Thermo Scientific
Horizon AC-FTS
Fogging Test Unit

Manual Part Number U01114
Rev. 03/24/2015

CE

Visit our Web site at:

http://www.thermoscientific.com/tc
Product Service Information, Applications Notes, MSDS Forms, e-mail.

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Table of Contents

Preface

Compliance

Refer to the Declaration of Conformity in the back of this manual.

WEEE

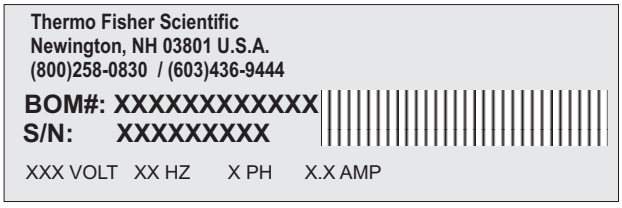
This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with this symbol.

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.thermofisher.com/WEEERoHS

After-sale Support

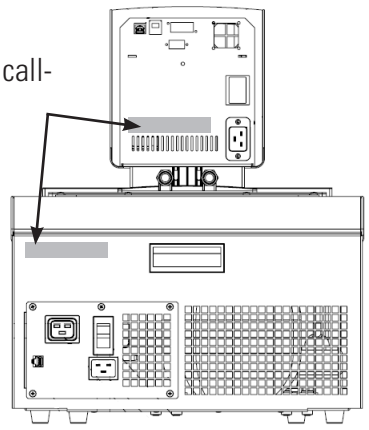
Thermo Fisher Scientific is committed to customer service both during and after the sale. If you have questions concerning the unit operation, or questions concerning spare parts or Service Contracts, call our Sales, Service and Customer Support phone number, see this manual's inside cover for contact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



Sample Nameplate

There can be up to three nameplates located on the rear of the unit. Before calling, please obtain the serial number printed on the complete system nameplate located on the upper rear of the bath.

Nameplate
Refer to nameplate when calling for after-sale support



Nameplates (Typical Locations)

Feedback

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

Warranty

Thermo Scientific Laboratory Temperature Control Products have a warranty against defective parts and workmanship for 36 months from date of shipment. See back page of this manual 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.

Refrigerated units should be left in an upright position for 24 hours before starting. This will ensure the lubrication oil has drained back into the compressor. ▲

Section 1 Safety

Safety Warnings

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

DANGER indicates an imminently hazardous situation which, if not avoided, *will* result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, *could* result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices.

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.

This label indicates read the manual.

Observe all warning labels. ▲

Never remove warning labels. ▲

Equipment construction provides protection against the risk of electrical shock by grounding appropriate metal parts. The protection will 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 circuit protector located on the rear of the circulator is not intended to act as a disconnecting means. ▲

Do not mount the immersion circulator backwards on the bath; the line cord could contact the reservoir fluid. Ensure the electrical cords do not come in contact with any of the plumbing connections or tubing. ▲

Operate the circulator using only the supplied line cord. If its power cord is used as the disconnecting device, it must be easily accessible at all times. ▲

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

Ensure the tubing you select meets your maximum temperature and pressure requirements. ▲

Ensure all communication and electrical connections are made prior to starting. ▲

Never operate the circulator without fluid in the bath reservoir. ▲

Other than water, before using any fluid, or when performing maintenance where contact with the fluid is likely, refer to the manufacturer's MSDS and EC Safety Data sheet for handling precautions. ▲

Ensure, that no toxic gases can be generated by the fluid. Flammable gases can build up over the fluid during usage. ▲

Never use corrosive or flammable fluids with the bath. Use of these fluids voids the manufacturer's warranty. ▲

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

Ensure the fluid is at a safe temperature (20°C to 55°C) before handling or draining. ▲

Never operate damaged or leaking equipment, or with any damaged cords. ▲

Never operate the equipment or add fluid to the reservoir with panels removed. ▲

Do not clean the FTS with solvents, only use a soft cloth and water. ▲

Drain the bath before it is transported and/or stored in, near or below freezing temperatures. ▲

Always turn the circulator off and disconnect the supply voltage from its power source before moving or before performing any service or maintenance procedures. ▲

Transport the equipment with care. Sudden jolts or drops can damage its components. ▲

Refer service and repairs to a qualified technician. ▲

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

Section 2 General Information

Description

The FTS consists of one PC or AC temperature control immersion circulator mounted to a Horizon bath. The outlet nozzle of the circulation pump guarantees uniform circulation of the heat transfer liquid throughout the bath. A specified temperature accuracy of ± 0.5°C is ensured throughout the entire bath while maintaining the necessary minimum distances between the beaker and bath wall as well as between the beaker and the bath base.

A frame fitted within the bath holds six glass beakers. The surface of the bath and the holder openings are sealed to prevent the heat transfer liquid vapors from condensing on the glass plates. A liquid level indicator, a bubble level and four adjusting screws for leveling the bath horizontally as well as six holders for storing the cooling plates when not being used are also included.

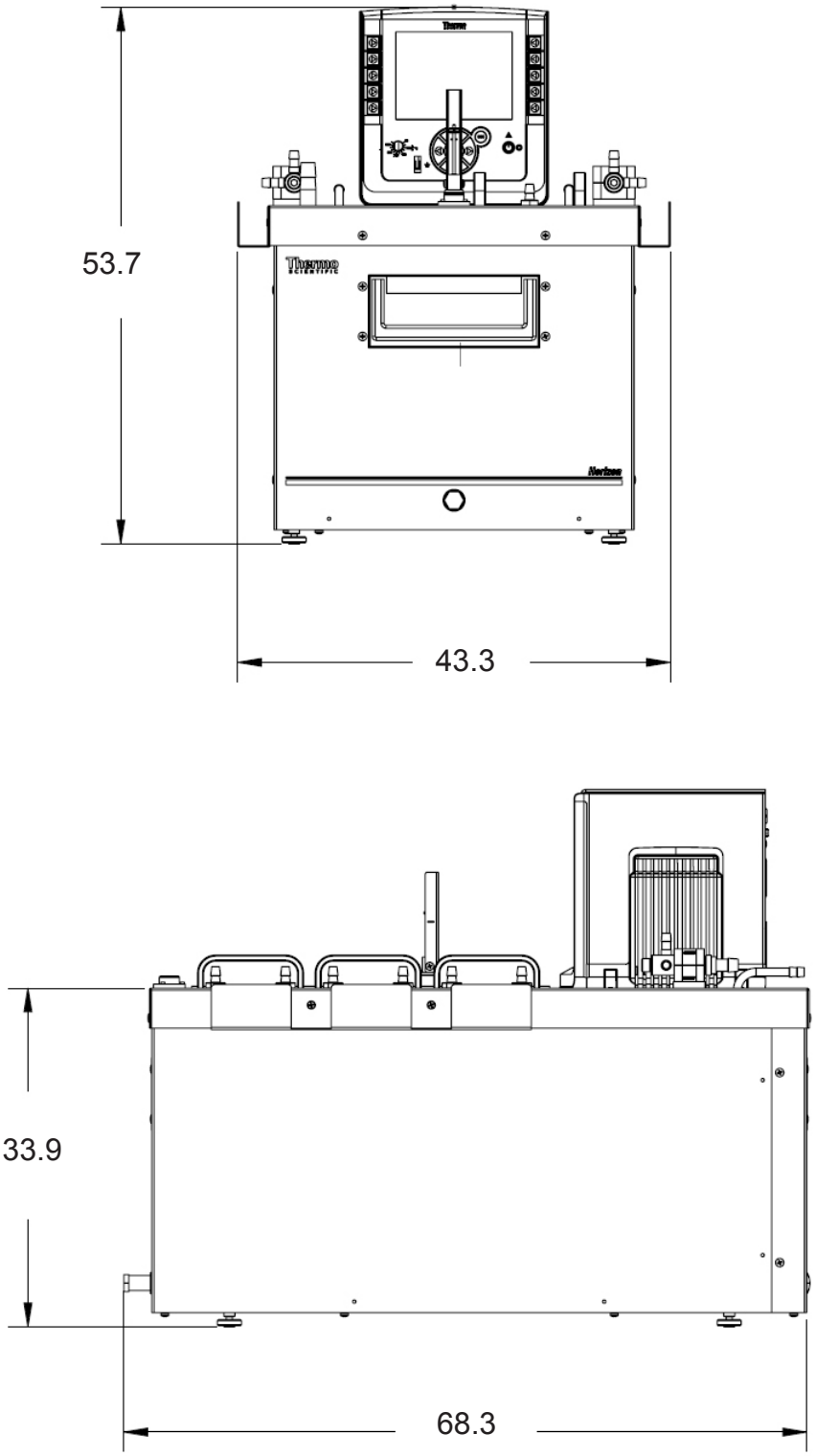
A refrigerated circulator ensures all six cooling plates are supplied with cooling water. The temperature difference between the plate inlet and outlet is not greater than 1°C. The high pump and cooling capacity of the refrigerated circulator ensures a tight temperature tolerance.

Specifications

	PC-FTS	AC-FTS
Working Temperature Range °C	45 to 200	45 to 200
Heater Capacity Watts 230V	3000	3000
Dimensions (W x L x H) cm	43.3 x 68.3 x 53.7 (see next page)	
Maximum Bath Volume liters	40	40
Bath Weight kilograms	43	43
Pumping Pressure		
Max flow rate lpm	24	20
Max pressure mbar	560	475
Pumping Suction		
Max flow rate lpm	24	20
Max pressure mbar	380	330
Total Wattage max 230 V	3150	3150

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

Dimensions (cm)



Accessories

Accessory kits are available:

Reflectometer Method Kit:	Gravimetric Method Kit:
Float glass 096-452	Float glass 096-451
Borosilicate glass 097-339	Borosilicate glass 097-340

Kit components are also available:

Six aluminum cooling plates, 333-0285, contact the surface to the glass plate. They are hollow and are cooled by the refrigerated circulator.

FOG 150 heat transfer fluid, 4 x 10 liters required, 999-0063.

Six glass beakers, 333-0276, made from heat-resistant glass and have a level base. The beakers are filled with the required quantities of raw materials.

Six metal rings, 333-0286, made from chrome-plated steel and keep the sample pressed onto the base of the beakers.
Outer diameter: 80 mm
Inner diameter: 74 mm
Height: 10 mm
Weight: 55 ± 1g

Six fluoroelastomer sealing rings, 333-0278, used as a seal between the ground collar of the beakers and the glass plates. They are designed as toroidal sealing rings.
Inner diameter: 95 ± 1 mm
Cross section: 4 ± 0.1 mm ø
Hardness: 65 ± 5 Shore A

Six support rings, 002-1658, used for stabilizing the sealing rings to simplifying handling.

Six square glass plates, 333-0288 for float glass and 097-262 for Borosilicate glass, to collect the fogging condensation. A variation range of ± 2 % from the permissible reflectometer value Roi is allowed.

Both sides of the glass plates can be used. Due to the high glass quality no identification of the active side of the plate is necessary according to ISO 6452.
Dimensions: 110 x 110 mm
Glass thickness: 3 ± 0.2 mm

Six round glass plates, 333-0443 for float glass and 097-261 for Borosilicate glass, for the round aluminum foils.
Dimensions: 103 0/-1 mm ø
Glass thickness: 3 ± 0.2 mm

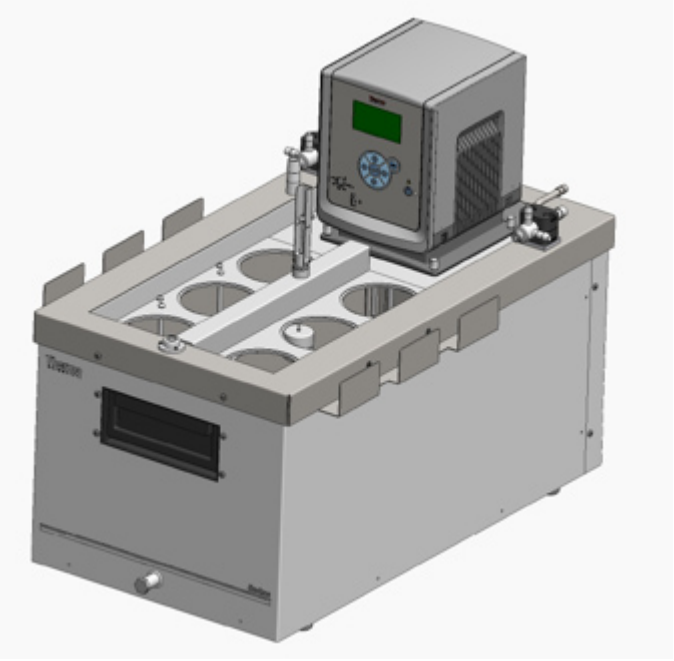
One set of round foils, 333-0442, containing approximately 200 foils used for gravimetric method only. One foil is used per test.

Section 3 Installation

Ambient Conditions

Ambient Temperature Range	5°C to 40°C (41°F to 104°F)
Maximum Relative Humidity	80% at 31°C (88°F)
Operating Altitude	Sea Level to 2000 meters (6560 feet)
Overvoltage Category	II
Pollution Degree	2
Degree of Protection	IP 20

The FTS is designed for continuous operation and for indoor use.



CAUTION

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

Electrical Requirements

DANGER

FTS construction provides protection against the risk of electrical shock by grounding appropriate metal parts. The protection will 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 FTS is intended for use on a dedicated outlet. All circulators are equipped with automatic thermally-triggered 20 Amp circuit protector.

Note If the circuit protector activates allow the FTS to cool before resetting. Restart the FTS. Contact us if it activates again. ▲

The circuit protection is designed to protect the FTS, and is not intended as a substitute for branch circuit protection. Position the FTS so it is not difficult to operate the disconnecting device.

CAUTION

If the FTS's power cord is used as the disconnecting device, it must be easily accessible at all times. ▲

Refer to the bath nameplate on the rear, upper-left-hand corner of the bath for specific electrical requirements. Voltage deviations of ± 10% are permissible. The outlet must be rated as suitable for the total power consumption of the FTS.

Remote Temperature Sensor

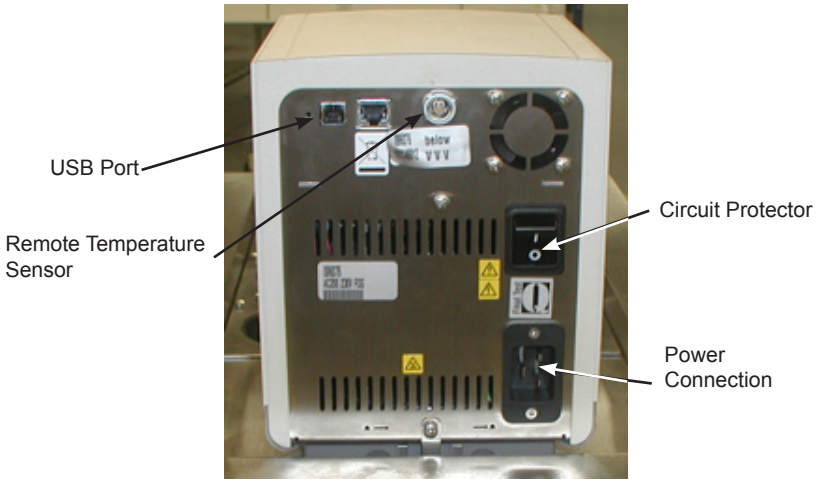
The remote temperature sensor on the rear of the immersion circulator requires a 4-pin connector that must mate to a LEMO # ECP.1S.304.CLL. The immersion circulator uses a 3 wire sensor, but a 4 wire sensor can be used (pins 3 and 4 are interconnected in the control head). The pin-out is:

Pin 1 and 2 = Pt100 + Pin 3 and 4 = Pt100 -

See Section 4 for instructions to enable the remote sensor.

USB Port

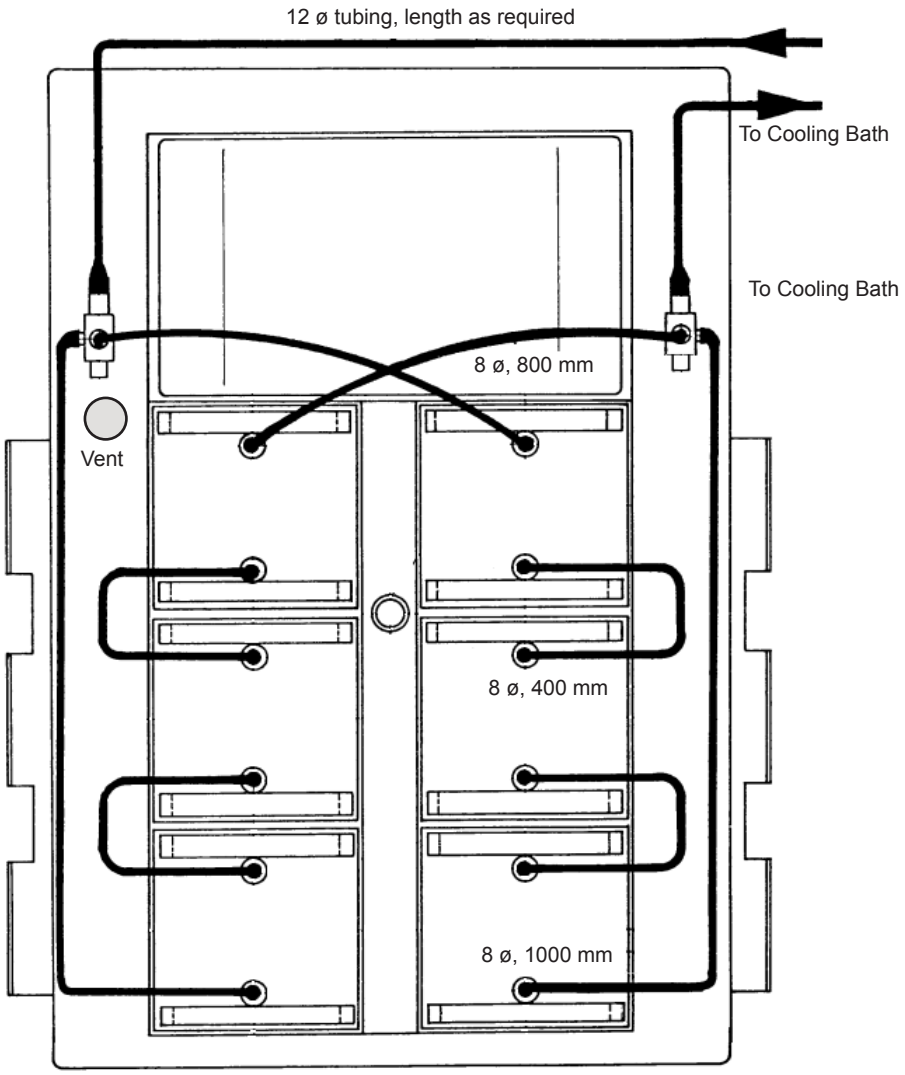
If your computer does not automatically recognize the USB driver, installation instructions are provided in Section 6.



Hose Connections

Cooling plate connections

Connect the six cooling plates in accordance with the following hose diagram and establish hose connection to the refrigerating circulator.



Tap water cooling

Normally tap water cooling is not necessary. It is used for a quick cooling down of the bath only.

Use hoses with 8mm internal ø and connect them to the tab water cooling coil. The direction of the flow does not matter but ensure that the outlet side is not blocked.

Fluids

DANGER

The user is always responsible for the fluid used. Never use corrosive fluids with the FTS. ▲

DANGER

Never use 100% glycol. ▲

CAUTION

Handle and dispose liquids, other than water, in accordance with the fluid manufacturer's specification and/or the MSDS. ▲

We recommend using FOG 150 heat transfer fluid, 4 x 10 liters required (part number 999-0063).

Filling Requirements

Ensure the reservoir drain port on the front of the Horizon bath is *closed* and that all plumbing connections are secure. Also ensure any residue is thoroughly removed before refilling.

CAUTION

Before using any fluid refer to the manufacturer's MSDS and EC safety data sheets for handling precautions. ▲

Level the entire bath using of the four adjustable feet.

Insert five glass beakers and fill in approximately 20 liters of bath liquid through the remaining opening.

Insert the sixth glass beaker and place five cooling plates on the glass beakers to prevent them from floating up.

Using a funnel, fill in the remainder of the bath liquid through the vent until the liquid level at the uncovered glass beaker is 56 mm ±2 mm below the ground seating area.

Loosen the red indicator plate. Lower the float onto the surface of the bath liquid and fasten indicator plate at the level of the cutouts on the metal housing.

Finally install the sixth glass plate.

Draining

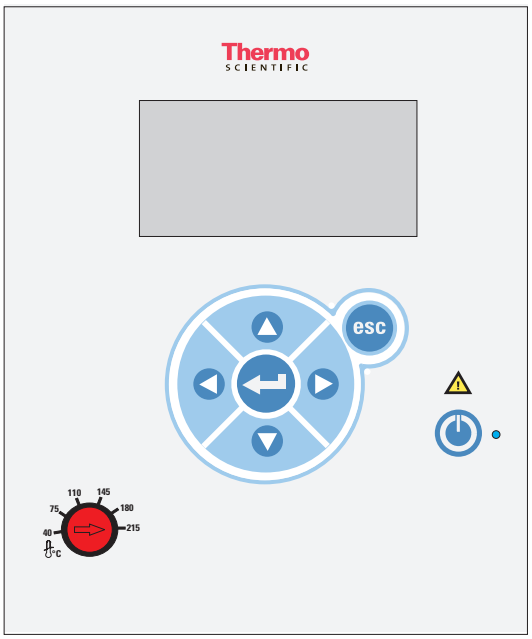
Ensure the fluid is at a safe handling temperature, ~55°C. Wear protective clothing and gloves. ▲

- place a suitable vessel underneath the drain. If desired, attach an 8 mm id tube on the drain.
- *slowly* turn the drain plug until flow is observed.

Section 4 Operation

ADVANCED Heated Immersion Circulator

The Thermo Scientific ADVANCED Heated Immersion Circulators have a digital display and easy-to-use touch pad, five programmable setpoint temperatures, acoustic and optical alarms. Some circulators offer adjustable high temperature protection.



This label indicates read the instruction manual before starting the circulator.

Use this button to place the circulator in and out of stand by. The blue LED illuminates when stand by is enabled.

Use these navigation arrows to move through the circulator displays and to adjust values.

Pressing this button once to make changes on the immersion circulator's display screen. In most cases, pressing it again is required to save the change.

Use this button to cancel any changes and to return the immersion circulator to its previous display. Canceling a change can only be made before the change is saved. In some cases, it is also used to save changes.

Note Holding this button for five seconds resets the display contrast to the default level and also brings up the language menu to change, if needed, the displayed language. See **Settings-Display Options** in this Section. ▲

Used for adjusting and resetting the High Temperature Cutout. Not all circulators are equipped with this feature. Details are explained in this Section.

Setup

⚠ CAUTION

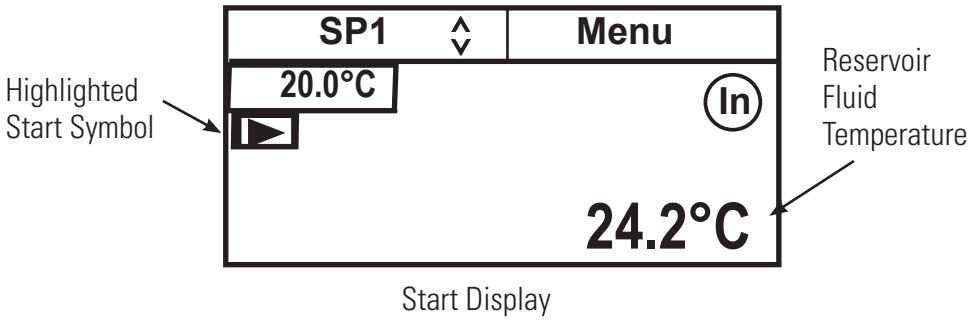
Before starting the circulator, double check all USB (optional), electrical and plumbing connections. ▲

Start Up

Do not run the circulator until fluid is added to the bath. Have extra fluid on hand. If the circulator does not start refer to Section 5.

- Place the circuit protector located on the back of the circulator to the **I** position. The blue LED on the front panel illuminates.

- Press  , the Start Display appears. The blue LED goes out.
- Ensure the start symbol has a highlight box around it, if not use the arrow keys to navigate to the symbol.



Start Display

- Press  . The circulator starts and the start symbol turns into a stop symbol (■).

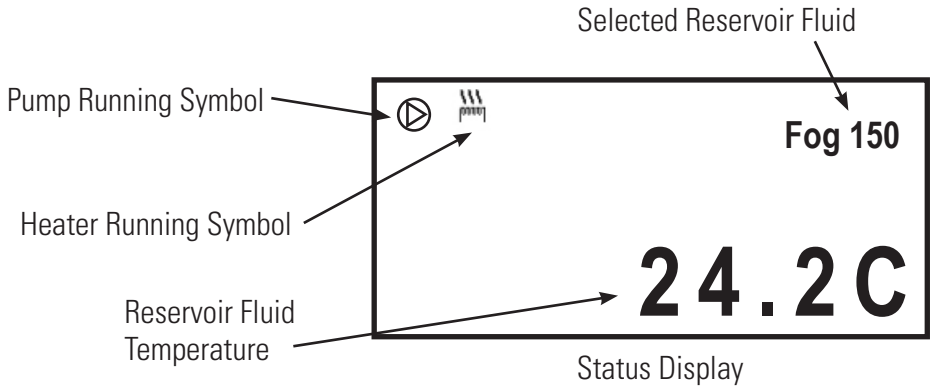
Note After start up, check all the plumbing connections for leaks. ▲

The **SP1** and **Menu** portions on the top of the display are used to view and/or change the circulator's settings. They are explained in detail later in this Section.

(In) indicates the circulator is using its internal sensor for temperature control. (Ex) is displayed when the optional external sensor is selected for temperature control.

Status Display

If desired, press esc to toggle between the Start/Status Displays.



Note If no operator inputs are being made to the circulator it automatically switches to the Status Display after 60 seconds. If desired, change the time or disable this feature using the **Display Options**

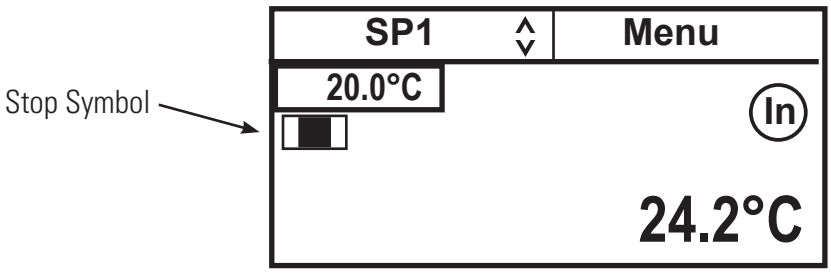
Stand By Mode

Press , the circulator's display goes blank and enters the stand by mode. The blue LED on the front panel illuminates.

Stopping the Circulator

Ensure the stop symbol is highlighted, if not use the arrow keys to navigate to the symbol.

Press . The circulator stops and the stop symbol turns into a start symbol (▶).



Power Down

Press  , the circulator display goes blank and enters the stand by mode. The blue LED on the front panel illuminates.

Shut Down

Place the circuit protector on the back of the circulator to the **O** position. The blue LED extinguishes.

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

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

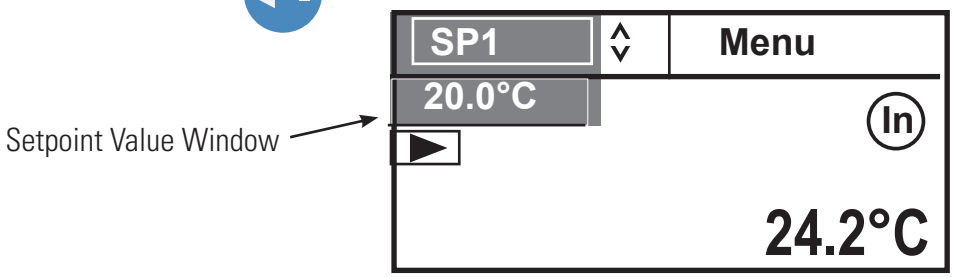
Changing the Setpoint

Note You cannot adjust the setpoint closer than 0.1°C to either of the fluid's system limits, see Fluids Type in this Section, or beyond the bath's temperature range. ▲

The setpoint can be changed with the circulator running or not.

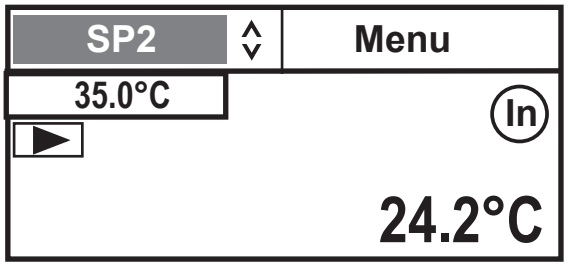
The Setpoint is the desired fluid temperature. The circulator can store up to five setpoints, **SP1** through **SP5**. The procedure for changing the stored setpoint values is discussed later in this Section.

Use the navigation arrows and move to the **SP1** window and then press to highlight it as shown below.

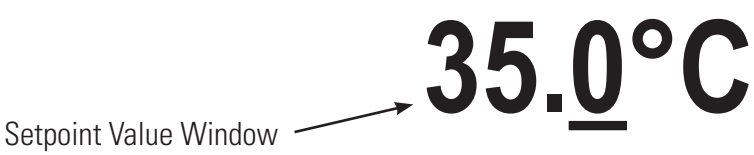


Use the up and down navigation arrows to bring up the desired setpoint and then press .

The display on the Setpoint Value Window now indicates the corresponding setpoint's stored value.



If desired, you can change the displayed setpoint value by using the navigation arrows to highlight the Setpoint Value Window and then pressing . The right-most digit now has a cursor beneath it.



Use the left and right arrows to move the cursor to the desired digit and then use the up and down arrows to change the value. Once all the desired changes are made, press to save the change.

Note Using this procedure also changes the setpoint's stored value. ▲

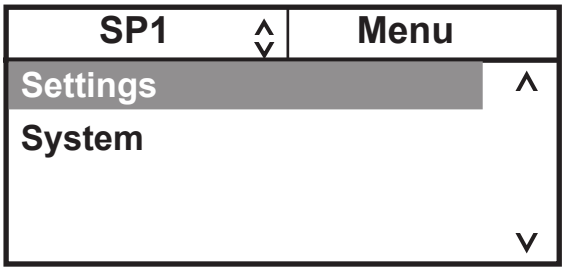
Menu Displays

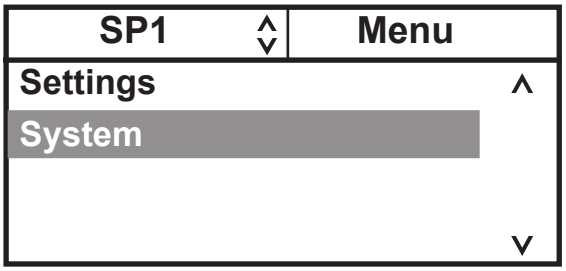
The circulator uses menus to view/change the settings.

Note The circulator does not need to be running to view/change these settings. ▲

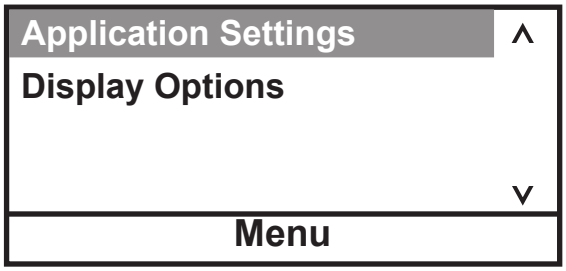
For all Menu displays, once  is pressed to change a display, you can press  to return to the previous screen.

1. Use the arrow buttons to highlight **Menu** and the circulator brings up the Main Menu Display.

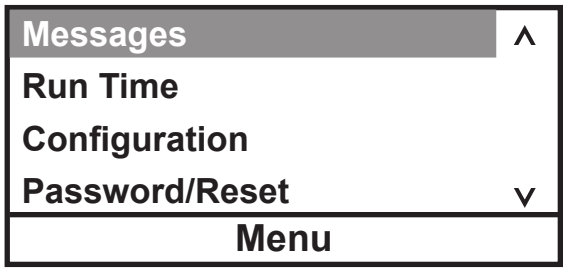




2. Use the up and down arrow to highlight the desired setting and then press  to bring up additional submenus.



See page 4-8.



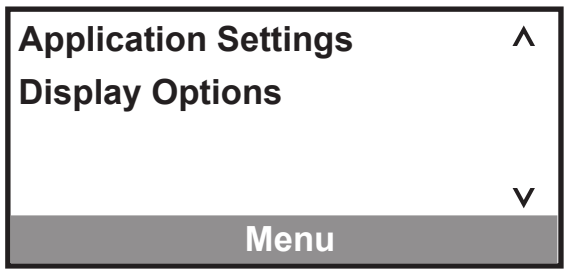
See page 4-17.

Since the circulator can only display five lines of text at a time, keep pressing the down arrow to view any additional options.

Menu

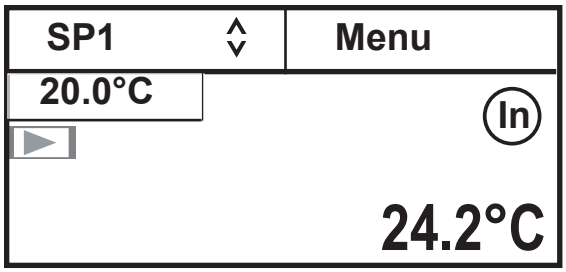
The **Menu** line, at the bottom of all the submenu displays, is another way to return the circulator back to the Main Menu Display.

1. From any submenu display, use the down arrow button to highlight **Menu**.



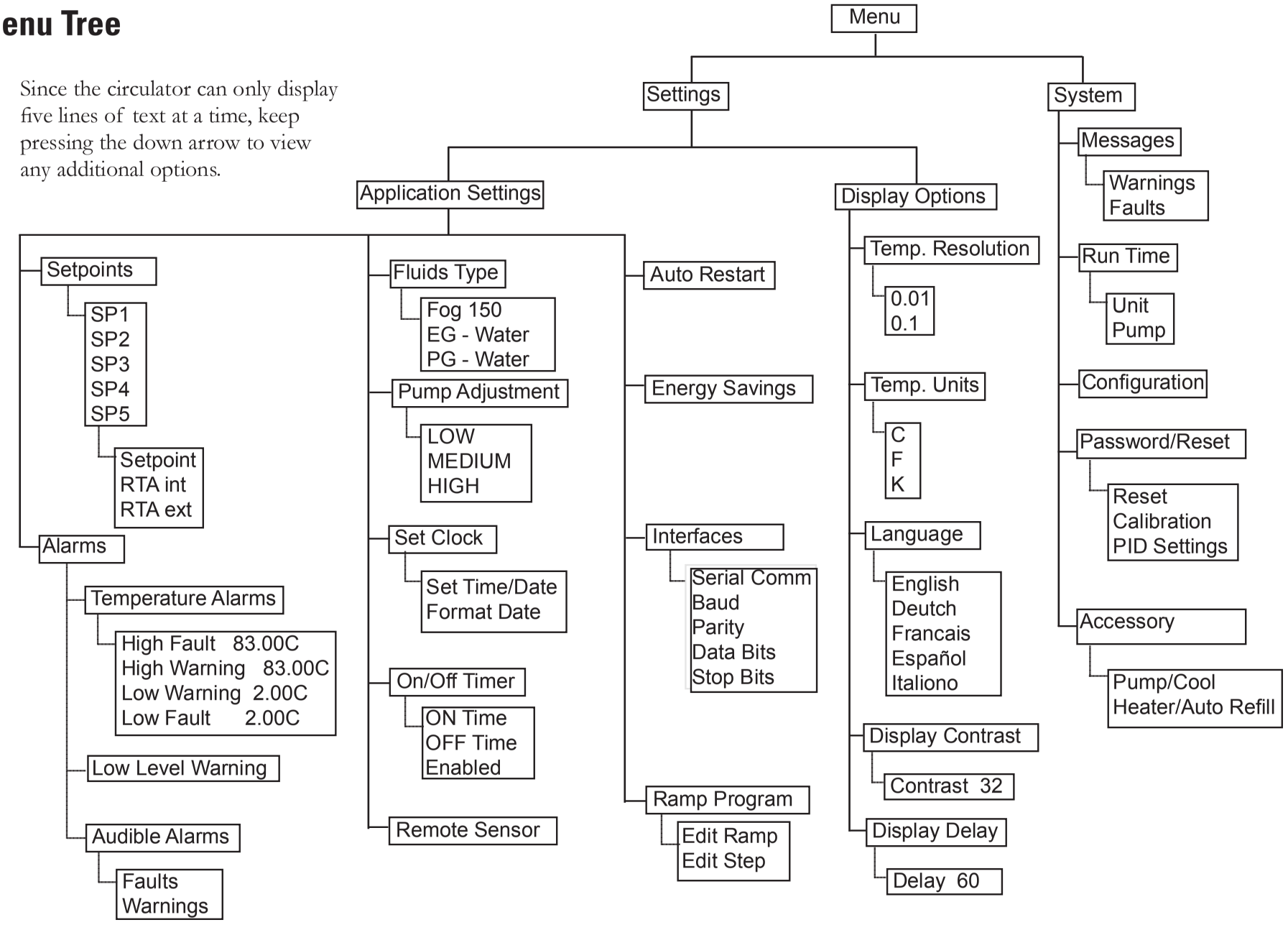
Note Pressing  from the **Menu** line returns you to the previous screen. ▲

2. Press  to return to the Start Display.



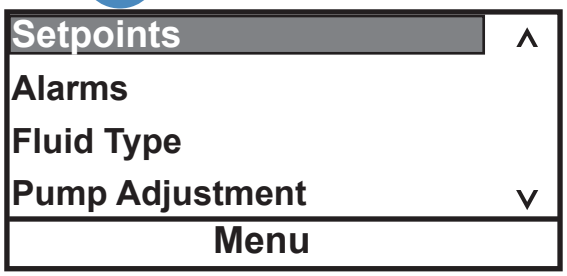
Menu Tree

Since the circulator can only display five lines of text at a time, keep pressing the down arrow to view any additional options.

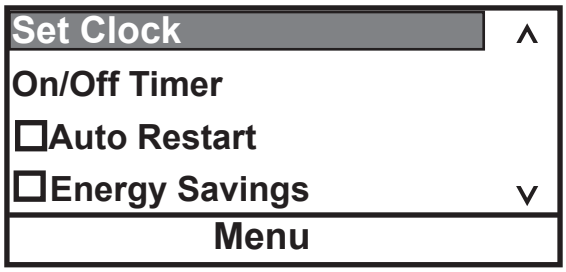


Settings - Application Settings is used to view/adjust the circulator's five Setpoints and Real Temperature Adjustments (RTA) enable/disable the alarms, change the fluid type, set the pump speed, configure the interfaces (optional), set the clock, turn the timer on or off, and turn auto restart and energy savings on or off.

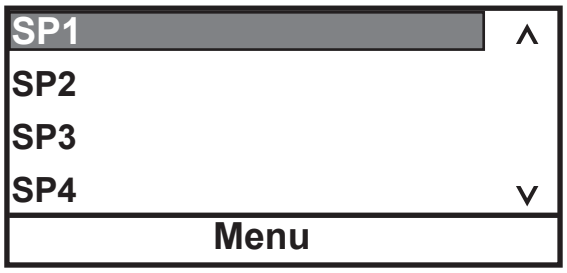
1. With **Application Settings** highlighted press  to view:



2. Scroll down for additional options.

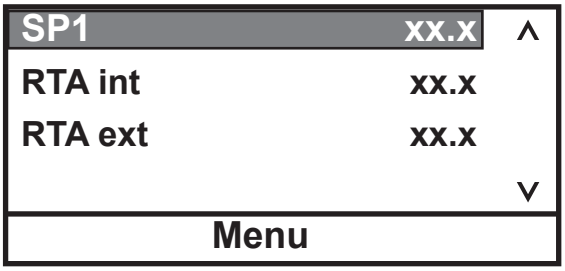


3. With **Setpoints** highlighted, press  to display the list. Use the up/down arrows to highlight the desired **SP**. **Note** Use the down arrow to display **SP5**. ▲



4. Press  .

The Setpoint and RTA are changed using the same procedure. With the desired setpoint highlighted press  to display the submenu.



If this temperature on the Start/Status Displays does not accurately reflect the actual temperature in the bath, an RTA can be applied. The RTA can be set ±10°C (±18°F).

As an example, if the circulator's temperature is stabilized and displaying 20°C but a calibrated reference thermometer reads 20.5°C, set the RTA to -0.5°C. After you enter a RTA value allow circulator to stabilize before verifying the temperature in the bath. **Note** If display accuracy is required, we recommend repeating this procedure at various setpoint temperatures and on a regular basis. ▲

Note You cannot adjust the setpoint closer than 0.1°C to either of the fluid's system limits, see Fluids Type in this Section. ▲

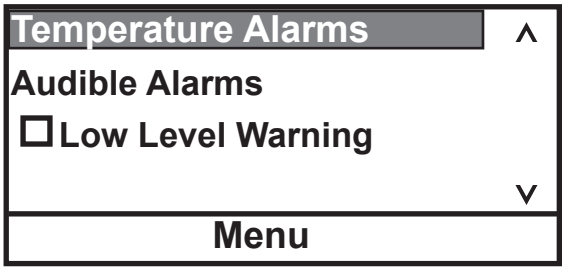
5. With the desired line highlighted press  .

The right-most digit now has a cursor beneath it. Use the left and right arrows to move the cursor to the desired digit and then use the up and down arrows to change the value. Once all the desired changes are made, press  to save the change or  to cancel it.

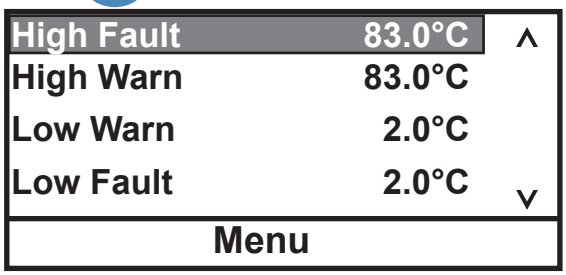
35.0°C

Alarms is used to view/adjust the high and low temperature alarm limits, to enable/disable the audible alarms and to configure the low level warning reaction.

1. With **Alarms** highlighted, press ↵ to display:



2. With **Temperature Alarms** highlighted, press ↵ to display:



3. Highlight the desired limit and press ↵. Follow the same procedure used to change a setpoint.

If the Fault temperature is exceeded the circulator shuts down and, if enabled, the audible alarm sounds. If the Warn temperature is exceeded the circulator continues to run and, if enabled, the audible alarm sounds. In both cases a message is displayed.

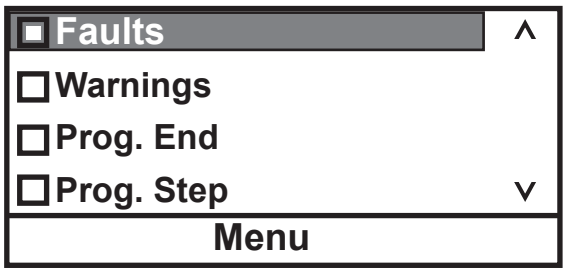
High Fault cannot be set below **High Warn**.
High Warn cannot be set below **Low Warn**.
Low Fault cannot be set above **High Warn**.

Press esc to return to the previous display.

Note When changing the temperature alarms the current setpoint is also changed if it falls outside the new limits. ▲

1. With **Audible Alarms** highlighted, press ↵ to display the alarms.

Highlight the desired alarm and press ↵ to toggle between enable and disable mode.

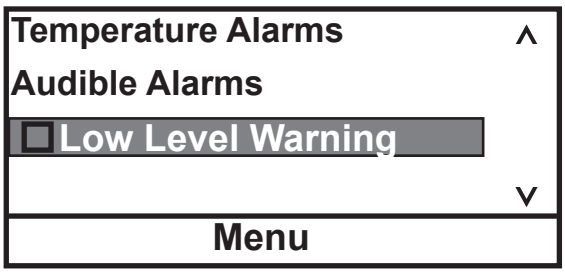


If **Faults** is enabled the alarm sounds when a fault occurs. If **Warnings** is enabled the alarm sounds when a warning occurs.

If **Prog. End** is enabled the circulator beeps twice at the end of each cycle and three times at the end of the program. If **Prog. Step** is enabled the circulator beeps once at the beginning of the program and once at the end of each step.

Press esc to return to the previous display.

1. With **Low Level** highlighted, press ↵ to toggle the low level warning alarm on/off:

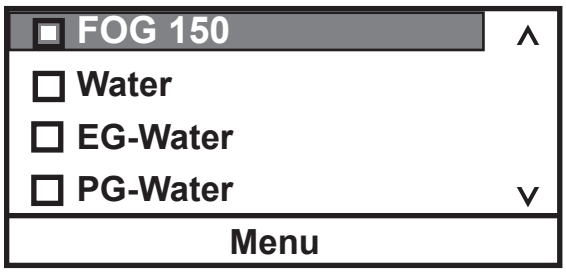


Press esc to return to the previous display.

Fluids Type is used to identify the type of fluid used. The circulator uses the fluid type to automatically set certain operating parameters.

1. With **Fluid Type** highlighted, press ↵ to display the list of acceptable fluids.

Highlight the desired fluid and then press ↵ to select it.



2. With the desired fluid selected press esc to return to the previous display.

Note The circulator's operating range is determined by the currently selected fluid. When a new fluid is selected the circulator, if necessary, automatically adjusts the temperature alarms and/or setpoint. ▲

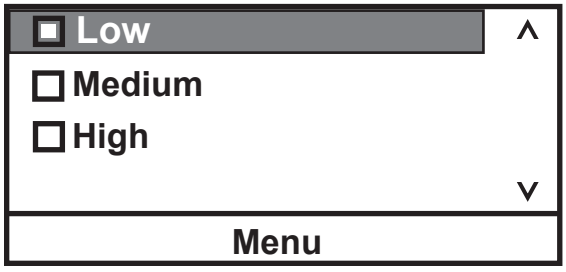
Fluid system limits:	High °C	Low °C
Fog 150	+150	+5
Water	+100	+5
Glycol-Water	+100	-30
SIL 100	+75	-75
SIL 180	+200	-40
SIL 300	+200	+80
SYNTH 60	+45	-50
SYNTH 200	+200	+30
SYNTH 260	+200	+45
Other	+200	-90

Note When using oil as a reservoir fluid, we recommend running the bath at 95°C for 15 minutes to remove any moisture in the fluid. ▲

Pump Adjustment is used to review/set the desired pump speed.

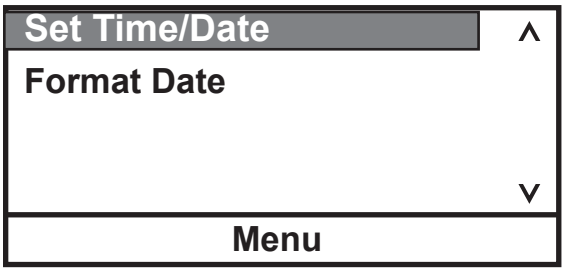
1. With **Pump Adjustment** highlighted, press ↵ to display the speeds.

Highlight the desired speed and press ↵ to select it.



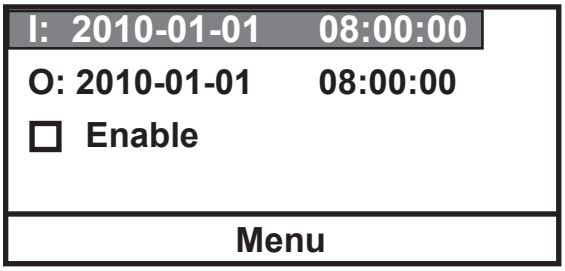
Set Clock is used to set the circulator's **Set Time/Date** (**hr : min : sec**) and date (**year - month - day**).

Format Date is only applied to the date sent out the serial interface **DD/MM/YYYY** or **MM/DD/YYYY**. The date displayed on the circulator is fixed at **year - month - day**.



On/Off Timer is used to enable and set the circulator's timer.

1. With **On/Off Timer** highlighted, press to display the on (**I**) and off (**O**) time as well as the enable box.



After setting the on and off times select **Enable** to activate the timer.

Remote Sensor is used to enable the optional remote temperature sensor feature, see Section 3.

1. With optional **Remote Sensor** highlighted, press to toggle between enable and disable.

Auto Restart is used to enable the auto restart feature. When enabled, the immersion circulator automatically restarts after a power failure or power interruption condition. If a ramp was running when power failed, the ramp program resumes where it left off.

1. With **Auto Restart** highlighted, press to toggle between enable and disable.

Energy Saving is a feature only used on refrigerated baths.

Edit - Ramp Program

Edit Ramp Program is used to view/adjust the immersion circulator's program function.

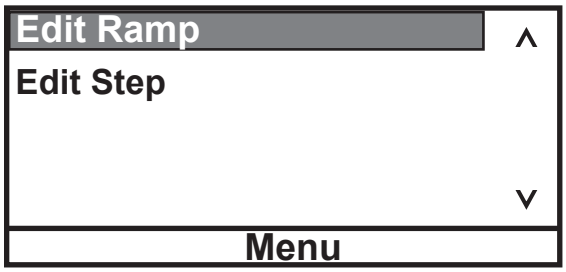
Define your program as a series of setpoints with a known period of time interval between each. Each interval is one step of the program. Pay careful attention to the first part of your program. What conditions must exist at the beginning of your process? For example, at the starting setpoint you may wish to program an initial period of constant temperature to allow for thermal stabilization.

Note Consider the circulator's limitations when designing programs. Temperature or time parameters which exceed the performance capabilities of the circulator will result in unsatisfactory operation. If reaching the ramp setpoint temperatures is important, you will have to operate the bath between the desired setpoints and note the duration before programming the ramp. ▲

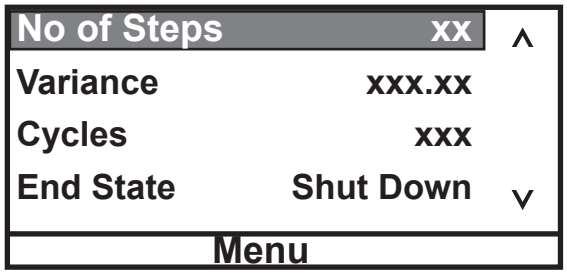
It is possible to create a program calling for very rapid changes in temperature. Although the circulator may not be capable of producing such changes, it may be practical to program such steps as a way to cause the fastest possible temperature change.

The ramp program has an optional **Assured Soak** feature that can be enabled for each step independently. When enabled this feature pauses the ramp timer while the temperature reaches setpoint, ± variance. This assures the temperature reaches setpoint before the ramp program continues to the next step.

1. With **Ramp Program** highlighted press to display:



2. With **Edit Ramp** highlighted press to display:



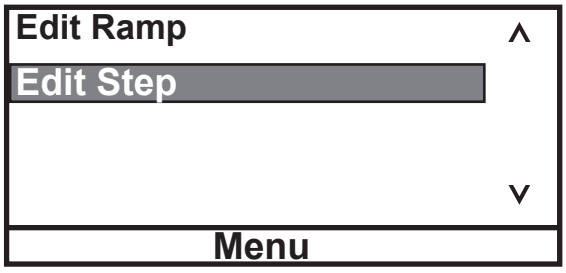
The ramp can have up to 30 **Steps**.

The **Variance** is used to set a temperature range, the program starts when the fluid temperature is within this range. For example, if the desired **Start Temp** is 25°C and the **Variance** is set to +5°C, the program automatically starts when the bath temperature is between 20°C to 30°C.

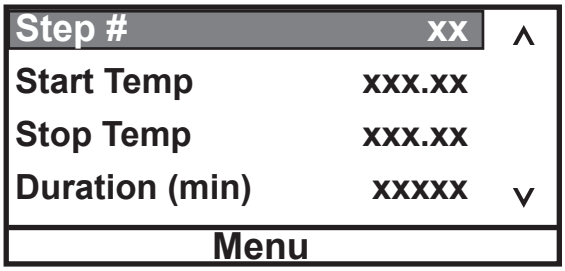
Cycles sets the number of times the entire ramp program is repeated after the last step is completed. For example, selecting 3 **Cycles** runs the entire ramp program a total of 3 times.

End State configures the circulator to either **Shut Down** or continue running (**Maintain**) when the program is over.

3. Once the **Edit Ramp** portion is complete press esc and then highlight **Edit Step**.



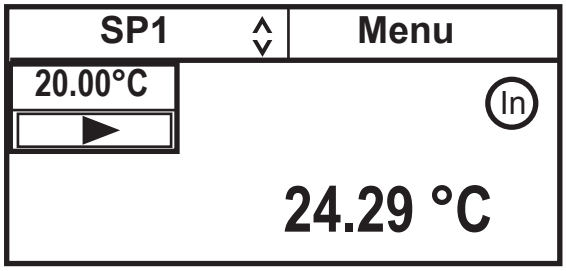
4. Use **Edit Step** to enter the parameters for each step.



5. The **Duration** can be up to 1000 minutes.

Scroll down to view the **Assured Soak** feature.

6. After all the desired steps are built, keep pressing esc until the Start Display appears.

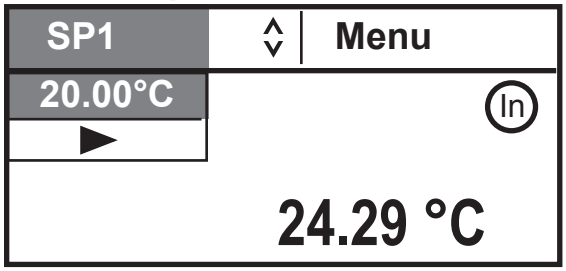


You can enable an alarm to sound when each step and/or the program is complete, see **Settings - Basic Settings** in this section.

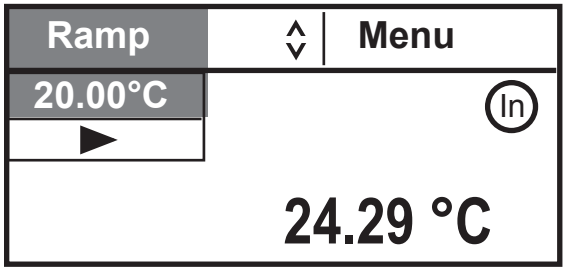
Running a Ramp Program

Highlighting **Ramp**, see step 2, with the circulator running causes the bath temperature to go to the ramp **Start Temp**, the temperature remains there until the ramp is started.

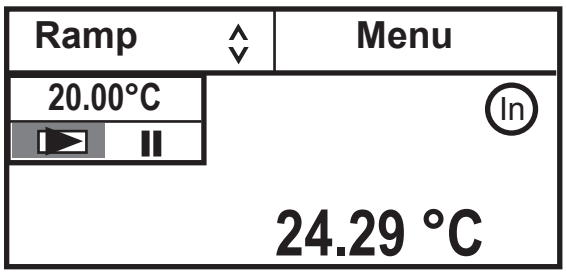
1. Use the arrow keys to highlight the **SP** display and press .



2. Press the up arrow key until the window displays **Ramp**.



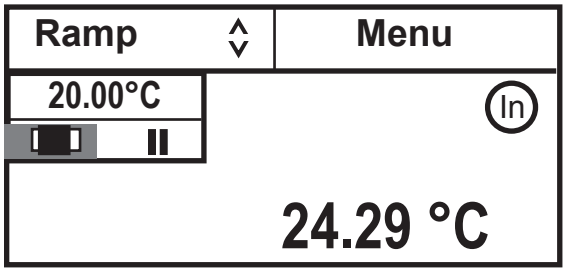
3. Press and the circulator displays the start ▶ and pause/resume ⏸ program symbols. Highlight the start symbol .



4. With the start symbol highlighted, press to start the program. The start symbol changes into a highlighted stop program symbol .

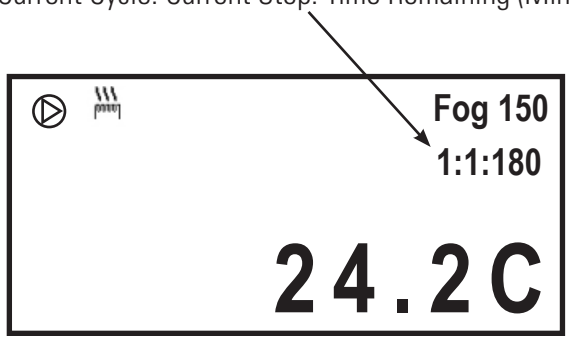
Note With the stop symbol highlighted, pressing shuts down the circulator . ▲

The program does not start until the process fluid temperature is at the **Step 1 Start Temp** ± the **Variance**.



Switching to the Status Display while a ramp program is running shows the status and time remaining. **Note** If assured soak is enabled the time stops counting down at the end of the step until the desired temperature ± variance is reached. ▲

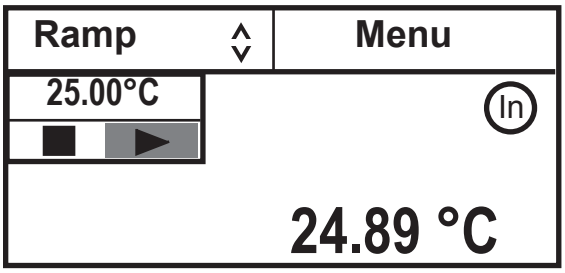
Current Cycle: Current Step: Time Remaining (Minutes)

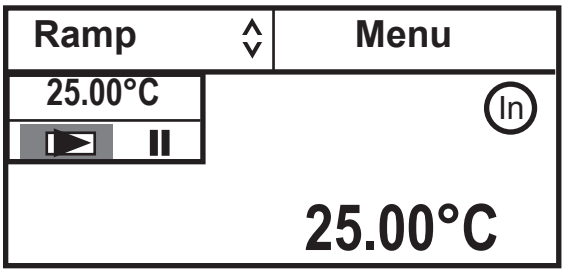


5. To pause the program at the current temperature, highlight the pause program symbol ▮▮ and press .

To restart the program press again.

6. When the program is complete the circulator maintains the last setpoint.



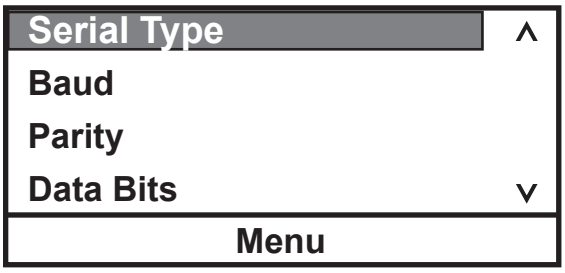


When is pressed after the ramp program is complete the refrigeration, pump and circulator shut off.

Interfaces is used to enable/configure the serial communications feature.

1. With **Interfaces** highlighted, press to display the list of parameters.

Highlight the desired parameter and press to view the available options.



Available options:

Serial Type	Off, RS232, RS485 or Analog IO
Baud	19200, 9600, 4800, 2400, 1200, 600 or 300
Parity	None, Odd or Even
Data Bits	8 or 7
Stop Bits	1 or 2

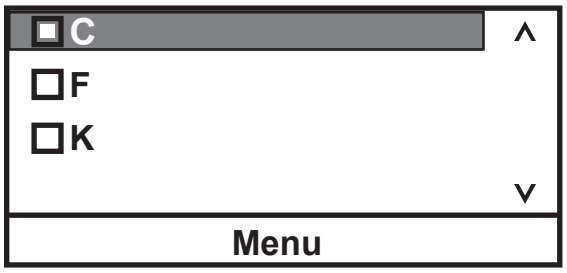
Supported protocols: AC, Standard, NC, Namur

See the Appendix for additional information.

Settings - Display Options is used to view/adjust the circulator's Temperature Units, the Temperature Resolution, the displayed Language, the Display Contrast and the Display Delay.

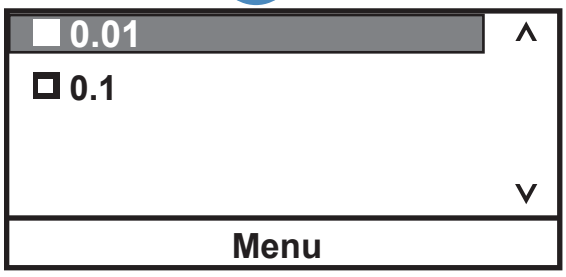
1. With **Temp. Unit** highlighted press . Use the up/down arrows to highlight the desired temperature scale.

Press .



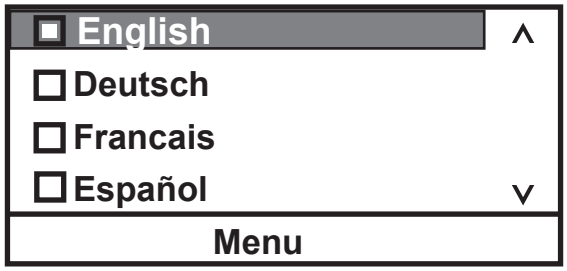
2. With **Temp. Resolution** highlighted press .

Use the up/down arrows to highlight the desired resolution. Press .



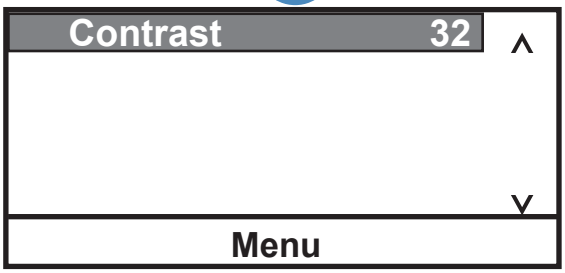
3. With **Language** highlighted press . Use the up/down arrows to highlight the desired language. Scroll down for Italian.

Press .



4. With **Display Contrast** highlighted press .

Press again and use the up/down arrows keys to change the contrast. With the desired contrast showing, press again.

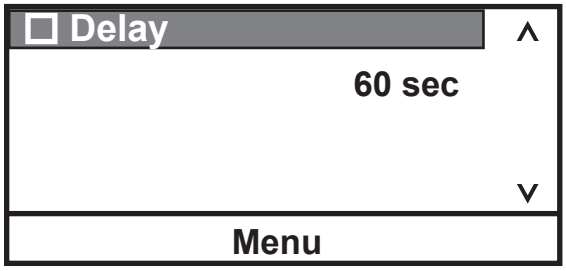


Note Holding esc for five seconds resets the display contrast to the default level and also brings up the language menu to change, if needed, the displayed language. ▲

5. With **Display Delay** highlighted press to enable/disable it.

Use the up/down arrows to highlight the time and press again.

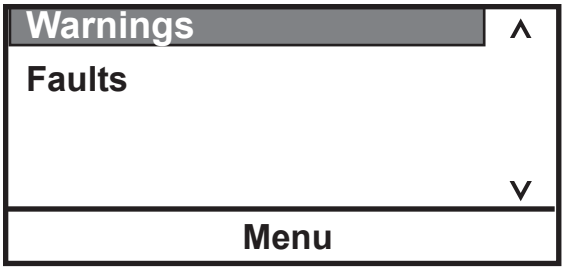
Use the up/down arrows to change the value. Once the desired delay is displayed press .



With **Display Delay** enabled and the Start Display showing, if no arrows are pressed the Start Display changes to the Status Display after the delay expires, see pages 4-2 and 4-3.

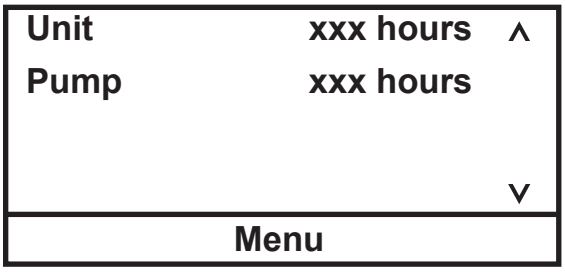
System Messages is used to view any Warning or Fault messages.

1. With **Messages** highlighted, press  to display the options.



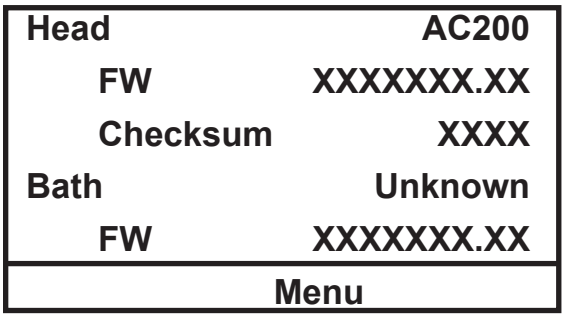
System Run Time is used to view the circulator (**Unit**) and pump operating hours.

1. With **Run Time** highlighted, press  to display the times.



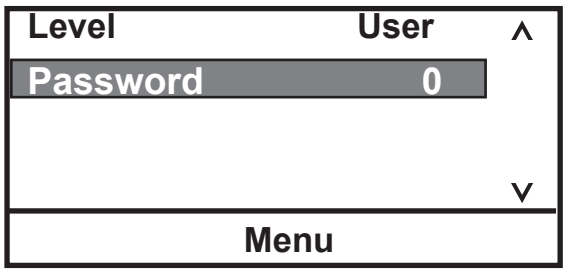
System Configuration is used to view the circulator's configuration.

1. With **Configuration** highlighted, press  to display the settings.

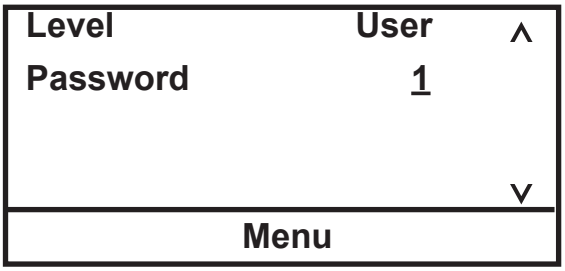


System - Password/Reset is used only by a qualified technician. Changing the password enables circulator reset options, the temperature sensor calibration procedure and displays PID values.

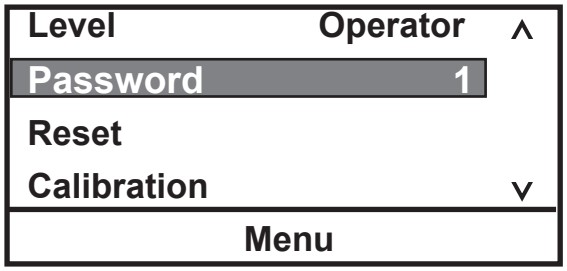
1. With **Password/Reset** highlighted, press to display:



2. Press and change the number to **1**.



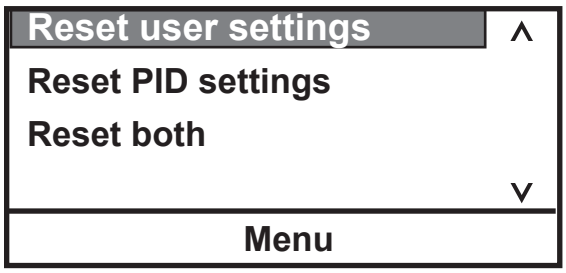
3. Press to display:



Scroll down to display **PID Tuning**.

Note The circulator resets to the **User** mode when it is turned off. The circulator also resets to the **User** mode when the Start/Status Display is displayed continuously for 10 minutes. ▲

1. If desired, highlight **Reset** and press to display:

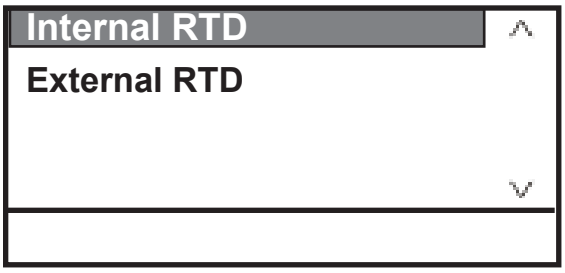


Highlight the desired reset option and press .

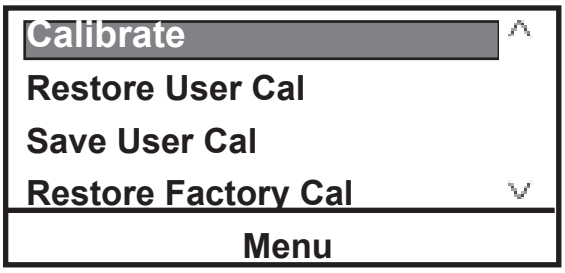
A confirmation message appears, press again.

Note Ensure the RTA is set to 0 before doing a calibration. ▲

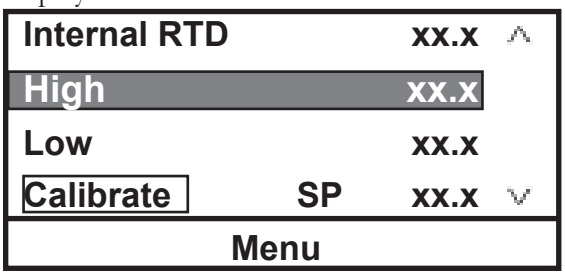
1. To calibrate the temperature sensor highlight **Calibration** and press ↵ to display:



2. With the desired sensor highlighted, press ↵ to display:



3. With **Calibrate** highlighted, press ↵ to display:



4. Set the temperature **SP** to the desired high cal setpoint. After the temperature has stabilized highlight **High** and press ↵.

Enter the temperature as measured by a calibrated sensor and press ↵ again to save the value. Next set the temperature **SP** to the desired low cal setpoint. After the temperature is stabilized for several minutes highlight **Low**. Press ↵ and enter the temperature measured by a calibrated sensor. Press ↵ again to save the value.

Lastly, highlight **Calibrate** and press ↵. The circulator calculates the new calibration values.

Note When the controlling RTD is selected for calibration, the setpoint can be changed within the Calibration Menu by highlighting **SP**, pressing ↵, entering the desired value and then pressing ↵ again. ▲

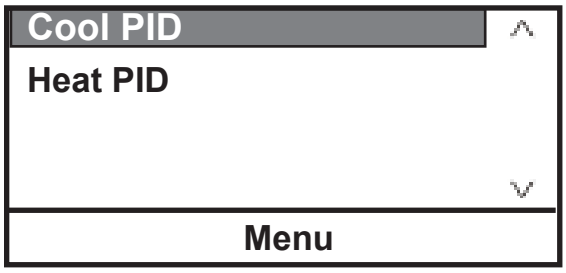
Once the calibration is complete you can store it into the circulator's memory by selecting **Save User Cal** and pressing ↵.

You can later restore the same calibration by highlighting **Restore User Cal** and pressing ↵.

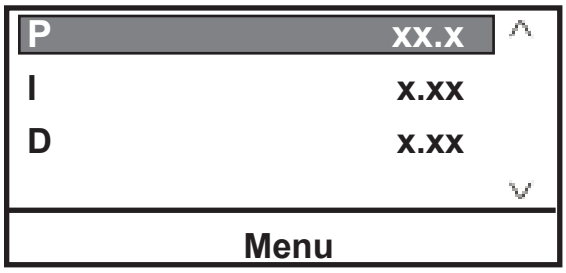
Another option is to restore the factory calibration values by highlighting **Restore Factory Cal** and pressing ↵.

The **Save Factory Cal** option is designed to be used only by a qualified technician.

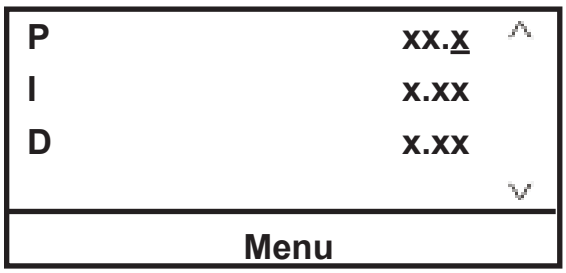
1. With **PID Tuning** highlighted, press to display:



2. Highlight the desired PID and press to display:



3 . If required, press to change the value.



Factory Default Settings:

P = 0.1%

I = 0.60 repeats/minute

D = 0.00 minutes

High Temperature Cutout

HTC (Temperature range varies with type of immersion circulator.)

To protect your application, the adjustable High Temperature Cutout (HTC) ensures the heater does not exceed temperatures that can cause serious damage. A temperature sensor is located in the reservoir. A HTC fault occurs when the temperature of the sensor exceeds the set temperature limit.

In the event of a fault the circulator shuts down and displays a fault message, see Section 6. The cause of the fault must be identified and corrected before the circulator can be restarted. A primary cause is low resrvoir fluid level.

The HTC is factory preset fully clockwise to the highest possible setting. To set the cutout start the chiller and adjust the setpoint a few degrees higher than the highest desired fluid temperature. Allow the chiller to stabilize at the temperature setpoint. Then, using a flathead screwdriver, slowly turn the red dial counterclockwise until the chiller shuts down and the fault message appears. Press to clear the message.

Before you can restart the circulator it has to cool down a few degrees. To restart the circulator press the black reset ring surrounding the red dial - and then press again. If Auto Restart is enabled the circulator restarts, if disabled use the Start Up procedure.

Note: We recommend periodically rechecking operation or if the circulator is moved. ▲

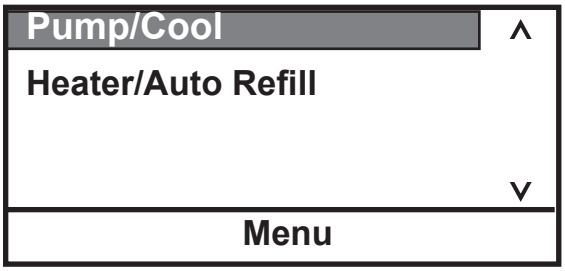
System - Accessory

Boost Heater (pins 5 and 10) is on when enabled and the setpoint is >2°C above the bath temperature. Boost heater is normally off when the bath temperature is within 2°C of setpoint. **Boost Pump** (pins 4 and 14) is on whenever the option is enabled.

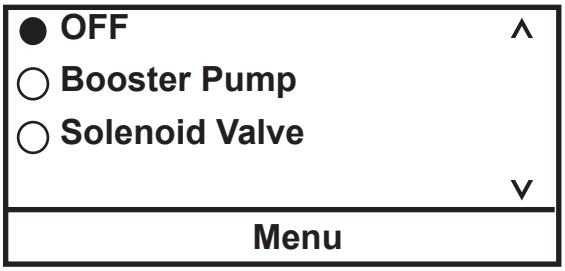
Multifunction Port Pin Out

The **Solenoid Valve** and **Auto Refill** are used in conjunction with an *optional* accessory box to select and activate additional features. The box connects to the multifunction port on the rear of the immersion circulator. **Solenoid Valve** for cooling coils (pins 4 and 14) is on when the bath temperature is >2°C above setpoint or when the heater power drops to 0%. The solenoid is off when the heater power exceeds 80%. **Auto Refill** (pins 5 and 10) is on when the fluid level drops below 47 mm (~1 7/8") from the top and is off when the fluid level is at 27 mm (~1") from the top.

1. With **Accessory** highlighted, press to display:

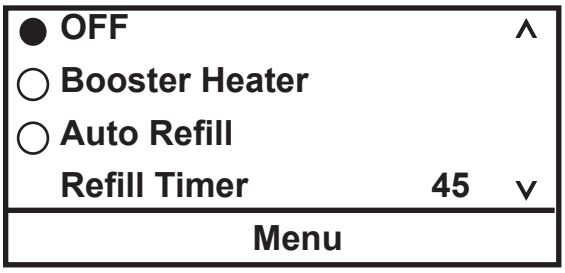


2. With **Pump/Cool** highlighted press to display:



Highlight the desired accessory, press to enable/disable.

3. With **Heater/Auto Refill** highlighted press to display:



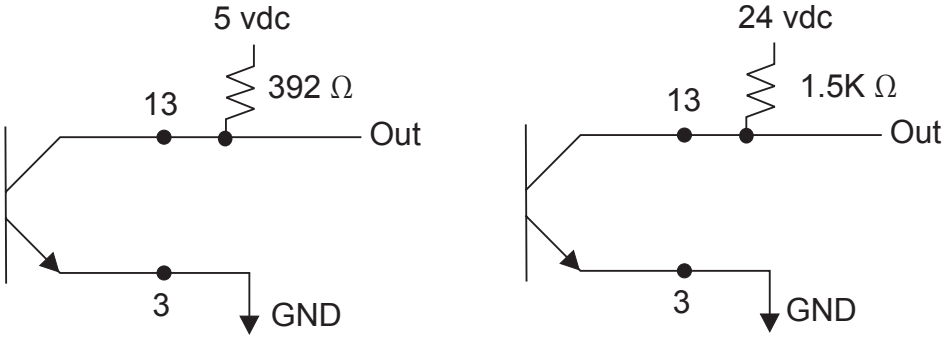
Highlight the desired accessory, press to enable/disable.

Refill Timer is the length of time the auto refill operates if the normal reservoir level is not reached. The range is adjustable from 5 to 600 seconds.

MultiFunction Port Standard I/O DB-15HD

Alarm Output Pins 13(+) and 3 (-) Open Collector Output

This output turns on (conducts) when there is an alarm. Any alarm that turns off the circulator will also set this output. An alarm message is displayed. (Maximum current on the output cannot exceed 25mA and 24 VDC.) A resistor must be supplied to limit the current, see samples below.



External Alarm Input Pins 12(+) and 2 (-)

To enable this input, apply 10 - 20 mA to pins 12 and 2. This input turns off the circulator. The alarm continues to sound until the input is removed. See samples below.

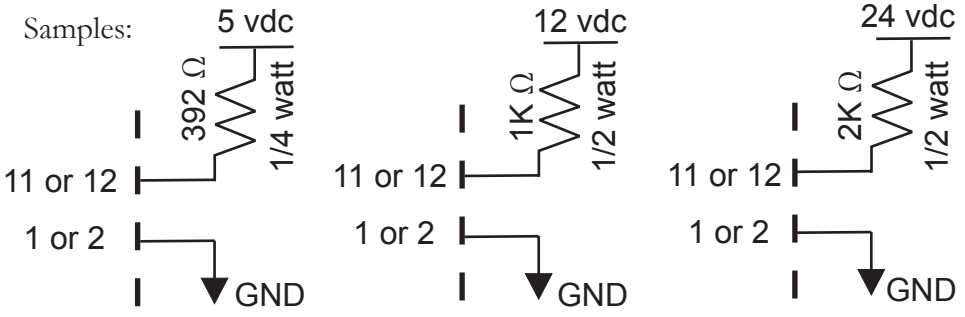
External Alarm
please remove reason and press ENTER to clear message

External On/Off Input Pins 11(+) and 1 (-)

To enable this input, apply customer supplied 10 - 20 mA to bath pins 11 and 1. This input turns the circulator on and off. A message is displayed when the input turns off. The circulator logic is reversed for this input: conducting = circulator off, not conducting = circulator on. See samples below.

External Signal
Operation Stopped by external command

Samples:



ON STATE Current = 10 - 20 mA

Section 5 Preventive Maintenance

Disconnect the power cord prior to performing any maintenance. ▲

CAUTION

Handle the FTS with care. Sudden jolts or drops can damage the its components. ▲

There are no user serviceable components within the equipment panels.

Cleaning

After time, the FTS's stainless steel surfaces may show spots and become tarnished. Only use warm water and a soft cloth.

Clean the bath vessel and built-in components at least every time the bath liquid is changed. Sponge down the tank with warm water.

The safety features for high temperature protection and low liquid level protection must be checked at regular intervals. The frequency depends on the circulator's designated application and the heat transfer fluid used.

Testing the Safety Features

High temperature protection
Use a flat head screwdriver to turn the arrow to the desired temperature.

Set a cut-off temperature that is lower than the desired setpoint temperature.

Switch on the circulator and ensure the FTS shuts down at the set cut-off temperature.

After the fluid cools down clear the HTC error message by pressing  , then press the HTC reset and then press  again.

If the circulator did not shut down have it checked by a qualified technician.

Reset the safety to the desired temperature.

Low liquid level protection
With the circulator on, use a screwdriver and slowly push down on each level sensor, one at a time, until an error message appears. See Section 6 for details on error messages.

If not, have the circulator checked by a qualified technic

Section 6 Troubleshooting

Error Displays

The circulator can display error messages and, if enabled, sound an alarm. Error messages are cleared by pressing the enter key ( ). Restart the circulator once the cause of the error message is identified and corrected. If the cause was not corrected the error code will reappear, contact our Sales, Service and Customer Support. If **Auto start** is enabled the circulator will restart, if disabled use the Start Up procedure.

Error Display (Typical)

Fault Displays

The heating element, pump and, if applicable, refrigeration shut down with a fault. A fault also sounds the alarm, if enabled.

Message	Cause	Actions
High Fixed Temp.	• circulator's nonadjustable high temperature protection limit exceeded	• clear message by pressing the enter key ( ) • check fluid selection • check environmental conditions
High Temperature	• adjustable high temperature protection limit exceeded	• clear message by pressing the enter key ( ) • check limit setting • check fluid selection • ensure circulator has adequate ventilation
High Temperature Refrigeration	• high refrigeration temperature	• clear message by pressing the enter key ( ) check voltage supply • the refrigeration may need servicing, contact us
HPC High Press. Cutout	• the high refrigeration pressure cutout activated	• clear message by pressing the enter key ( ) • check for obstructions to air flow • the refrigeration may need servicing, contact us

Message	Cause	Actions
HTC **High Temp. Cutout**	• if the fluid level is greater than approximately 5.5 cm (2.2") below the reservoir top it is a low level fault. • if not, high temperature protection limit exceeded	• clear message by pressing the enter key ( ) • if required, fill fluid to proper level • if fluid is not the issue, allow circulator to cool down to at least 10°C below than the HTC setting • turn the red knob on the HTC fully clockwise • press the HTC's black reset ring • press the enter key ( ) again • reset HTC to desired setting, see Section 4 • if message reappears recycle power to circulator and repeat the procedure
LLC **Low Level Cutout**	• reservoir fluid level too low for safe operation	• clear message by pressing the enter key ( ) • check fluid level • check for leaks
High Level	• reservoir fluid level too high for safe operation	• clear message by pressing the enter key ( ) • check fluid level, drain excess fluid if required • verify optional auto refill operation
Low Fixed Temp.	• circulator's nonadjustable low temperature protection limit exceeded	• clear message by pressing the enter key ( ) • check fluid selection
Low Temperature	• adjustable high temperature protection limit exceeded	• clear message by pressing the enter key ( ) • check limit setting • check fluid selection
Motor Fault	• high motor temperature	• clear message by pressing the enter key ( ) • it can take over 10 minutes for the motor temperature to get low enough before the circulator can be restarted
MOL **Motor Overload**	• high motor overload temperature	• clear message by pressing the enter key ( ) • allow circulator to cool down

Message	Cause	Actions
Open RTD1 Internal	• open internal temperature sensor	• clear message by pressing the enter key ( ) • contact us
Open RTD2 External	• open external temperature sensor	• clear message by pressing the enter key ( ) • contact us
Shorted RTD1 Internal	• shorted internal temperature sensor	• clear message by pressing the enter key ( ) • contact us
Shorted RTD2 External	• shorted external temperature sensor	• clear message by pressing the enter key ( ) • contact us

Warning Displays

The circulator will continue to run with a warning. A warning also sounds the alarm, if enabled.

Message	Cause	Actions
Bad Calibration	• bad temperature probe calibration	• clear message by pressing the enter key ( ) • redo calibration
High Temperature	• adjustable high temperature protection limit exceeded	• clear message by pressing the enter key ( ) • check limit setting • check fluid selection
Low Level	• reservoir fluid level too low for safe operation	• clear message by pressing the enter key ( ) • check fluid level
Low Temperature	• adjustable low temperature protection limit exceeded	• clear message by pressing the enter key ( ) • check limit setting • check fluid selection

Checklist

Circulator will not start

Check the display for error codes, see Error Codes in this section.

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

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

No display

Recycle the circuit protector on the rear of the circulator.

Display reads 239°C

External temperature probe selected but no probe attached to circulator.

Attach external probe or select internal temperature sensor.

Circulator will not circulate process fluid

Check the reservoir level. Fill, if necessary.

Check the application for restrictions in the cooling lines.

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 circulator in a high ambient temperature condition or excessively confined space. Allow time for the motor to cool down.

Ensure supply voltage matches the circulator's nameplate rating ±10%.

Inadequate temperature control

Verify the setpoint.

For refrigerated baths, ensure the condenser is free of dust and debris.

Check the fluid concentration.

Ensure circulator installation complies with the site requirements in Section 3.

Ensure supply voltage matches the nameplate rating ±10%.

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

Enter the controller menu and ensure the ENERGY SAVER mode is on in order for the system to maintain a stable temperature.

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

Circulator shuts down

Ensure  button wasn't accidently pressed.

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

Check the display for error codes.

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

Restart the circulator.

USB Driver Not Recognized

If your operating system does not automatically recognize the optional driver log on to:

http://www.ftdichip.com/FTDrivers.htm

for instructions.

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

Appendix AC Serial Communications Protocol

Serial communication is accomplished either through the optional 9-pin Serial Communications Box or through the USB port on the immersion circulator. If your operating system does not automatically recognize the optional driver log on to: http://www.ftdichip.com/FTDrivers.htm for instructions.

Note This appendix assumes you have a basic understanding of communications protocols. Information on the NC, STANDARD and NAMUR protocols is available upon request. ▲

Note NC protocol is required to use RS485 device addressing. ▲

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, the controller responds with an error command. Otherwise, the controller responds with the requested data.

Commands are not case sensitive. Upper or lower case letters may be used. Commands are listed in the Commands Table, error responses are given in the Errors Table, and symbols are shown in the Key Table.

Key	
Symbol	Meaning
[B]	A binary value 0 or 1 (0 = Off, FALSE or Disable(d); 1 = On, TRUE or Enable(d)).
[CR]	Carriage return – used as the termination character.
[U]	Text representing the units associated with a value.
[V]	A value that can be requested in a read command or sent as part of a set command.
[V_{MAX}]	Maximum allowed value. Part of error message when set value is too high.
[V_{MIN}]	Minimum allowed value. Part of error message when set value is too low.

Value: Read commands return analog [V] or bit [B] values or settings, while set commands send analog or bit settings. Read commands return values in the same precision as they are display. Set command messages missing the space character between the command and the setting will be rejected, as the user's intent is unclear.

Units: A read command returning an analog [V] value or setting, will include the units [U] associated with that value or setting. A set command sending an analog value will not include the units. The units returned by the complementary read command are assumed.

Termination character: A carriage return [CR] is used to terminate command and response messages. (Typically the "Enter" key on the keyboard.)

Note The inter-character timeout (time between transmitted characters) is set to30 seconds. Exceeding the timeout will clear the receiver buffer and require the message to re retransmitted. ▲

Note Special characters (backspace, delete, insert, etc.) are not recognized by the protocol and generate error responses. ▲

Commands Table:

Commands	*All messages from master and slave are terminated with a carriage return [CR]*	
Command Description *Notes*	Master Sends	Sample Slave Response *(echo off)* *Alternate units*
Read Temperature *Internal*	RT	*[V]*C *F K*
Read Temperature 2 *External*	RT2	*[V]*C *F K*
Read Displayed Setpoint	RS	*[V]*C *F K*
Read Internal RTA1 – Internal RTA5	RIRTA1 – 5	*[V]*C *F K*
Read External RTA1 – External RTA5	RERTA1 - 5	*[V]*C *F K*
Read Setpoint X (X = 1 to 5)	RSX	*[V]*C *F K*
Read High Temperature Fault	RHTF	*[V]*C *F K*
Read High Temperature Warn	RHTW	*[V]*C *F K*
Read Low Temperature Fault	RLTF	*[V]*C *F K*
Read Low Temperature Warn	RLTW	*[V]*C *F K*
Read Proportional Heat Band Setting	RPH	*[V]*%
Read Proportional Cool Band Setting	RPC	*[V]*%
Read Integral Heat Band Setting	RIH	*[V]*Repeats per minute
Read Integral Cool Band Setting	RIC	*[V]*Repeats per minute
Read Derivative Heat Band Setting	RDH	*[V]*Minutes
Read Derivative Cool Band Setting	RDC	*[V]*Minutes
Read Temperature Precision	RTP	*[V]*
Read Temperature Units	RTU	*[V]* *C,F,K*
Read Unit On	RO	*[B]*
Read External Probe Enabled	RE	*[B]*
Read Auto Restart Enabled	RAR	*[B]*
Read Energy Saving Mode	REN	*[B]*
Read Time	RCK	*hh:mm:ss*
Read Date	RDT	*mm/dd/yyyy or dd/mm/yyyy*
Read Date Format	RDF	*mm/dd/yyyy or dd/mm/yyyy*
Read Ramp Status	RRS	*Stopped, Running, Paused*

Commands	*All messages from master and slave are terminated with a carriage return [CR]*	
Command Description *Notes*	Master Sends	Sample Slave Response *(echo off)* *Alternate units*
Read Firmware Version	RVER	*[V]*
Read Firmware Checksum	RSUM	*[V]*
Read Unit Fault Status	RUFS	*[V_1, V_2 , V_3, V_4, V_5] See page 5*
Set Displayed Setpoint	SS *[V]*	OK
Set Internal RTA1 – Internal RTA5	SIRTA1 – SIRTA5 *[V]*	OK
Set External RTA1 – External RTA5	SERTA1 – SERTA5 *[V]*	OK
Set Setpoint X (X = 1 to 5)	SSX *[V]*	OK
Set High Temperature Fault	SHTF *[V]*	OK
Set High Temperature Warning	SHTW *[V]*	OK
Set Low Temperature Fault	SLTF *[V]*	OK
Set Low Temperature Warning	SLTW *[V]*	OK
Set Proportional Heat Band Setting	SPH *[V]*	OK
Set Proportional Cool Band Setting	SPC *[V]*	OK
Set Integral Heat Band Setting	SIH *[V]*	OK
Set Integral Cool Band Setting	SIC *[V]*	OK
Set Derivative Heat Band Setting	SDH *[V]*	OK
Set Derivative Cool Band Setting	SDC *[V]*	OK
Set Temperature Resolution	STR *[V]*	OK
Set Temperature Units	STU *[V] C,F,K*	OK
Set Unit On Status	SO *[B]*	OK
Set External Probe On Status	SE *[B]*	OK
Set Auto Restart Enabled	SAR *[B]*	OK
Set Energy Saving Mode	SEN *[V]*	OK
Set Pump Speed	SPS *[V] L,M,H*	OK
Set Ramp Number	SRN *[V]*	OK

Commands	*All messages from master and slave are terminated with a carriage return [CR]*	
Command Description *Notes*	Master Sends	Sample Slave Response *(echo off)* *Alternate units*
Set Ramp Program *this will load defaults for all steps declared by V1*	SRP [v1,v2,v3,v4,v5] V1 #of steps V2 variance V3 cycles V4 start temp V5 end state	OK Note: If unit allows more than one ramp the ramp number must first be set. V5 = M (maintain) or S (shut down)
Set Ramp Step	SRS[v1,v2,v3,v4] V1 step # V2 end temp V3 duration V4 assured soak	OK Note: If unit allows more than one ramp the ramp number must first be set and SRP defined. (0,1)
Set Ramp On Status	SRO [V] S,E,P Start, End, Pause/resume	OK Note: (P)pause toggles Pause/resume

Errors Table:

Errors	
Error Description *Notes*	Slave Responds
Not defined, not implemented or incorrectly formatted	? Unsupported command
Extra characters…	? Format error
Set value too high	? Maximum allowed is *[V_{MAX}]*
Set value too low	? Minimum allowed is *[V_{MIN}]*
Argument to binary set command not 0 or 1	? Value must be 0 or 1
Set command attempted while in read only mode	? Mode is read only
Set command failed (e.g. SO 1 with low level)	? Failed

Refer to Key table on page 1 for explanation of symbols and their meanings.

Examples:

Read Temperature:

Host

R	T		**CR**
Command			[CR]

Controller:

2	0	.	0	C	**CR**
[V]				[U]	[CR]

Set Setpoint:

Host

S	S		2	0	**CR**
Command			[V]		[CR]

Controller:

O	K	**CR**
Command Accepted		[CR]

Read Temperature 2:

Host:	R	T	2	**CR**		
Controller:	2	0	.	0	C	[CR]

Set Setpoint to -22°C when minimum allowed is -20°C: Minimum allowed is $[V_{MIN}]$

Host:	S	S		-	2	2	**CR**																	
Controller:	?		M	i	n	i	m	u	m		a	l	l	o	w	e	d		i	s		-	2	0	**CR**

Laboratory Equipment Div.
25 Nimble Hill Road
Newington, NH 03801

DECLARATION OF CONFORMITY

Manufacturer: Thermo Fisher Scientific

Address: 25 Nimble Hill Road
Newington, NH USA 03801

CE

Year of inception 2010

Product: Heated Liquid Baths.

We declare that the following products conform to the Directives and Standards listed below:

Horizon Fogging Test System models FTS-AC and FTS-PC.

With Bill of Material #'s: 1568005 & 1588005. Rated: 230 Volts, 50 Hz

Equipment Class: Measurement, control and laboratory

Directives and Standards:

2004/108/EC – Electromagnetic Compatibility (EMCD):

EN 61326-1: 2006 – Electrical equipment for measurement, control, and laboratory use – EMC Requirements - EMC Class A.

2006/95/EC – Low Voltage Directive (LVD):

EN 61010-1: 2010 – Safety requirements for electrical equipment for measurement, control, and laboratory use: general requirements.

En 61010-1: 2001 – Safety requirements for electrical equipment for measurement, control, and laboratory use: General requirements.

En 61010-2-010: 2003 – Safety requirements for electrical equipment for measurement, control, and laboratory use – part 2-010: Particular requirements for laboratory equipment for the heating of materials.

2011/65/EU - Restriction of the Use of Certain Hazardous Substances In Electrical and Electronic Equipment (ROHSD).

EN 50581: 2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

2012/19/EU - Waste from Electrical and Electronic Equipment (WEEED).

Manufacturer's Authorized Representative:

Robin Wiley

Robin Wiley Compliance Engineering

Date:

21 July 2014

Warranty

Thermo Fisher Scientific warrants for 24 months from date of shipment the Thermo Scientific Horizon PC and AC FTSs according to the following terms.

Any part of the FTS 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 FTS, including any defective part must be returned to an authorized Thermo Fisher Repair Depot within the warranty period. The expense of returning the FTS 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 FTS. With respect to FTSs 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 FTS that has been subject to misuse, neglect, or accident. This warranty does not apply to any damage to the FTS that is the result of improper installation or maintenance, or to any FTS 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 FTS 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 FTS or adversely affect its operation, performance, or durability.

Thermo Fisher Scientific reserves the right to change or improve the design of any FTS without assuming any obligation to modify any FTS 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 FTS, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to FTSs sold by Thermo Fisher Scientific. (Refer to the warranty for FTSs sold by the affiliated marketing company of Thermo Fisher Scientific for any additional terms.) 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.

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