our Sales, Service and Customer. Support.
High Pressure	With a warning message the unit will continue to run. With a fault message the unit will shut down.	The pump's discharge pressure exceeded the adjustable high value.	•If the unit is still running press enter to see if the message clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Check application valves and ensure that they have not changed or been closed. **NOTE** If routine shut-off of the process flow is required then an external pressure relief valve should be added, see Section 5. ▲ •Check for debris in the application or external filters. •May occur as a result of changing the internal DI cartridge. Disconnecting the cartridge adds an additional 0.5 gpm to the main flow, see Section 5. •Double check fluid lines. Excessive bends, long tubing and diameter reductions can affect the pump's discharge pressure. **NOTE** If diameter reductions must be made, they should be made at the inlet and outlet of your application, not at the chiller. ▲ •Contact our Sales, Service and Customer Support.
High RA Temperature	Unit will shut down.	Refrigeration suction gas temperature exceeded 50°C.	•Make sure supply voltage matches the unit's nameplate rating ±10%. •Contact our Sales, Service and Customer Support.
High Resistivity	Unit will continue to run. (Optional display)	The process fluid resistivity exceeded the upper adjustable value.	•Press enter to see if the message clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Replace process fluid. •Contact our Sales, Service and Customer Support.

Faults and Warnings

Message	Reaction	Cause	Actions
High Temp	With a warning message the unit will continue to run. With a fault message the unit will shut down. **NOTE** If the unit does shut down it can be restarted provided the temperature is still within the factory-set high fixed temperature limit. However, the error will reoccur if the temperature goes below the adjustable setting and then again exceeds it. ▲	The process fluid temperature exceeded the adjustable high value.	•If the unit is still running press enter to see if the message clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Ensure the unit meets all environmental requirements, see Section 3. •Ensure unit has adequate ventilation, see Section 3. •Clean air filter. Dirt and debris on filter can prevent the unit from functioning at full capacity, see Section 6. •Ensure that the heat load being applied to the chiller is not too high. Contact Thermo Fisher for assistance on calculating heat loads. •Bring cooler air in from another area or exhaust the hot air into another location using an auxiliary fan. •Verify/adjust controller PID values, see **TUNING** in this Section. •Contact our Sales, Service and Customer Support.
HPC	Unit will shut down.	High refrigeration pressure cutout activated.	**Air-cooled units** •Ensure that the ambient temperature is not exceeding the recommended range, see Section 3. •Ensure unit has adequate ventilation, see Section 3. •Clean air filter, see Section 6. •Bring cooler air in from another area or exhaust the hot air into another location using an auxiliary fan. •Contact our Sales, Service and Customer Support. **Water-cooled units** •Ensure facility water is on and connected. •Check facility water flow rate and pressure. •Contact our Sales, Service and Customer Support.
HTC	Unit will shut down.	High heater temperature.	•Contact our Sales, Service and Customer Support.
Invalid Level	Unit will shut down.	Invalid level fault. Unit sensed both a high level and low level reservoir fluid level.	•Contact our Sales, Service and Customer Support.

Faults and Warnings

Message	Reaction	Cause	Actions
Invalid rem setpt	Unit will continue to run using the last valid setpoint received. (Optional display - only units equipped with Analog I/O)	Analog remote setpoint is enabled and the unit receives a voltage or current level that is outside the unit's set point range.	•The error can be cleared only after a valid set point is received, or the remote analog setpoint is turned off.
LLC	Unit will shut down.	Low Level Cutout activated.	•Check for leaks. •Contact our Sales, Service and Customer Support.
Local EMO	Unit will shut down. (Optional display)	Unit's EMO button depressed.	•When able, reset unit's EMO.
Low Fixed Flow	Unit will shut down. (Optional display - only units equipped with a flow transducer) (This error code has priority over **Low Flow**)	Low flow fault. For units with a P1, P2 or T1 pump the flow dropped below 0.8 GPM for more than 15 seconds. For units with a P3, P4 or P5 pump the flow dropped below 3.8 GPM for more than 15 seconds.	•Adjust flow, if unit is equipped with an optional flow control valve, see Section 5. •Check all valves in your application and plumbing lines to ensure that they have not changed or closed. •If flow transducer has recently been calibrated, double check calibration to ensure it was done properly, see Section 4. •Contact our Sales, Service and Customer Support.
Low Fixed Pressure	Unit will shut down. (This error code has priority over **Low Pressure**)	Process pressure (P1) below *factory preset* low limit of 3 psi for greater than 15 seconds.	•Ensure that the chiller reservoir is not empty. •Unit requires >3 PSIG application pressure drop. If a bypass valve has been installed, some restriction may need to be added to the bypass line. •Contact our Sales, Service and Customer Support.

Message	Reaction	Cause	Actions
Low Fixed Temp	Unit will shut down. **NOTE** Unit will not restart until process fluid temperature exceeds +2°C. ▲ (This error code has priority over **Low Temp**)	Reservoir fluid temperature below the *factory preset* low value of +2°C.	•Check ambient temperature. Unit may not to be able to reach setpoint at low ambient temperatures. If your load is constant, then turn your unit on. Unit will control setpoint when sufficient heat is added. •Verify/adjust controller PID values, see **TUNING** in this Section. •Add insulation to external plumbing lines to reduce the heat-loss to the environment. •Ensure that the ambient temperature is not exceeding the recommended range, see Section 3. •For water-cooled units check facility water temperature. •Contact our Sales, Service and Customer Support.
Low Flow	With a warning message the unit will continue to run. With a fault message the unit will shut down. (Optional display - only units equipped with a flow transducer)	The process fluid flow rate has gone below the adjustable setting's low value.	•If the unit is still running press enter to see if the code clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Adjust flow, if unit is equipped with an optional flow control valve, see Section 5. •Check all valves in your application and plumbing lines to ensure that they have not changed or closed. •If flow transducer has recently been calibrated, double check calibration to ensure it was done properly, see Section 4. •Contact our Sales, Service and Customer Support.
Low Level	With a warning message the unit will continue to run. With a fault message the unit will shut down.	Reservoir fluid level too low for normal operation.	•Excessive evaporation. Ensure the unit is operating with the funnel and cap in place. •Check for leaks. •Check auto refill operation, see Section 5. •Check the supply pressure on the auto refill supply line. With low pressure the auto refill time span setting may be set too low and the reservoir does not have time to fill. Verify controller's **SETTINGS**, see Section 4. •Contact our Sales, Service and Customer Support.

Faults and Warnings

Message	Reaction	Cause	Actions
Low Pressure	With a warning message the unit will continue to run. With a fault message the unit will shut down.	Pump's discharge pressure is below adjustable low setting.	•If the unit is still running press enter to see if the message clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Ensure that chiller reservoir is not empty. •Unit requires >3 PSIG application pressure drop. If a bypass valve has been installed, some restriction may need to be added to the bypass line. •Contact our Sales, Service and Customer Support.
Low Resistivity	Unit will continue to run. (Optional display)	The process fluid resistivity exceeded the lower adjustable value.	•Press enter to see if the message clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Replace process fluid. •Contact our Sales, Service and Customer Support.
Low Temp	With a warning message the unit will continue to run. With a fault message the unit will shut down. **NOTE** If the unit does shut down it can be restarted provided the temperature is still above the factory-set low fixed temperature limit. However, the error will reoccur if the temperature goes above the adjustable setting and then again drops below it. ▲	Process fluid temperature is below adjustable low value.	•If the unit is still running press enter to see if the code clears, the limit may have been only temporarily exceeded. •Verify controller's **SETTINGS**, see Section 4. •Ensure that the ambient temperature is not exceeding the recommended low-range, see Section 3. If your application load is constant and/or the lower temperature can be temporarily tolerated, then continue operation. (The ThermoFlex will control setpoint when sufficient heat is added.) •Add insulation to external plumbing lines to reduce the heat-loss to the environment. •For water-cooled units check facility water temperature. •Contact our Sales, Service and Customer Support.
LPC	Unit will shut down.	Low refrigeration pressure cutout switch activated.	•Check for refrigerant leak. •Contact our Sales, Service and Customer Support.
Open RTD	Unit will shut down.	Internal sensor open.	•Contact our Sales, Service and Customer Support.

Faults and Warnings

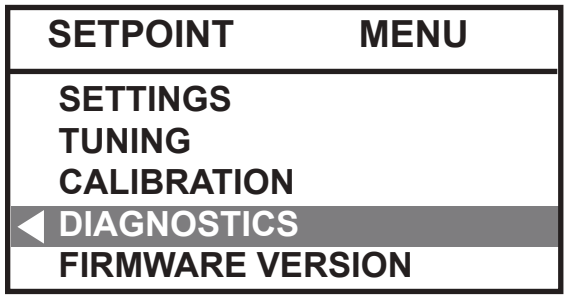
Message	Reaction	Cause	Actions
Open Remote RTD	Unit will shut down.	Remote temperature sensor open.	•Contact our Sales, Service and Customer Support.
Over Flow	Unit will shut down.	There is an overflow condition in the reservoir.	•Ensure the reservoir was not filled above the MAX LEVEL line. •Check for clogged reservoir filter. •Contact our Sales, Service and Customer. Support.
Shorted Remote RTD	Unit will shut down.	Remote temperature sensor shorted.	•Contact our Sales, Service and Customer Support.
Shorted RTD	Unit will shut down.	Internal sensor shorted.	•Contact our Sales, Service and Customer Support.
Motor Overload	Unit will shut down. (Units equipped with 3-Φ pump motor overload)	Pump motor exposed to excessive current due to high pressure, flow or ambient temperature.	•Allow pump to cool down. •Contact our Sales, Service and Customer Support.
Phase Monitor	Unit will shut down. (3-Φ units only)	Phase rotation is wrong.	•Disconnect unit from power source and reverse any two line conductors on the line side of the main circuit breaker. •Contact our Sales, Service and Customer Support.
UNIT FAULT	Unit will shut down.	Critical error.	•Contact our Sales, Service and Customer Support.

Error

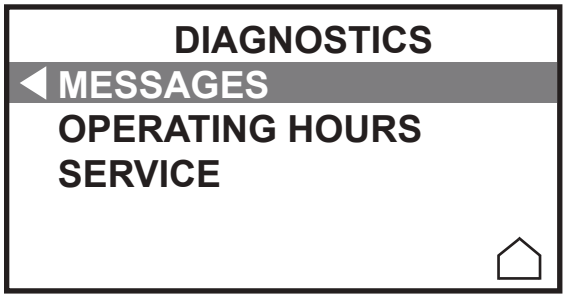
Message	Reaction	Cause	Actions
Async Rec Err Int	Unit will continue to run.	Communication error between display and main control board.	•Check the serial communication connection. •Cycle circuit protector on the rear of the unit off and on. •Contact our Sales, Service and Customer Support.
CAN Bus	Unit will continue to run.	Internal communications error.	•Contact our Sales, Service and Customer Support.
I2C Bus	Unit will continue to run.	Internal communications error.	•Contact our Sales, Service and Customer Support.
NO 5V CAL	Unit will continue to run.	No 5V calibration stored in controller memory.	•Perform a 5V calibration, see Section 4. •Contact our Sales, Service and Customer Support.
NO PRES CAL	Unit will continue to run.	No pressure calibration stored in controller memory.	•Perform a pressure calibration, see Section 4. •Contact our Sales, Service and Customer Support.
NO RTD CAL	Unit will continue to run.	No temperature calibration stored in controller memory.	•Perform a temperature calibration, see Section 4. •Contact our Sales, Service and Customer Support.
NVS 3 4 RESET	Unit will not start.	Bad checksum when unit is started. (Normal when new software is installed.)	•Press enter to try and clear the message. •Try a restart. •Contact our Sales, Service and Customer Support.

MESSAGES displays the ten most recent warnings and faults. The date and time each error occurred is shown. The alarm value is also displayed. Use the arrow buttons to scroll through the list of messages. Press the enter key to show the deletion options, **Single** or **All**. Choose **Single** to delete the selected error or **All** to delete all errors in the category. Press the enter key to show the delete confirmation screen. Finally, press the enter key again to make the deletion.

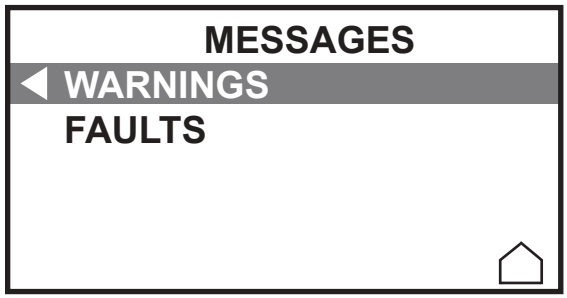
1. From the Main Menu display use the arrow buttons to highlight **DIAGNOSTICS**.



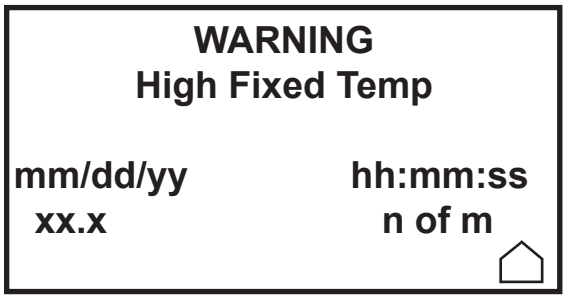
2. Press enter and use the arrow buttons to highlight **MESSAGES**.



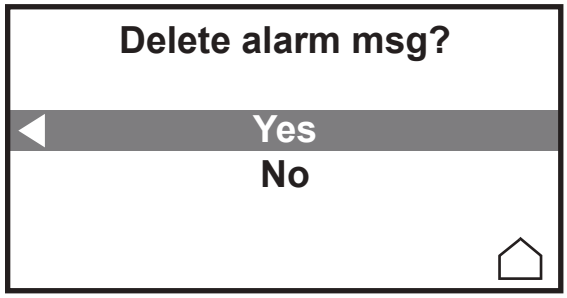
3. Press enter to display:



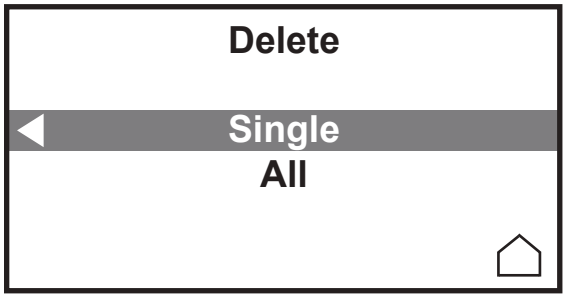
4. Highlight the desired type message and press enter again to display:



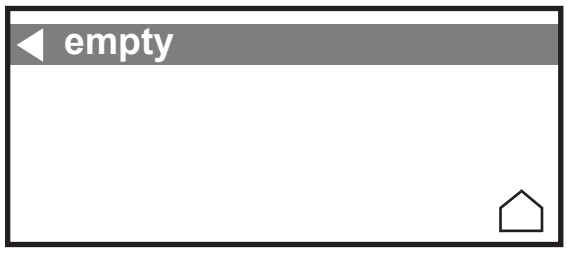
4. If desired, press enter again to display:



5. If Yes is selected press enter again to display:



For either message type, if there aren't any messages the display will indicate:



Checklist

Unit will not start

For first time use, please refer to the quick start instructions included with your unit or the copy in this manual. The manual's copy follows the Table of Contents.

Check the controller for messages, see Messages in this section.

Ensure the circuit protector is in the on (**I**) position.

For ThermoFlex900 - 5000 Global Voltage units ensure the unit is properly configured, see Appendix B.

Make sure supply voltage is connected and matches the unit's nameplate rating ±10%

NOTE Once RS232 or RS485 is activated, all keypad operations are disabled except for turning the unit off and changing the serial communication's settings. ▲

Unit shuts down

Ensure button wasn't accidently pressed.

Ensure the circuit protector is in the on (**I**) position.

Check the controller for messages, see Messages in this section.

Make sure supply voltage is connected and matches the unit's nameplate rating ±10%.

Restart the unit.

Clearing Messages

Note the code in case it cleares before you are done troubleshooting.

If desired, silence the audible alarm by pressing enter.

If the unit shut down the controller will continue to display the message. Press **enter** to clear the display and silence any alarm. Refer to Messages in this section. Once the cause of the shut down is identified and corrected, start the unit. If the cause was not corrected the message will reappear.

If the unit is still running press **enter** to see if the message clears, a limit may have been only temporarily exceeded. If the message does not clear refer to Messages in this section.

Unit will not circulate process fluid

Check the reservoir level. Fill, if necessary.

Ensure the reservoir bag filter is not clogged.

Check the application for restrictions in the cooling lines.

Unit requires >3 PSIG application pressure drop. If a bypass valve has been installed, a restriction may need to be added to the bypass line.

The pump motor overloaded. The pump's internal overtemperature overcurrent device will shut off the pump causing the flow to stop. This can be caused by low fluid, debris in system, operating unit in a high ambient temperature condition or excessively confined space. Allow time for the motor to cool down.

Make sure supply voltage matches the unit's nameplate rating ±10%.

Inadequate temperature control

Verify the setpoint.

Make sure the condenser/air filter is free of dust and debris.

Check the fluid concentration, see Section 3.

Ensure your unit's installation complies with the site requirements listed in Section 3.

Make sure supply voltage matches the unit's nameplate rating ±10%.

If the temperature continues to rise, make sure your application's heat load does not exceed the rated specifications.

Check for high thermal gradients (i.e., the application load is being turned on and off or rapidly changing).

If operating at high altitude note that heat removal capacity decreases 1.2% per 1,000 feet above sea level. Also, reduce the maximum temperature for the air entering the ThermoFlex by 1°C per 1,000 feet above sea level.

Verify/adjust controller PID values, see next page. Ensure the unit was shut down properly, see Section 4. If not the compressor may be damaged.

Unit vibration

The optional pressure relief valve setting may be the cause. If it is, change the pressure setting ± 5 psi to eliminate the vibration.

Please contact Thermo Fisher Scientific Sales Service and Customer Support if you need any additional information, see inside cover for contact instructions.

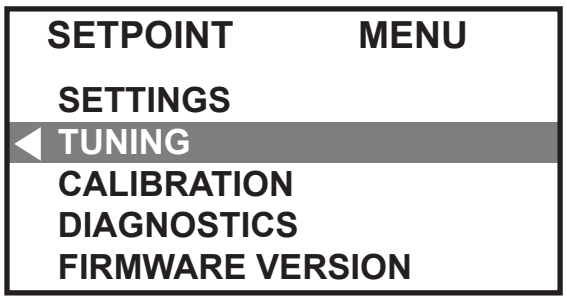
TUNING

Verifying/ Adjusting the Controller PID Values

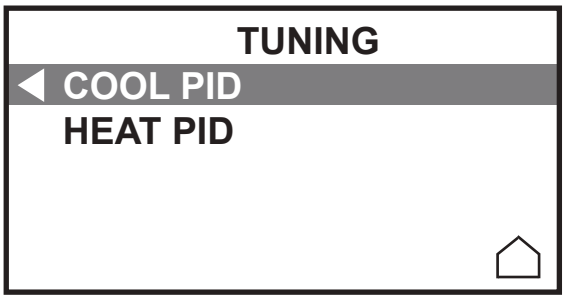
The controller controls temperature using a Proportional-Integral-Derivative (PID) algorithm. Should your unit experience temperature control issues, verifying/adjusting the controller's PID values may correct the condition.

NOTE Thermo Fisher recommends that only a qualified technician adjust the PID values. Incorrect values will hamper unit performance. ▲

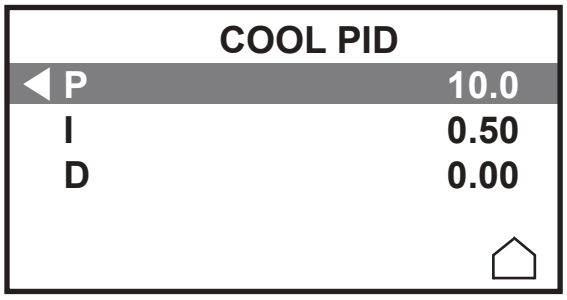
1. From the Main Menu display use the arrow buttons to highlight **TUNING**.

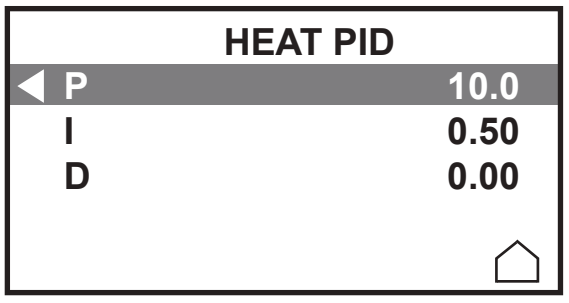


2. Press enter and highlight **COOL PID** or **HEAT PID**.



3. Highlight and change the desired values as required.





NOTE **HEAT PID** appears only on units equipped with a heater. ▲

P proportional value
P = % of span (100°C)
Range: 0.0 to 99.9
Factory Preset:
ThermoFlex900-5000 10.0
ThermoFlex7500-10000 15.0

I integral value
I = repeats/minute
Range: 0.00 to 9.99
Factory Preset: 0.50

D derivative value
D = minutes
Range: 0.0 to 9.9
Factory Preset: 0.0

Section 8 Additional Information

Draining

Before using any fluid or performing maintenance where contact with the fluid is likely refer to the manufacturer's MSDS for handling precautions. ▲

Ensure the fluid is below the safe-handling temperature (55°C) before draining the unit. ▲

Position a suitable pan beneath the drain port at the rear of the unit. The drain pan must be shallow (under 3½" in height) and have a volume of approximately 3 gallons(6 gallons for ThermoFlex7500 - 10000). Remove ¼" Male NPT pipe plug from drain port. This will drain the return line, reservoir, plate exchanger, and the suction side of the pump.

To drain the discharge side of the pump disconnect the Female NPT outlet connection on the rear of the unit.

NOTE Internally the unit does not contain a large quantity of fluid on the discharge side however take care to contain what fluid does drain, a wet-vac can be employed to minimize the potential for spillage. ▲

If the unit is equipped with the flow control or pressure relief with flow control option, open the valve or remove the drain plug in order to drain the discharge line.

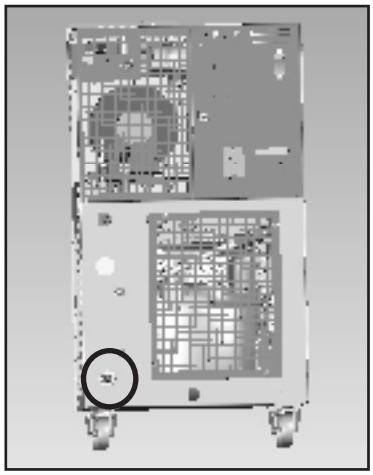


Figure 8-1 1/4" Male NPT Reservoir Drain Plug

If the unit is equipped with the anti drainback option, use the controller's **SETTINGS** menu to open the valve, see Section 4. Opening the valve allows the fluid to drain out of the unit.

Reinstall ¼" Male NPT pipe plug using a sealant suitable for the wetted materials prior to refilling the unit.

Water-Cooled

Draining ThermoFlex900 - 2500 water-cooled units is accomplished by removing the right side panel. Use a Philips head screwdriver to remove the five screws indicated in the illustration below. Slide the panel back approximately one inch, then lift slightly from the rear to disengage the panel's two tabs from their slots.

Figure 8-2 Water-Cooled

Install a $^{7}/_{16}$" ID tube on the drain petcock valve located on the lower end of the exchanger. Open the valve to allow fluid to drain into an external device. When draining is complete close the valve and replace the panel.

A wet-vac is needed on the facility water inlet connection to thoroughly drain any remaining fluid from the lines.

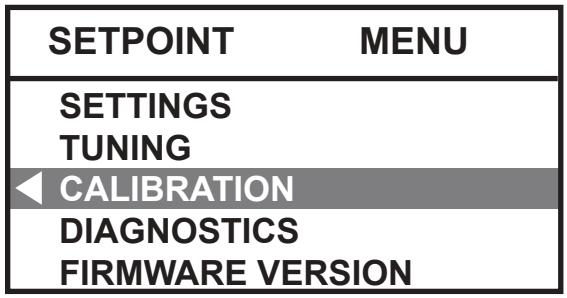
CALIBRATION

The ThermoFlex has been designed to minimize the need for calibration. However, if calibration is desired or recommended by our Sales, Service and Customer Support, please use the following procedure.

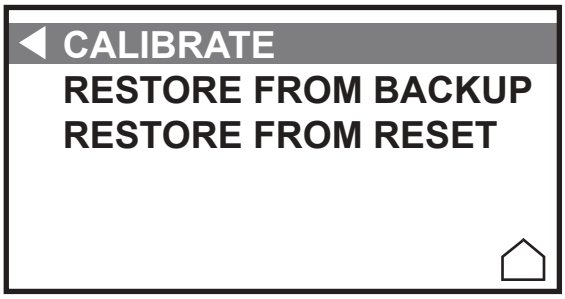
CALIBRATION calibrates the unit's temperature (t1), pressure (p2) and optional fluid flow (flow1) sensors.

Each calibration requires a running unit and a calibrated reference device. Typically, a 2 point calibration is used. Select which point to calibrate, low or high. Press enter and enter the value as read by the reference device. Press enter. Select "Cal." to the right of the value just entered by pressing the down key. Press enter and note that the current value now equals the value just entered.

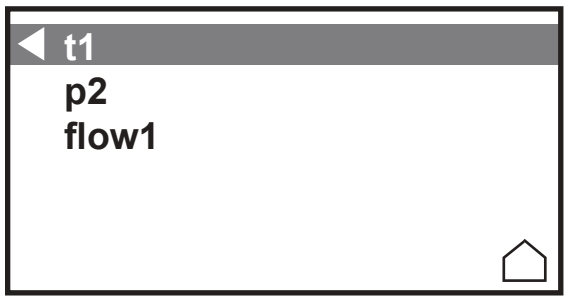
1. Highlight **CALIBRATION**.



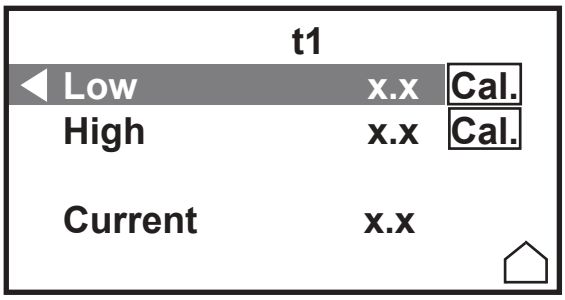
2. Press enter and highlight **CALIBRATE**.



3. Press enter to display:



4. Highlight the desired sensor then press enter to display:



For **t1**, run the unit to a suitable high-end calibration point. Place a calibrated reference thermometer in the reservoir. Ensure the fluid temperature is stabilized before performing the calibration. If it is more convenient, perform the low-end calibration before doing the high-end. Do not pick calibration points that are outside the safe operating limits of the fluid in your application. For example with water, 40°C and 5°C are typical high and low calibration points.

For **p2**, connect a calibrated reference pressure gauge to the outlet line. Use an external flow control valve to adjust the pressure to suitable calibration points. Ensure the pressure is stabilized before calibrating.

For **flow1**, connect a calibrated reference flowmeter to the outlet line. Use an external flow control valve to adjust the flow to suitable calibration points. Ensure the flow is stabilized before calibrating.

To restore a selected sensor to the factory values you have two options, **BACKUP** and **RESET**. **BACKUP** restores both the controller board and sensor calibration, **RESET** restores only the board calibration.

Wetted Materials

P1 and P2 Pumps

300 Series Stainless Steel
Bronze
Carbon Graphite
Ceramic
Fluorocarbon (Viton®)
Polysulfone

T1 Pumps

Stainless Steel AISI 304
Bronze ASTM B62
Bronze ASTM B16
Buna N
Buna/Ceramic
Buna/Carbon

Tank

Polyethylene (standard temp)
Polyvinyldiene Diflouride (high temp)
Brass
EPDM
Pyrex®

P3, P4 and P5 Pumps

316 Series Stainless Steel
Carbon
Silicon Carbide
Fluorocarbon (Viton®)

Plumbing

300 Series Stainless Steel
Bronze
Fluorocarbon (Viton®)
Nickel
Polypropylene
EPDM
Brass
Copper
Teflon®
PPS (flow transducer)
Nitrile (Buna-n®)

Filter bag

Polypropylene
Mono-filament nylon

Funnel

Acetal Copolymer

Shipment/Storage

Transporting and/or storing the unit in near or below freezing temperatures requires draining, see Draining in this Section. Store the unit in the temperature range of -25°C to 60°C (with packaging), and <80% relative humidity. ▲

Do not store the unit for more than 90 days. ▲

Appendix A Country Specific 230 VAC, 50 Hz, 1Ø Requirements

Refer to the nameplate label located on the rear of the unit for specific electrical requirements.

1. Units shipped to the following locations require a **16 Amp service**:

Afghanistan, Albania, Algeria, Andorra, Angola, Argentina, Armenia, Austria, Azerbaijan, Belarus, Belgium, Benin, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, Comoros, Congo, Croatia, Czech Republic, Denmark, Djibouti, DR Congo, Ecuador, Egypt, Eritrea, Estonia, Ethiopia, Finland, France, French Guiana, Gabon, Georgia, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Iraq, Israel, Italy, Ivory Coast, Jordan, Kazakhstan, Kyrgyzstan, Latvia, Lebanon, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Mali, Mauritania, Moldova, Monaco, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, Niger, North Korea, Norway, Paraguay, Peru, Poland, Portugal, Romania, Russia, Rwanda, Saint Vincent and the Grenadines, San Marino, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia, Somalia, South Africa, South Korea, Spain, Sweden, Switzerland, Syria, Tajikistan, Thailand, Togo, Tunisia, Turkey, Turkmenistan, Ukraine, Uruguay, Uzbekistan, Vanuatu, Vatican City, Vietnam.

2. Units shipped to the following locations require a **15 Amp service**:

Australia, China, Fiji Islands, Nauru, New Zealand, Papua New Guinea, Solomon Island, Tonga, Tuvalu.

3. Units shipped to the following locations require a **13 Amp service**:

Abu Dhabi, Bahrain, Bangladesh, Botswana, Brunei, Cyprus, Dominica, Gambia, Ghana, Gibraltar, Grenada, Hong Kong, India, Ireland, Kenya, Kiribati, Kuwait, Lesotho, Malawi, Malaysia, Maldives, Malta, Mauritius, Myanmar, Nigeria, Oman, Pakistan, Qatar, Saint Lucia, Seychelles, Sierra Leone, Singapore, Sri Lanka, Sudan, Swaziland, Tanzania, Uganda, United Arab Emirates, United Kingdom Yemen, Zambia, Zimbabwe.

Appendix B Voltage Configuration Instructions

ThermoFlex900 to 5000 units configured to operate at either 115V 60Hz or 100V 50/60Hz, or units with the Global Voltage option, have a voltage configuration panel located behind the access panel on the rear of the unit.

- Use a 1/4" socket to remove the four screws securing the access panel to the unit.
- The configuration panel has two 3-position toggle switches, one for voltage and one for frequency. All units are shipped with the toggle switch in the center **SHIP** position. Place each switch to the settings that match the voltage/frequency supplied to the unit.
- Reinstall the access panel.

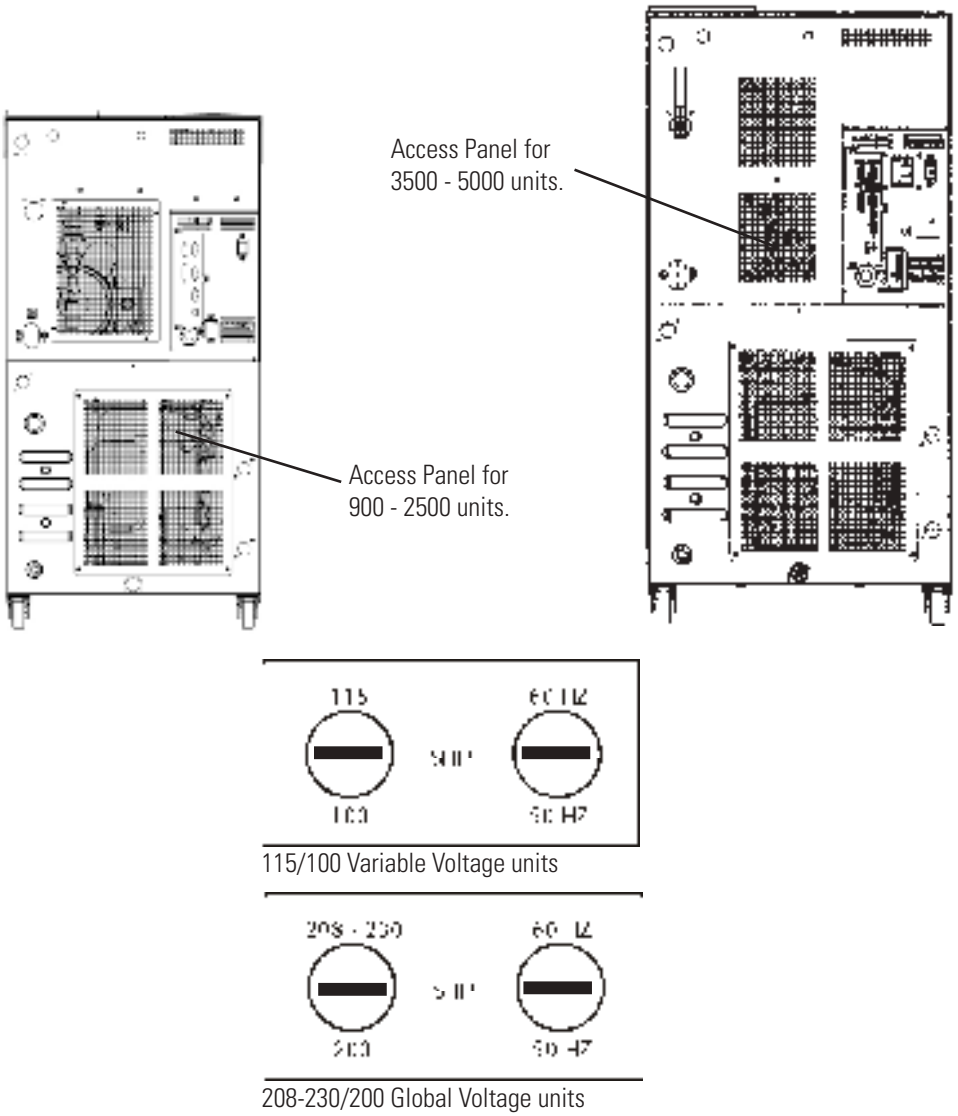


Figure B-1 Variable/Global Voltage Units

Appendix C NC Serial Communications Protocol

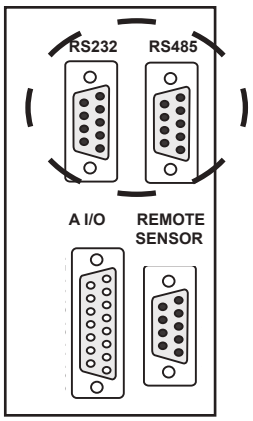


Figure C-1 Connectors

NOTE Appendix C assumes you have a basic understanding of communications protocols. ▲

Connect your PC to the applicable connector on the rear of the unit. Use the controller, see Section 4, to enable serial communications.

NOTE Once RS232 or RS485 is activated, all keypad operations are disabled except for turning the unit off and changing the serial communication's settings. ▲

All data is sent and received in binary form, do not use ASCII. In the following pages the binary data is represented in hexadecimal (hex) format.

The NC Serial Communications Protocol is based on a master-slave model. The master is a host computer, while the slave is the chiller's controller. Only the master can initiate a communications transaction (half-duplex). The slave ends the transaction by responding to the master's query. The protocol uses RS-232/RS-485 serial interface with the default parameters: 9600 baud, 8 data bits, 1 stop bit, and no parity. RS-485 offers a slave address selection, default parameter: 1.

The unit can be controlled through your computer's serial port by using the unit's standard female 9-pin connection.

RS-232 COMM

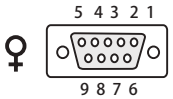
Pin #	**Function**
1	No connection
2	TX
3	RX
4	No connection
5	GND = Signal ground
6 - 9	No connection

TX = Transmitted data from controller
RX = Received data to controller.

RS-485 COMM

Pin #	**Function**
1-7	No connection
8	T+
9	T-

Hardware **Mating Connector**
AMP Part# 745492-2 or equivalent



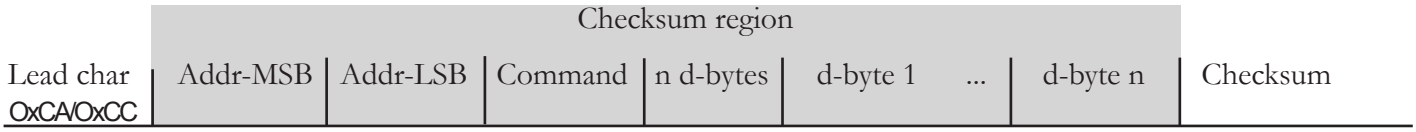
Communication cables are available from Thermo Fisher. Contact us for additional information.

All commands must be entered in the exact format shown in the tables on the following pages. The tables show all commands available, their format and responses. Controller responses are either the requested data or an error message. The controller response *must* be received before the host sends the next command.

The host sends a command embedded in a single communications packet, then waits for the controller's response. If the command is not understood or the checksums do not agree, the controller responds with an error command. Otherwise, the controller responds with the requested data. If the controller fails to respond within 1 second, the host should resend the command.

NOTE All byte values are shown in hex, hex represents the binary values that must be sent to the chiller. **Do not use ASCII.**

The framing of the communications packet in both directions is:



Lead char	**0xCA (RS-232) 0xCC (RS-485)**
	Device address is 1 (RS-232)
Addr-msb	Most significant byte of slave address (RS-232: 0)
Addr-lsb	Least significant byte of slave address (RS-232: 1)
Command	Command byte (see Table of Commands)
n d-bytes	Number of data bytes to follow
d-byte 1	1st data byte (the qualifier byte is considered a data byte)
...	...
d-byte n	nth data byte.
Checksum	Bitwise inversion of the 1 byte sum of bytes beginning with the most significant address byte and ending with the byte preceding the checksum. (To perform a bitwise inversion, "exclusive OR" the one byte sum with FF hex.)

When a command has no value associated with it (e.g. REQ ACK), "n d-bytes" will be set to 0. Values such as temperature and flow are sent as either 2 or 4 byte signed integers, depending on how they are stored in the controller RAM.

When the controller sends a value, a qualifier byte is sent first, followed by a 2 or 4 byte integer (the least significant byte is sent last). The qualifier indicates the precision and units of the value. The host does not send the qualifier byte; it must send the value using the correct precision, units and number of bytes. The host first inquires about a value it wants to change, then uses the number of data bytes and the qualifier byte it receives to generate the proper integer to send.

Analog Values

*Qualifier Byte	
b.7 b.6 b.5 b.4	Precision of measurement
b.3 b.2 b.1 b.0	Unit of measure index

Unit of Measure	
Index	Unit
0	NONE
1	Temperature in °C
2	Temperature in °F
3	Flow liters per minute
4	Flow in gallons per minute
5	Time in seconds
6	Pressure in PSI
7	Pressure in bars
8	Resistivity in MΩ-cm
9	%
10	Volts
11	Pressure in K Pascals
12	Conductivity in µs/cm

E.g., the integer 986 proceded by a qualifier byte of 0x12 is 98.6°F.

Examples to set setpoint to 25°C:

A. The precision and units are 1°C; a 2 byte integer is used. If you already know this, skip to step 3.

1. Master sends: CA 00 01 70 00 8E (Request Setpoint 1)
2. Slave responds: CA 00 01 70 03 01 00 14 76 (1°C x 20)
   Response indicates:
   uses a 2 byte integer (nn=03)
   precision and units are 1°C (d1=01)
3. Master sends: CA 00 01 F0 02 00 19 F3 (Set Setpoint 1 to 25°C)
4. Slave responds: CA 00 01 F0 03 01 00 19 F1 (1°C x 25)

B. The precision and units are 0.1°C; a 2 byte integer is used. If you already know this, skip to step 3.

1. Master sends: CA 00 01 70 00 8E (REQ SETPOINT1)
2. Slave responds: CA 00 01 70 03 11 00 C8 B2 (0.1°C x 200)
   Response indicates:
   uses a 2 byte integer (nn=03)
   precision and units are 0.1°C (d1=11)
3. Master sends: CA 00 01 F0 02 00 FA 12 (Set Setpoint 1 to 25.0°C)
4. Slave responds: CA 00 01 F0 03 11 00 FA 00 (0.1°C x 250)

See Additional Command Examples in this Appendix.

Set Commands – When a Set Command is received and the value is within the allowable limits, the new value will take effect immediately and the new value will be returned as part of the response to the command. If the value is outside of the allowable limits, the value will be rejected and the old value will be returned as part of the response to the command.

Error Response F0 - The "Bad Data" and "Bad Checksum" error responses will not be used. Reject out of range values and return old settings. Do not reply to message frames with bad checksums. This behavior is compatible with existing implementations of the protocol.

Table of Commands

Command	M: Master Sends S: Slave Responds	Notes
Request Status		
REQ ACK	M: lc a1 a2 **00** 00 cs S: lc a1 a2 **00** 02 v1 v2 cs	protocol version v1=0; v2=1
REQ UNIT SW VER	M: lc a1 a2 **02** 01 d1 cs S: lc a1 a2 **02** nn d1 … dn cs	d1 = 0 Unit SW version in ASCII d1 = 1 Unit SW checksum
REQ DISPLAY MSG	M: lc a1 a2 **07** 00 cs S: lc a1 a2 **07** nn d1 … dn cs	Display message in ASCII
REQ STATUS	M: lc a1 a2 **09** 00 cs S: lc a1 a2 **09** nn d1 … dn cs	see Request Status Table in this Appendix
ERROR	M: S: lc a1 a2 **0F** 02 en ed cs	Response Only! ed = Error Data en = Error Number 1: Bad Command See Error in this Appendix
Request Measurements		
REQ FLOW1	M: lc a1 a2 **10** 00 cs S: lc a1 a2 **10** 03 d1 d2 d3 cs	Process Fluid Supply Pressure (P1)
REQ TEMP1	M: lc a1 a2 **20** 00 cs S: lc a1 a2 **20** 03 d1 d2 d3 cs	Process Fluid Supply Temperature (RTD1)
REQ TEMP2	M: lc a1 a2 **21** 00 cs S: lc a1 a2 **21** 03 d1 d2 d3 cs	Process Fluid Return Temperature (RTD2)
REQ TEMP4	M: lc a1 a2 **23** 00 cs S: lc a1 a2 **23** 03 d1 d2 d3 cs	Entering Air/Facility Water (RTD4)
REQ TEMP7	M: lc a1 a2 **26** 00 cs S: lc a1 a2 **26** 03 d1 d2 d3 cs	ThermoFlex 2500 Air-cooled Fan Speed
REQ ANALOG1	M: lc a1 a2 **28** 00 cs S: lc a1 a2 **28** 03 d1 d2 d3 cs	Process Fluid Supply Pressure (P2)
REQ ANALOG2	M: lc a1 a2 **29** 00 cs S: lc a1 a2 **29** 03 d1 d2 d3 cs	Refrigeration Suction Pressure (P5)
REQ ANALOG3	M: lc a1 a2 **2A** 00 cs S: lc a1 a2 **2A** 03 d1 d2 d3 cs	Process Fluid Return Pressure (P1)
REQ ANALOG4	M: lc a1 a2 **2B** 00 cs S: lc a1 a2 **2B** 03 d1 d2 d3 cs	Condensing Pressure (P6)
REQ ANALOG5	M: lc a1 a2 **1C** 00 cs S: lc a1 a2 **1C** 03 d1 d2 d3 cs	Facility Inlet Pressure (P7)

REQ ANALOG6	M: lc a1 a2 **1D** 00 cs S: lc a1 a2 **1D** 03 d1 d2 d3 cs	Facility Outlet Pressure (P8)
REQ ANALOG7	M: lc a1 a2 **1E** 00 cs S: lc a1 a2 **1E** 03 d1 d2 d3 cs	Analog Level (LEV4)
REQ ANALOG9	M: lc a1 a2 **2F** 00 cs S: lc a1 a2 **2F** 03 d1 d2 d3 cs	+5V Sense
REQ REMOTE RTD	M: lc a1 a2 **1B** 00 cs S: lc a1 a2 **1B** 03 d1 d2 d3 cs	Remote Temperature from Ooptional Analog Board
REQ RES1	M: lc a1 a2 **2C** 00 cs S: lc a1 a2 **2C** 03 d1 d2 d3 cs	Process Fluid Resistivity

Request Low Alarm Values

REQ LO FLOW1	M: lc a1 a2 **30** 00 cs S: lc a1 a2 **30** 03 d1 d2 d3 cs	Process Warning
REQ LO FLOW3	M: lc a1 a2 **32** 00 cs S: lc a1 a2 **32** 03 d1 d2 d3 cs	Process Fault
REQ LO ANALOG1	M: lc a1 a2 **48** 00 cs S: lc a1 a2 **48** 03 d1 d2 d3 cs	Pressure Process Supply Warning
REQ LO ANALOG2	M: lc a1 a2 **49** 00 cs S: lc a1 a2 **49** 03 d1 d2 d3 cs	Pressure Process Supply Fault
REQ LO ANALOG7	M: lc a1 a2 **3E** 00 cs S: lc a1 a2 **3E** 03 d1 d2 d3 cs	Level Warning
REQ LO ANALOG8	M: lc a1 a2 **3F** 00 cs S: lc a1 a2 **3F** 03 d1 d2 d3 cs	Level Fault
REQ LO TEMP1	M: lc a1 a2 **40** 00 cs S: lc a1 a2 **40** 03 d1 d2 d3 cs	Process Warning
REQ LO TEMP2	M: lc a1 a2 **41** 00 cs S: lc a1 a2 **41** 03 d1 d2 d3 cs	Process Fault
REQ AUTO REFILL ON	M: lc a1 a2 **45** 00 cs S: lc a1 a2 **45** 03 d1 d2 d3 cs	Auto Refill On Setting
REQ LO RES1	M: lc a1 a2 **4C** 00 cs S: lc a1 a2 **4C** 03 d1 d2 d3 cs	Process Warning

Request High Alarm Values

REQ HI FLOW1	M: lc a1 a2 **50** 00 cs S: lc a1 a2 **50** 03 d1 d2 d3 cs	Process Warning
REQ HI FLOW3	M: lc a1 a2 **32** 00 cs S: lc a1 a2 **32** 03 d1 d2 d3 cs	Process Fault
REQ HI TEMP1	M: lc a1 a2 **60** 00 cs S: lc a1 a2 **60** 03 d1 d2 d3 cs	Process Warning
REQ HI TEMP2	M: lc a1 a2 **61** 00 cs S: lc a1 a2 **61** 03 d1 d2 d3 cs	Process Fault
REQ HI ANALOG1	M: lc a1 a2 **68** 00 cs S: lc a1 a2 **68** 03 d1 d2 d3 cs	Pressure Process Supply Warning
REQ HI ANALOG2	M: lc a1 a2 **69** 00 cs S: lc a1 a2 **69** 03 d1 d2 d3 cs	Pressure Process Supply Fault
REQ HI ANALOG7	M: lc a1 a2 **5E** 00 cs S: lc a1 a2 **5E** 03 d1 d2 d3 cs	Level Warning
REQ HI ANALOG8	M: lc a1 a2 **5F** 00 cs S: lc a1 a2 **5F** 03 d1 d2 d3 cs	Level Fault
REQ Auto Refill Off	M: lc a1 a2 **65** 00 cs S: lc a1 a2 **65** 03 d1 d2 d3 cs	Auto Refill Off Setting
REQ HI RES1	M: lc a1 a2 **6C** 00 cs S: lc a1 a2 **6C** 03 d1 d2 d3 cs	Process Warning

Request PID Settings

REQ SETPT1	M: lc a1 a2 **70** 00 cs S: lc a1 a2 **70** 03 d1 d2 d3 cs	Process Fluid Setpoint
REQ COOL P	M: lc a1 a2 **74** 00 cs S: lc a1 a2 **74** 03 d1 d2 d3 cs	
REQ COOL I	M: lc a1 a2 **75** 00 cs S: lc a1 a2 **75** 03 d1 d2 d3 cs	
REQ COOL D	M: lc a1 a2 **76** 00 cs S: lc a1 a2 **76** 03 d1 d2 d3 cs	
REQ HEAT P	M: lc a1 a2 **71** 00 cs S: lc a1 a2 **71** 03 d1 d2 d3 cs	For units equipped with optional heater only
REQ HEAT I	M: lc a1 a2 **72** 00 cs S: lc a1 a2 **72** 03 d1 d2 d3 cs	
REQ HEAT D	M: lc a1 a2 **73** 00 cs S: lc a1 a2 **73** 03 d1 d2 d3 cs	

Set Status Settings

SET KEYSTROKE	M: lc a1 a2 **80** 02 d1 d2 cs S: lc a1 a2 **80** 02 d1 d2 cs	See Set Keystroke in this Appendix
SET ON/OFF ARRAY	M: lc a1 a2 **81** nn d1 … dn cs S: lc a1 a2 **81** nn d1 … dn cs	See Set On/Off Array in this Appendix di: 0 = OFF, 1 = ON, 2 = no change
SET CALIBRATION	M: lc a1 a2 **82** 05 d1 … d5 cs S: lc a1 a2 **82** 07 d1 … d7 cs	See Calibration in this Appendix
SAVE UNIT CALIBRATION	M: lc a1 a2 **8B** 02 d1 d2 cs S: lc a1 a2 **8B** 01 d1 cs	Save unit calibration data in reset calibration See Save Unit Calibration in this Appendix.

Set Low Alarm Values

SET LO FLOW1	M: lc a1 a2 **B0** 02 d1 d2 cs S: lc a1 a2 **B0** 03 d1 d2 d3 cs	Process Warning
SET LO FLOW3	M: lc a1 a2 **B2** 02 d1 d2 cs S: lc a1 a2 **B2** 03 d1 d2 d3 cs	Process Fault
SET LO TEMP1	M: lc a1 a2 **C0** 02 d1 d2 cs S: lc a1 a2 **C0** 03 d1 d2 d3 cs	Process Warning
SET LO TEMP2	M: lc a1 a2 **C1** 02 d1 d2 cs S: lc a1 a2 **C1** 03 d1 d2 d3 cs	Processm Fault
SET LO ANALOG1	M: lc a1 a2 **C8** 02 d1 d2 cs S: lc a1 a2 **C8** 03 d1 d2 d3 cs	Pressure Process Supply Warning
SET LO ANALOG2	M: lc a1 a2 **C9** 02 d1 d2 cs S: lc a1 a2 **C9** 03 d1 d2 d3 cs	Pressure Process Supply Fault
SET LO ANALOG7	M: lc a1 a2 **BE** 02 d1 d2 cs S: lc a1 a2 **BE** 03 d1 d2 d3 cs	Level Warning
SET LO ANALOG8	M: lc a1 a2 **BF** 02 d1 d2 cs S: lc a1 a2 **BF** 03 d1 d2 d3 cs	Level Fault
SET AUTOREFILL ON	M: lc a1 a2 **C5** 02 d1 d2 cs S: lc a1 a2 **C5** 03 d1 d2 d3 cs	When level % drops below this, turn on auto refill
SET LO RES1	M: lc a1 a2 **CC** 02 d1 d2 cs S: lc a1 a2 **CC** 03 d1 d2 d3 cs	Process Warning
SET LO RES2	M: lc a1 a2 **CD** 02 d1 d2 cs S: lc a1 a2 **CD** 03 d1 d2 d3 cs	Process Fault

SET High Alarm Values

SET HI FLOW1	M: lc a1 a2 **D0** 02 d1 d2 cs S: lc a1 a2 **D0** 03 d1 d2 d3 cs	Process Warning
SET HI FLOW3	M: lc a1 a2 **D2** 02 d1 d2 cs S: lc a1 a2 **D2** 03 d1 d2 d3 cs	Process FFault
SET HI TEMP1	M: lc a1 a2 **E0** 02 d1 d2 cs S: lc a1 a2 **E0** 03 d1 d2 d3 cs	Process Warning
SET HI TEMP2	M: lc a1 a2 **E1** 02 d1 d2 cs S: lc a1 a2 **E1** 03 d1 d2 d3 cs	Process Fault
SET HI ANALOG1	M: lc a1 a2 **E8** 02 d1 d2 cs S: lc a1 a2 **E8** 03 d1 d2 d3 cs	Pressure Process Supply Warning
SET HI ANALOG2	M: lc a1 a2 **E9** 02 d1 d2 cs S: lc a1 a2 **E9** 03 d1 d2 d3 cs	Pressure Process Supply Fault
SET HI ANALOG7	M: lc a1 a2 **DE** 02 d1 d2 cs S: lc a1 a2 **DE** 03 d1 d2 d3 cs	Level Warning
SET HI ANALOG8	M: lc a1 a2 **DF** 02 d1 d2 cs S: lc a1 a2 **DF** 03 d1 d2 d3 cs	Level Fault
SET AUTOREFILL OFF	M: lc a1 a2 **C5** 02 d1 d2 cs S: lc a1 a2 **C5** 03 d1 d2 d3 cs	When level % drops below this, turn off auto refill
SET HI RES1	M: lc a1 a2 **EC** 02 d1 d2 cs S: lc a1 a2 **EC** 03 d1 d2 d3 cs	Process Warning
SET HI RES2	M: lc a1 a2 **ED** 02 d1 d2 cs S: lc a1 a2 **ED** 03 d1 d2 d3 cs	Process Fault

SET PID Settings

SET SETPT1	M: lc a1 a2 **F0** 02 d1 d2 cs S: lc a1 a2 **F0** 03 d1 d2 d3 cs	Process Fluid Setpoint
SET COOL P	M: lc a1 a2 **F4** 02 d1 d2 cs S: lc a1 a2 **F4** 03 d1 d2 d3 cs	Cool P Term
SET COOL I	M: lc a1 a2 **F5** 02 d1 d2 cs S: lc a1 a2 **F5** 03 d1 d2 d3 cs	Cool I Term
SET COOL D	M: lc a1 a2 **F6** 02 d1 d2 cs S: lc a1 a2 **F6** 03 d1 d2 d3 cs	Cool D term
SET HEAT P	M: lc a1 a2 **F1** 02 d1 d2 cs S: lc a1 a2 **F1** 03 d1 d2 d3 cs	Heat P Term for units equipped with optional heater only
SET HEAT I	M: lc a1 a2 **F2** 02 d1 d2 cs S: lc a1 a2 **F2** 03 d1 d2 d3 cs	Heat I Term
SET HEAT D	M: lc a1 a2 **F3** 02 d1 d2 cs S: lc a1 a2 **F3** 03 d1 d2 d3 cs	Heat D term

Request Status Table

nn	4				
	b0	Unit Running		b0	L1 HTC
	b1	Unit Faulted		b1	L2 LLC
	b2	Process Supply RTD open or shorted		b2	L3 MOL
d1	b3	Process Return RTD open or shorted	d3	b3	L4 Phase Monitor
	b4	Suction RTD open or shorted		b4	L5 HPC
	b5	Entering Air or Facility Water RTD open or shorted		b5	L6 LPC
	b6	High Temp Error		b6	L7 EMO
	b7	Low Temp Error		b7	L8 External EMO
	b0	High Pressure Error		b0	RA T_MAX
	b1	Low Pressure Error		b1	0_MIN
	b2	High Flow Error		b2	Auto Refill Valve Open
d2	b3	Low Flow Error	d4	b3	Anti Drainback Valve Open
	b4	High Level Error		b4	Clogged Fluid Filter Fault
	b5	Low Level Error		b5	Temp Fault Startup Bypass
	b6	Drip Pan fault		b6	System Low Flow
	b7	Auto Refill fault		b7	System High Pressure

Error

The slave detected an error in the message it received from the master, so it returns this command instead of echoing the command sent by the master. The slave returns the command it received from the master in the ed byte, and an error code in the en byte.

en	Error
1	Bad command – not recognized by slave
2	Reject value and return old setting
3	Do not respond at all

Some errors may not result in any response. The slave ignores incoming bytes until it sees the valid lead character and its slave address. Then it must receive the correct number of bytes (determined by the length byte) before it can respond. If an incomplete frame is received, the slave will timeout and clear its input buffer without responding.

Set On/Off Array

This command is used to set the state of various features of the unit, such as whether the unit is on or off, and whether the remote probe is enabled or disabled. The number of features and their position in the array is product specific. Sending a 0 in the array turns off or disables the feature while sending a 1 turns on or enables it. Sending a 2 does not change the state of the feature. In all cases, the array is returned showing the state of each feature after the command has been carried out. Sending all 2's effectively turns this command into a request status command.

nn	1
d1	Unit On/Off

Set Keystroke

This command is used to effect a keystroke remotely as if someone pressed the key on the controller.

Value	
0	Null
1	Enter
2	Up/Yes
3	Down/No
4	Esc
5	On/Off
6	Left
7	Right

Set Special Command

Used for product specific commands, in the Thermoflex this command configures the analog options (Dac out, Analog in and turns on and off DAC output)

CA 00 01 8D nn d1…dn cs

Set Special Command

Byte		Notes
d1	Command Byte	Indicates what command
d2	Description Byte	See description below
d3	Entered Value if necessary	

Command Byte

Command	Description
00	Set Analog Option
01	Set Resistivity Control (for Basic derivatives)
02	Unused

Description Byte

Byte	Notes	
b.7 - b.6	Unused	
b.5 and b.4	Remote DAC output enable	00 = Off, 01 = On, 1x = No Change
b.3 - b.2	Configure DAC Output	00h = Volt, 01h = millivolt, 02h = milliamp, 03h = No Change
b.1 - b.2	Configure Analog Input	00h = Volt, 01h = millivolt, 02h = milliamp, 03h = No Change

The following command string example enables the DAC output, configures the DAC for millivolts and configures the analog input for voltage:

CA 00 01 8D 02 00 14 cs

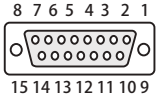
Save Unit Calibration

This command is used to save unit calibration parameters from the reset memory. Use the 7 bit Identifier Byte from the SET CALIBRATION command.

d1	Calibration ID	See 7 bit Identifier Byte from SET CALIBRATION command.

Appendix D Analog I/O and Remote Sensor

Analog I/O Connector Pinout ♀



Install your analog input/output device to the 15-pin female connector on the rear of the unit. Analog I/O is activated using the controller, see Section 4.

PIN	NAME	NOTES	DEFINITION
1	DIGITAL INPUT COMMON		Common for digital inputs (pins 12, 13 and 14)
2	Not Used		
3	LOW LEVEL (Only if option chosen)	Note 1	Dry Relay Contact: Reference to pin 11. Closes if either level switch is in the "low" position for more than 1 second.
4	CONFIGURABLE RELAY 2	Note 1	Dry Relay Contact: Reference to pin 11. Closes when any configured fault or warning occurs, see Table 2.
5	PUMP ON	Note 1	Dry Relay Contact: Reference to pin 11. Closes when pump is turned on. Opens when pump is turned off.
6	ANALOG GROUND		Common for analog signals (pins 2, 7 and 15)
7	RESERVOIR TEMP OUT **OR** EXTERNAL SENSOR TEMPERATURE IF EXTERNAL SENSOR ENABLED	Note 2	Analog Voltage Output 0-10VDC, 10mV/°C, or 4-20mA: Reference to pin 6. This voltage output is proportional to the reservoir fluid temperature: Default scale= 0–10V (where: 0V = Low Temp Span, 10V = Hi Temp Span) Optional Range = 10mV/ ^{0}C. (Ex: 200mV = 20°C) (Max Load @ 10V = 5mA) or 4-20mA, 4mA = low temp span, 20 mA = high temp span (maximum output current = 5mA @10VDC. Contact us for details.
8	LOW FLOW (Only if option chosen)	Note 1	Dry Relay Contact: Reference to pin 11. Closes when a low flow occurs while the pump is on. Note: To allow the pump to get up to speed at startup, the pump runs for 3 - 5 seconds before the low flow sensor is read.
9	CONFIGURABLE RELAY 1 (Normally Open)	Note 1	Dry Relay Contact: Reference to pin 11. Closes when any of the configured faults occur, see Table 1.
10	CONFIGURABLE RELAY 1 (Normally Closed)	Note 1	Dry Relay Contact: Reference to pin 11. Complement of pin 9 (open when pin 9 is closed).
11	RELAY COMMON		Common for all relay contacts (pins 3, 4, 5, 8, 9, 10).
12	REMOTE START ENABLE	Note 3	Digital Input (Isolated): Reference to pin 1. Connect to pin 1 to allow unit to be remotely turned on/off through pin 14 REMOTE START.

Note 1: All relay contacts (except for Pin 10) are normally OPEN when power is off. Pin 10 contacts are normally CLOSED when power is off. Relay contacts are rated: 24V AC/DC, 2A, <= 0.08 Ohm maximum each or 5A total for all relays combined, 1mA minimum, switching capacity: 48VA/48W (Resistive load only).

Note 2: Jumper Configurable (Default = 10mV/°C)

Note 3: Sink 0.5mA @ 5VDC (Rated for signal level gold contact or TTL device)

PIN	NAME	NOTES	DEFINITION
13	REMOTE SETPOINT ENABLE	Note 3	Digital Input (Isolated): Reference to pin 1. Connect to pin 1 to allow the setpoint to be changed remotely through pin 15 REMOTE SETPOINT.
14	REMOTE START	Note 3	Digital Input (Isolated): Reference to pin 1. Connect to pin 1 to turn unit on. Disconnect to turn unit off. Note: Pins 1 and 12 must be connected to allow operation from this pin.
15	REMOTE SETPOINT	Note 2	Analog Voltage Input 0-10VDC, 10mV/°C, or 4-20mA: Reference to pin 6. Apply a DC voltage to this pin to adjust the unit's setpoint: Default Range = 0 – 10V (where: 0V = Low Temp Span, 10V = Hi Temp Span) (Input Impedance > 600K) Optional Range = 10mV/ ^{0}C. (Ex: 200mV = 20°C) (Max Input Voltage = 10VDC, or 4-20mA, 4mA = low temp span, 20 mA = high temp span. Contact us for details.

Note 1: All relay contacts (except for Pin 10) are normally OPEN when power is off. Pin 10 contacts are normally CLOSED when power is off. Relay contacts are rated: 24V AC/DC, 2A, <= 0.08 Ohm maximum each or 5A total for all relays combined, 1mA minimum, switching capacity: 48VA/48W (Resistive load only).

Note 2: Jumper configurable (default = 10mV/°C)

Note 3: Sink 0.5mA @ 5VDC (rated for signal level gold contact or TTL device)

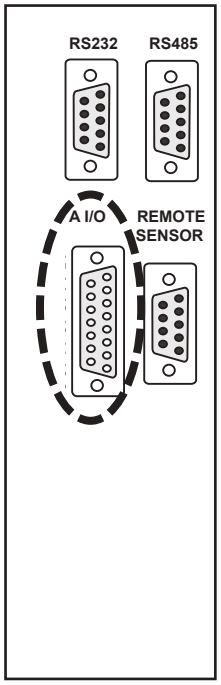
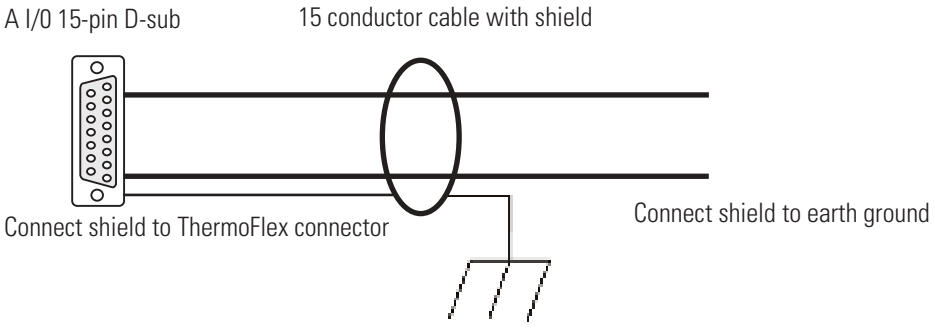


Figure D-1 Analog I/0 Connec-

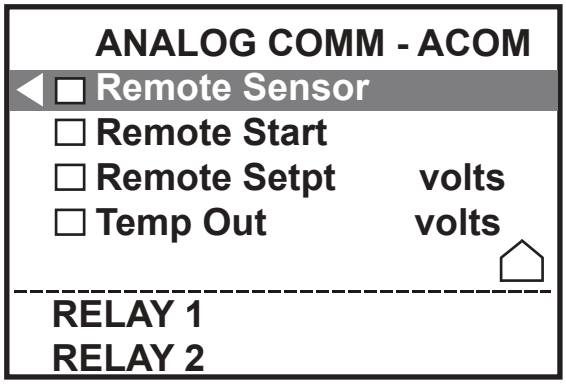
NOTE When making your connection to the ThermoFlex Analog I/0 connector, in order to comply with the EMC directive:

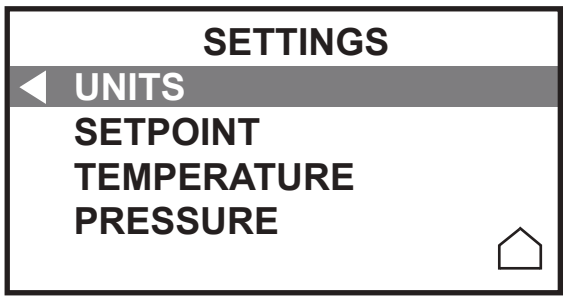
- Use a shielded I/0 cable
- Connect the remote end of the cable shield to earth ground.
- Connect cable shield to ThermoFlex end connector. ▲

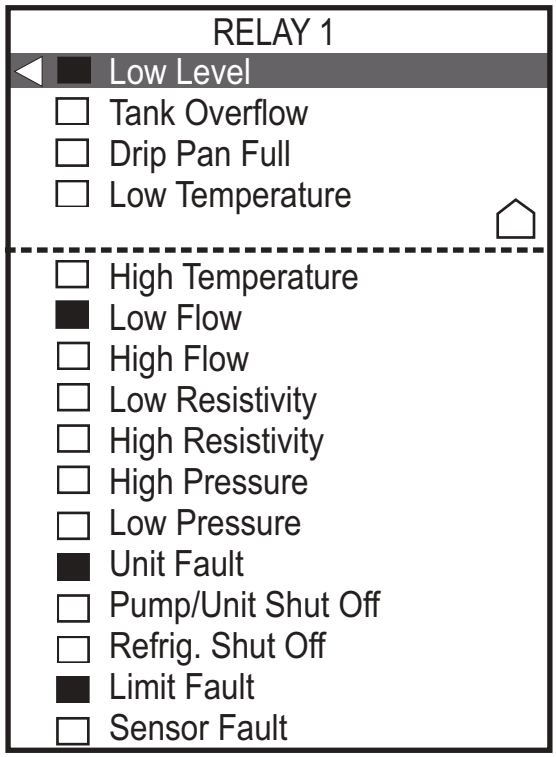


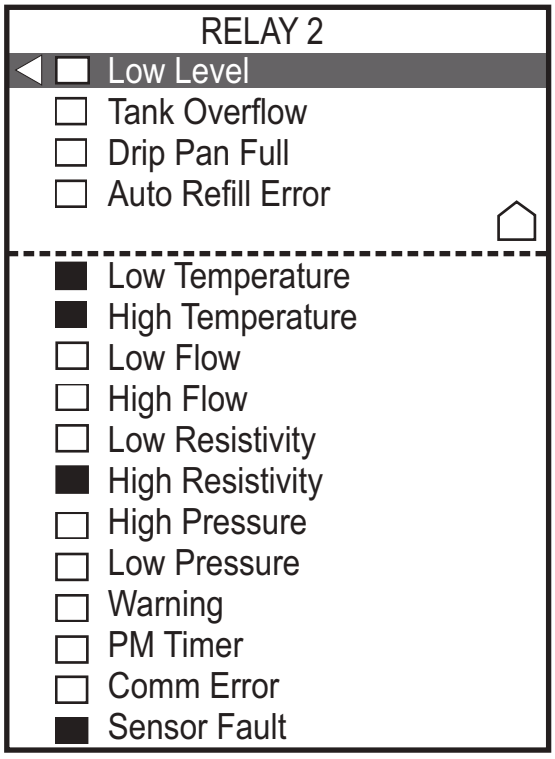
Configurable Relays

Use the up/down arrows to scroll through the entire menu (only six lines are displayed at a time). When any desired feature is highligthed press enter to select it. The Relay default features are indicated by ■.





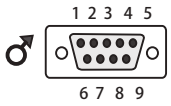




Remote Sensor Connector Pinout

Table 3

Pin	
1	White
2	NA
3	NA
4	White
5	NA
6	NA
7	Red
8	NA
9	Red (4th wire not connected to the control board)



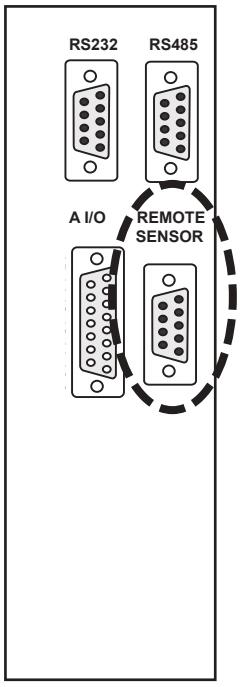


Figure D-2 Remote Sensor Connector

WARRANTY

Thermo Fisher Scientific warrants for 24 months from date of shipment the Thermo Scientific NESLAB ThermoFlex unit according to the following terms.

Any part of the unit manufactured or supplied by Thermo Fisher Scientific and found in the reasonable judgment of Thermo Fisher to be defective in material or workmanship will be repaired at an authorized Thermo Fisher Repair Depot without charge for parts or labor. The unit, including any defective part must be returned to an authorized Thermo Fisher Repair Depot within the warranty period. The expense of returning the unit to the authorized Thermo Fisher Repair Depot for warranty service will be paid for by the buyer. Our responsibility in respect to warranty claims is limited to performing the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or recision of the contract of sales of any unit. With respect to units that qualify for field service repairs, Thermo Fisher Scientific's responsibility is limited to the component parts necessary for the repair and the labor that is required on site to perform the repair. Any travel labor or mileage charges are the financial responsibility of the buyer.

The buyer shall be responsible for any evaluation or warranty service call (including labor charges) if no defects are found with the Thermo Scientific product.

This warranty does not cover any unit that has been subject to misuse, neglect, or accident. This warranty does not apply to any damage to the unit that is the result of improper installation or maintenance, or to any unit that has been operated or maintained in any way contrary to the operating or maintenance instructions specified in this Instruction and Operation Manual. This warranty does not cover any unit that has been altered or modified so as to change its intended use.

In addition, this warranty does not extend to repairs made by the use of parts, accessories, or fluids which are either incompatible with the unit or adversely affect its operation, performance, or durability.

Thermo Fisher Scientific reserves the right to change or improve the design of any unit without assuming any obligation to modify any unit previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

OUR OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND Thermo Fisher Scientific DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION.

Thermo Fisher Scientific ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to units sold in the United States. Any units sold elsewhere are warranted by the affiliated marketing company of Thermo Fisher Scientific. This warranty and all matters arising pursuant to it shall be governed by the law of the State of New Hampshire, United States. All legal actions brought in relation hereto shall be filed in the appropriate state or federal courts in New Hampshire, unless waived by Thermo Fisher Scientific.