

# **Waters Temperature Control System**

## **Operator's Guide**

71500079102/Revision B

**Waters**  
THE SCIENCE OF WHAT'S POSSIBLE.™

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We seriously consider every customer comment we receive. You can reach us at [tech\\_comm@waters.com](mailto:tech_comm@waters.com).



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Internet	The Waters Web site includes contact information for Waters locations worldwide. Visit <a href="http://www.waters.com">www.waters.com</a> , and click Waters Division > Contact Waters Online.
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## Safety considerations

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Some reagents and samples used with Waters instruments and devices can pose chemical, biological, and radiological hazards. You must know the potentially hazardous effects of all substances you work with. Always follow Good Laboratory Practice, and consult your organization's safety representative for guidance.

When you develop methods, follow the "Protocol for the Adoption of Analytical Methods in the Clinical Chemistry Laboratory," *American Journal of Medical Technology*, 44, 1, pages 30–37 (1978). This protocol addresses good operating procedures and the techniques necessary to validate system and method performance.

## Safety advisories

Consult [Appendix A](#) for a comprehensive list of warning and caution advisories.

## Operating the Waters Temperature Control System

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When operating the Temperature Control Module II, follow standard quality-control (QC) procedures and the guidelines presented in this section.

### Applicable symbols

Symbol	Definition
	Confirms that a manufactured product complies with all applicable European Community directives
 ABN 49 065 444 751	Australia C-Tick EMC Compliant

### Audience and purpose

This guide is for installers and operators of the Waters Temperature Control System. It describes how to install and operate a Waters Temperature Control System as a component of a Waters HPLC system.

### Intended use of the temperature control system

Waters designed the temperature control system to simultaneously regulate and maintain the operating temperature of as many as three column heater modules for LC applications requiring column heating.

### Calibrating

To calibrate LC systems, follow acceptable calibration methods using at least five standards to generate a standard curve. The concentration range for standards should include the entire range of QC samples, typical specimens, and atypical specimens.

To calibrate mass spectrometers, consult the calibration section for the operator's guide of the instrument you are calibrating.

## Quality-control

Routinely run three QC samples that represent subnormal, normal, and above-normal levels of a compound. Ensure that QC sample results fall within an acceptable range, and evaluate precision from day to day and run to run. Data collected when QC samples are out of range might not be valid. Do not report these data until you are certain that the instrument performs satisfactorily.

## EC Authorized Representative

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## **ISM classification**

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### **ISM Classification: ISM Group 1 Class B**

This classification has been assigned in accordance with CISPR 11 Industrial Scientific and Medical, (ISM) instruments requirements. Group 1 products apply to intentionally generated and/or used conductively coupled radio-frequency energy that is necessary for the internal functioning of the equipment. Class B products are suitable for use in both commercial and residential locations and can be directly connected to a low voltage, power-supply network.



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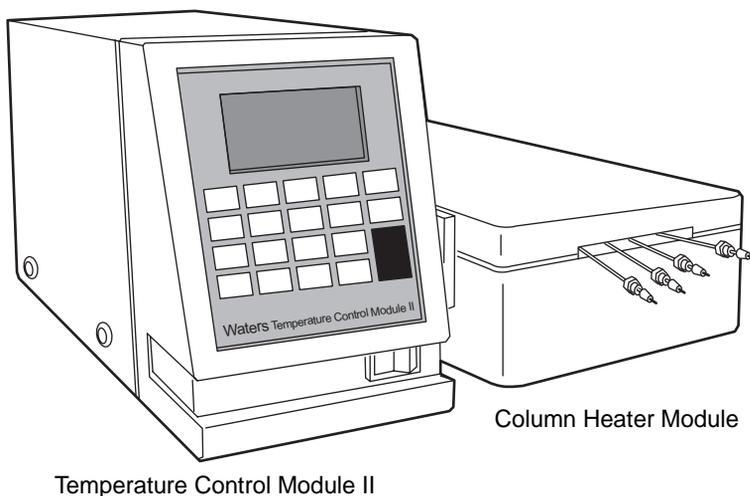


# 1 Introduction

The Waters<sup>®</sup> Temperature Control System provides stable operating temperatures for HPLC columns and insulates them from changes in ambient temperature. The system consists of these two Waters components:

- Temperature Control Module II
- Column Heater Module

## Temperature Control System



The temperature control module is an independent, microprocessor-controlled unit capable of simultaneously regulating and maintaining the temperature of as many as three column heater modules. Using the front-panel keypad, you can independently set each column heater module temperature. An audible alarm sounds, and an error message appears on-screen when the temperature of any column heater module exceeds its programmed upper limit or falls below its programmed lower limit.

Additionally, you can configure the temperature control module to operate as a remote controller in an HPLC system, the case when Waters Empower or Millennium<sup>32</sup>® software controls the module. Using this software, you

regulate and maintain the column heater module temperatures by programming instrument method settings.

A programmed microprocessor serves as the control element for the temperature control module. The program measures the difference between the set and measured temperature and determines the duty cycle to approach and maintain temperature. This feedback system allows rapid warm-up and stabilization of the system while minimizing the possibility of a temperature overshoot.

You can purchase the column heater modules separately or as a complete system. Each column heater module supports up to four, 30-cm columns.

## System configurations

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When the temperature control system is under data system control, it can operate in one of these configurations:

- Where all system components, including the Temperature Control Module II, communicate with the data system via an IEEE-488 bus interface
- Where all system components, including the Temperature Control Module II, communicate with the data system via Ethernet communications

**Restriction:** You cannot use the temperature control module's Ethernet port at the same time you are using its IEEE-488 bus interface for communications.

For details on the temperature control module's software and firmware requirements, see the release notes for the Waters Temperature Control Module II.

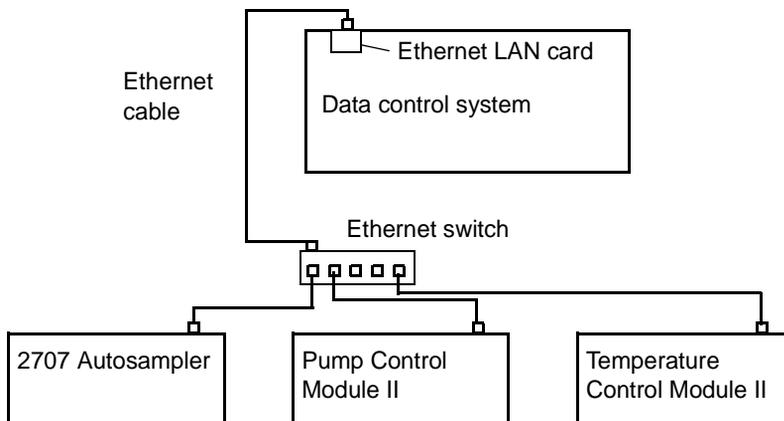
## Ethernet configuration

To communicate with the Waters data control system via Ethernet, an Ethernet cable connects the temperature control module with the system's Ethernet network in one of two ways:

- Directly, through the Ethernet LAN card in the data control system
- Through a network switch

For more information, see [“Ethernet signal cable connections” on page 2-5](#).

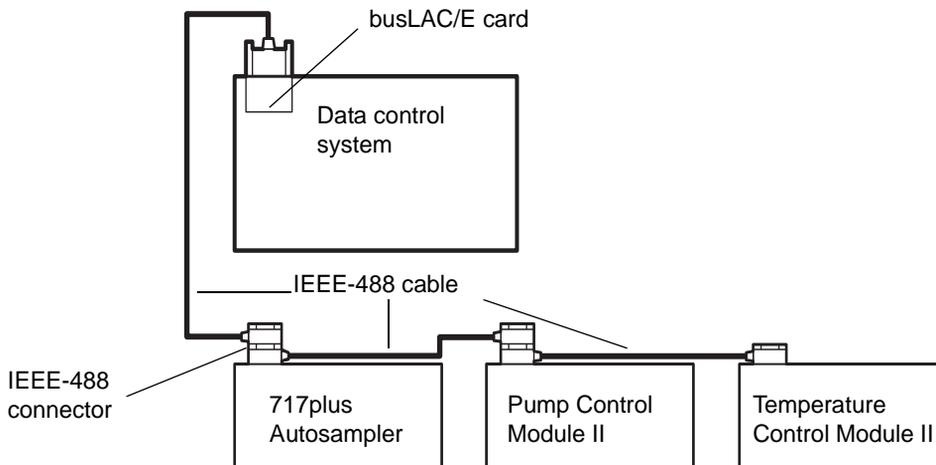
## HPLC system configuration using Ethernet communications



## IEEE-488 configuration

To communicate with the Waters data control system via IEEE-488, an IEEE-488 cable connects the temperature control module to an IEEE-488 controller (a busLAC/E™ card in the data control system for Empower or Millennium<sup>32</sup> software). For more information, see [“IEEE-488 signal cable connections” on page 2-6](#).

## IHPLC system using IEEE-488 connections





# 2 Installing the System

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## Site selection and unpacking

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The column heater modules' solvent drains direct any spilled solvent to a suitable waste container. Install the modules on a level surface to ensure proper drainage.



**Warning:** Always observe Good Laboratory Practices when handling solvents and performing maintenance.



**Caution:**

- To avoid the damaging effects of spilled solvents, do not place the column heater module atop other devices or instruments.
- The temperature control module is not designed for hazardous environments. Solvents spilled on its keypad can damage the plastic components and cause short circuiting of the module's electronic components.

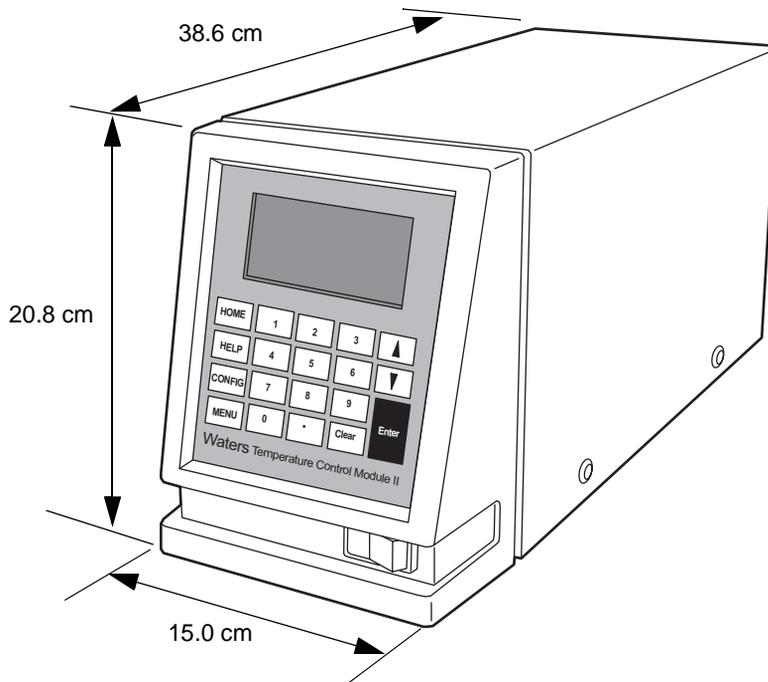
### Site selection

Install the temperature control system in an area that meets the requirements listed in the table below.

#### Installation site requirements

Parameter	Requirement
Operating temperature range	4 to 40 °C
Storage temperature range	-40 to 70 °C
Relative humidity	10 to 90% noncondensing
Temperature control module bench space	At least 15 cm wide × 39 cm deep × 21 cm high
Column heater module bench space	At least 13 cm wide × 37 cm deep × 23 cm high
Power	Grounded AC, 100 to 240 V, 50/60 Hz

## Dimensions of the Temperature Control Module II



## Unpacking and inspecting the system

Unpack the shipment comparing all items received to those specified in the packing list. Notify Waters immediately if you discover a discrepancy. In the case of damaged items, immediately notify the shipping agency and Waters Technical Service.

Waters recommends you save the packing materials for future transport or shipment.

## Rear-panel signal connections

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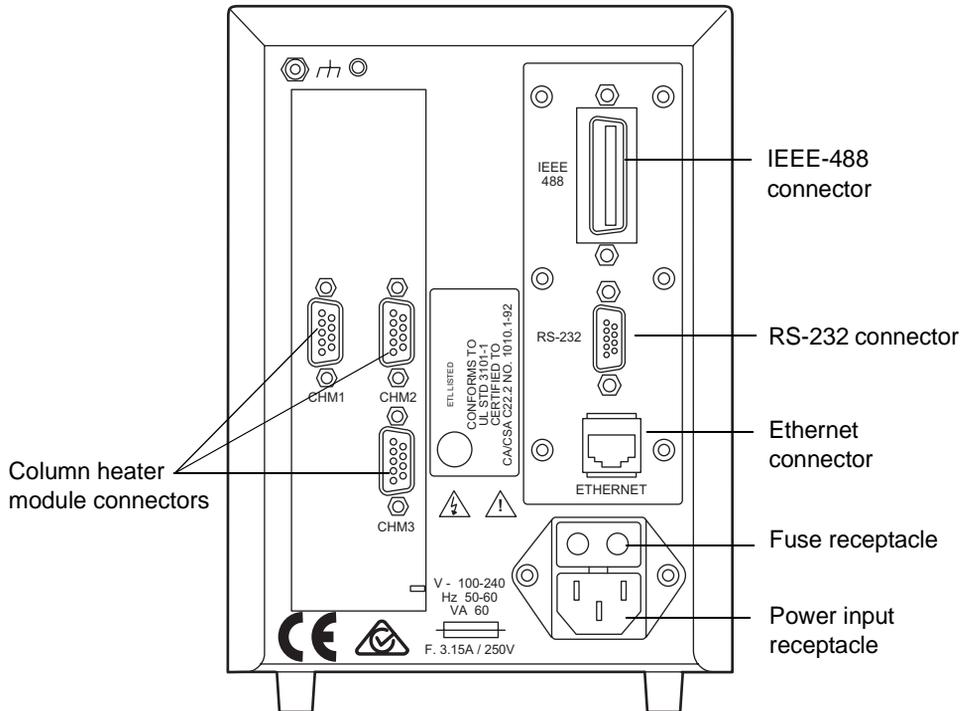
The signal connectors on the temperature control module's rear panel connect the module to other HPLC system components. The following table describes these signal connections.

### Component connector types

Connector type	Component
Ethernet	Waters data control system, such as an Empower 2 system, connected via the Ethernet network <b>Tip:</b> The Ethernet port also supports the Waters PC-based Autoloader utility for installing firmware (for details, see the Waters Temperature Control Module II release notes).
IEEE-488	An Empower or Millennium <sup>32</sup> data control system connected via the IEEE-488 bus
CHM1, CHM2, and CHM3	As many as three column heater modules, connected to the temperature control module via the 9-pin external device connectors
RS-232	For firmware upgrades only

The following figure shows the rear panel locations of the signal connectors used to operate the temperature control module with external devices.

## Temperature control module, electrical connections, rear panel



Connecting the temperature control module to an external data control system involves one of these procedures:

- Connecting the Ethernet signal cable.
- Connecting the IEEE-488 interface cable and setting a unique IEEE-488 address for the temperature control module.

## Ethernet signal cable connections

The temperature control module is equipped with a RJ-45 connector for Ethernet port communications (see the figure, above). The Ethernet port—a 10/100 Base-T networking interface—is used only for remote control, the case when Empower 2 controls its operation, and for firmware upgrades via the Waters Autoloader utility.

## Requirements:

- In an Ethernet configuration, all of the Waters HPLC system components, including the Temperature Control Module II, must communicate with the data system via Ethernet communications.
- You cannot use the temperature control module's Ethernet port at the same time you are using its IEEE-488 bus interface for communications.

## To make the Ethernet connections

1. Connect one end of the Ethernet cable to the Ethernet port on the module's rear panel (see the figure on [page 2-4](#)).
2. Connect the other end of the Ethernet cable to the Ethernet LAN network card in the data control system or to an Ethernet switch connected to the data control system. For additional Ethernet configuration information, see the *Waters Ethernet Instrument Getting Started Guide* (P/N: 7150074403).

## IEEE-488 signal cable connections

The IEEE-488 cable transmits digital data between the temperature control module and the busLAC/E card. Observe the IEEE cabling and connection requirements, and follow the IEEE specifications when adding the module to the existing IEEE-488 connections.

## Requirements:

- In an IEEE-488 configuration, all Waters HPLC system components, including the temperature control module, must communicate with the data system via IEEE-488 communications.
- You cannot use the module's Ethernet port at the same time you are using its IEEE-488 bus interface for communications.
- Like all other IEEE-488 devices, the temperature control module requires a unique IEEE-488 address to be recognized by an IEEE-488 address controller, such as a busLAC/E Module or an Alliance<sup>®</sup> system controller.

## To make the IEEE-488 connections

1. Place the module on a level surface.
2. Insert one end of the IEEE-488 cable into the IEEE-488 port on the module's rear panel, and tighten both thumbscrews.
3. Insert and secure the other end of the cable to the IEEE-488 connection on the busLAC/E card in the data control system.

**Tip:** You can daisy-chain IEEE-488 cables.

4. Verify that the module has a unique IEEE-488 address in the HPLC system.

**Tip:** The factory-set default IEEE-488 address for the temperature control module is 14. If you need to change this setting, see [“Changing the IEEE-488 address” on page 3-7](#)

## Column heater module and power connections

### To connect the column heater module to the temperature control module

1. Plug the column heater module's 9-pin connector into any of the 3 receptacles on the temperature control module's rear panel (see the figure on [page 2-5](#)), and tighten the connector screws.
2. Locate the red, voltage-selection switch on the rear of the column heater module.
3. Use a small screwdriver to position the switch to the desired voltage (115 or 230 V).
4. Repeat steps 1 through 3 for additional column heater modules.

For the temperature control system, the temperature control module and column heater module require individual connections to the AC power source (refer to the table on [page 2-2](#) for AC power requirements).

## To connect the modules to the AC power source

Attach the power cord to the module's rear panel AC connector, and then connect the power cord to the grounded AC power source.



**Caution:** To avoid transient spikes in voltage and amperage, which can damage electronic components, do not plug the column heater into the AC power source, or unplug it, while the column heater's control switch is in the "on" position.

## Installing columns in the column heater module

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**Warning:** To avoid possible burns, allow sufficient time for the column heater module to cool before opening. The internal components (including the columns) can be hot.

The column heater module contains four separate inlet lines to accommodate up to four columns, simultaneously. When connected properly, all four columns are heated to the same temperature.

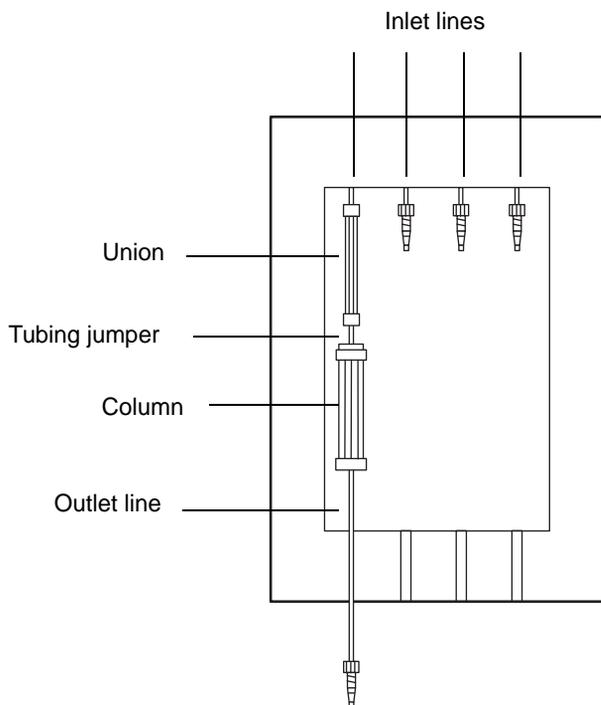
**Tip:** To run the columns in series, connect them with the column joining tubes (part number WAT038154).

### Required materials

- Open-end wrench, 5/16-inch
- Appropriate heater insert kit (for a listing, see ["Column Heater Module" on page C-2](#))

To ensure proper heat exchange during operation, you must connect the inlet and outlet tubing provided with the column heater module, as shown in the following figure.

## Column heater module column connections



### To connect the inlet and outlet tubing

1. Select the appropriate column heater insert to fit the desired column.  
**Tip:** A list of these inserts appears in the spare parts list in [“Column Heater Module” on page C-2](#).
2. A tubing jumper is supplied for all column lengths other than 30 cm.  
**Requirement:** If your column heater module insert kit includes a jumper, use the 5/16-inch, open-end wrench, and the union provided, to connect it to the module’s inlet line (see the figure above).
3. Position the column inside the module so that the inlet side faces the inlet line of the module.

4. Sandwich the column between the two halves of the module insert, and loosely attach the insert to the module with the two screws supplied in the insert kit.

**Tip:** Do not tighten the screws yet.

5. Connect the column to the jumper (or heater inlet tube) using the 5/16-inch, open-end wrench.
6. Tighten the screws to secure the module insert in place.
7. Connect the column outlet to the outlet tubing and route it out of the module through the space provided.

# 3 Operating the System

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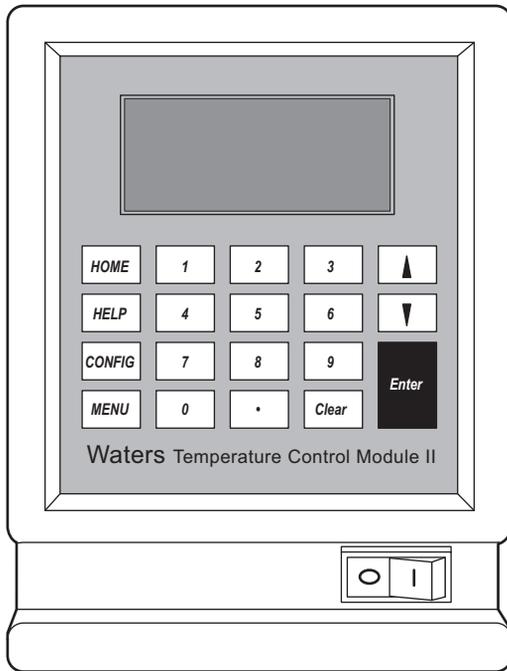
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## Using the operator interface

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The front panel of the temperature control module contains a 19-key membrane keypad.

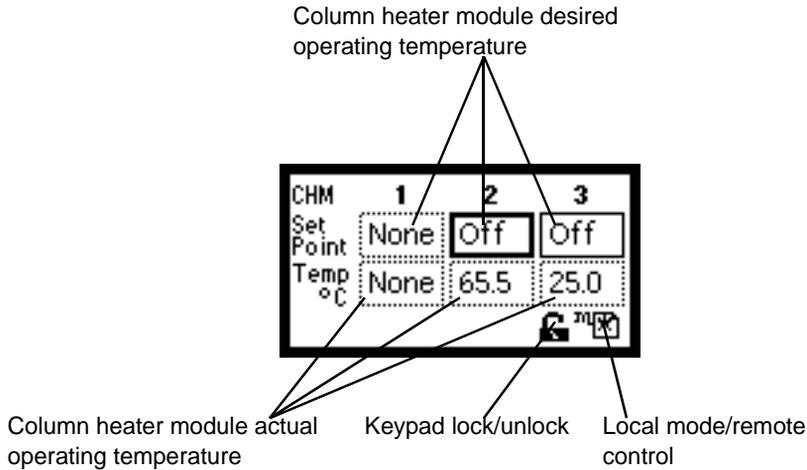
### Temperature control module front panel



7500007

The module's operator interface contains a 128 × 64 bitmap graphic display.

## Home screen



You can display the Home screen anytime by pressing HOME. When powered-on, the statuses of all three column heater modules are displayed by default. If a channel is connected to a column heater module, the Set Point field displays the status message Off and the Temp °C field displays the current temperature inside the module. If a channel is not connected to a column heater module, both the Set Point and Temp °C fields display the status message None.

The following table lists the control key names and functions.

### Front panel control keys

Control key name	Function
0 to 9	Enter temperature values
HELP	Provides help for the highlighted field
MENU	Displays the menu screen
Clear	Clears erroneous entries; also turns off the column heater module(s)
HOME	Displays the Home screen
CONFIG	Shows the configuration of the IEEE address
Enter	Enters the set temperature or limits

The following table describes the Home screen fields and icons.

### Home screen fields and icons

Field or icon	Field or icon name	Function
Set Point	Column heater module set point	Shows the programmed operating temperature of each column heater module.
Temp °C	Current column heater module temperature	Shows the current temperature of each column heater module.
CHM	Column heater module number	Indicates by number the device presently being programmed/monitored.
 	Keypad Unlock  Keypad Lock	Open lock - Unrestricted keypad entry. Close lock - Keypad locked. Parameter changes are not allowed.
 	Local Mode  Remote Control	Local Mode – When the temperature control module is not controlled by a data system, it displays the local mode icon. Remote Control – When the temperature control module is controlled by a data system (via IEEE-488 or Ethernet), it displays a remote control icon with the IEEE-488 address in the middle of the icon.
    		Message screen icons (from left): Error, Question, Warning, Information, and Standby.

## Startup sequence

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When all devices in the data system are installed and properly connected, power-on the temperature control module and any devices connected to the data system as follows.

**Tip:** Refer to the installation guides for each device for their power-on procedures.

### To power-on the temperature control system

1. Power-on all the equipment not controlled by the data system.
2. Power-on all equipment controlled by the data system that is not under direct IEEE-488 or Ethernet control, such as the column heater modules.
3. Power-on the temperature control module and all other equipment controlled through the IEEE-488 or Ethernet interface.

**Result:** The module beeps three times, displays the message “Booting System... Please Wait (Service Keypad Inputs Accessible for 3 sec.)”, and then the Startup screen appears.

**Restriction:** Service keypad inputs are coded for use only by Waters field service engineers for troubleshooting purposes.

4. Power-on the data control system.



**Caution:** To avoid transient spikes in voltage and amperage, which can damage electronic components, do not plug equipment into the AC power source, or unplug it, while it's power control switch is in the “on” position.

## Operating the temperature control module

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You can operate the temperature control module in one of two operating modes: local or remote.

- In local mode, you set the desired operating temperature and the upper and lower temperature limits on each column heater module. The devices continue to operate while the temperature control module is in local mode, and the temperature field displays the desired operating temperature.

**Tip:** To prevent accidental entry, each key beeps once when pressed. If you make an invalid entry (for example, an entry above 150 °C for the column heater module), the module beeps twice and displays an error message. To clear the error message and display the previous value, press Enter.

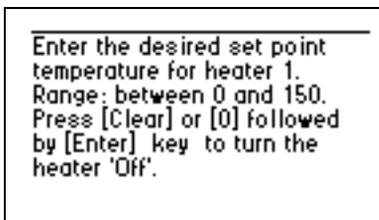
- In remote mode, the temperature control module is under data system control. When the module is in remote mode, the keypad is locked, and the lock icon appears on the Home screen.

**Tip:** In remote mode, you can change the column heater module temperature setting using the software instrument method. See [“Changing the existing set temperature under data system control” on page 3-10.](#)

### Using Help

Limited, context-sensitive, Help accompanies the temperature control module. When you press HELP for a highlighted field with which a Help screen is associated, the screen appears. If Help is not available for a function, pressing Help yields no response.

#### Example of a Help screen



```
Enter the desired set point
temperature for heater 1.
Range: between 0 and 150.
Press [Clear] or [0] followed
by [Enter] key to turn the
heater 'Off'.
```

Press Enter to restore the previous screen.

## Changing the IEEE-488 address

Like all other IEEE-488 devices, the temperature control module requires a unique IEEE-488 address to be recognized by an IEEE-488 address controller, such as a busLAC/E Module or an Alliance<sup>®</sup> system controller.

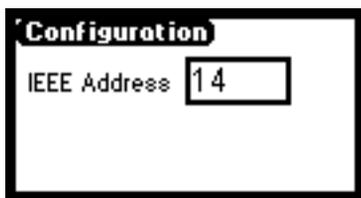
The module's factory-set, default IEEE-488 address is 14.

**Tip:** If the IEEE-488 address is changed from the default, the module uses the last saved address.

### To change the IEEE-488 address

1. On the control module's keypad, press CONFIG to open the Configuration screen.

#### Configuration screen



2. Enter the number corresponding to the desired IEEE-488 address, and then press Enter.

**Note:** IEEE-488 addresses must be a unique number between 2 and 29 for each instrument in the HPLC system. Your HPLC system can require that the module's IEEE-488 address be greater than that for other devices in the system. Consult your data system or controller operator's guide for more information on IEEE-488 communications.

3. To exit the configuration functions, press HOME.

## Setting the temperature in local mode

The following procedure independently sets the temperature of the column heater modules via the temperature control module's keypad.

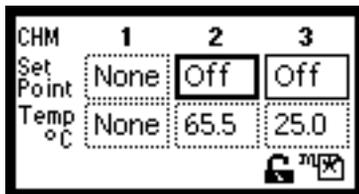
**Recommendation:** Make sure that the selected operating temperature is compatible with the solvent(s) and column(s) used.

## To set the temperature

1. Verify that the column(s) are properly installed in the column heater module, and test all fittings for tightness before securing the module's cover.
2. Power-on the both the column heater module(s) and the temperature control module.

**Result:** The temperature control module undergoes a brief self-test routine and then engages local control mode.

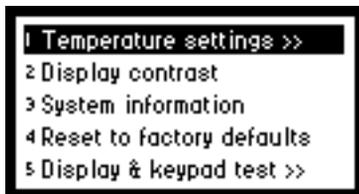
## Home screen



**Tip:** You can modify the Set Point value from the Home screen by placing the cursor in the appropriate set point field and entering the desired operating temperature.

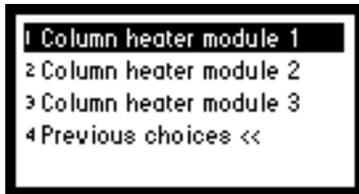
3. On the control module's keypad, press MENU.

## Main menu



4. From the Main menu, press 1 Temperature settings.

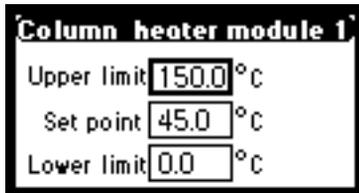
## Temperature settings menu



5. Press the number that corresponds to the column heater module you want to change temperature settings for.

**Result:** The Temperature Settings screen for the selected module appears.

## Column heater module temperature settings screen



- Note:** The preset values are ambient for the lower limit and 150 °C for the upper limit for the column heater module. Setting a temperature outside prescribed limits can cause the alarm to trigger.
6. With the cursor positioned in the Upper limit field, enter the desired upper temperature limit, in degrees and tenths of degrees (*nnn.n*), and then press Enter.

**Tip:** The control module automatically positions the decimal point. If you want the upper limit to remain at 150 °C, press Enter.

### Restrictions:

- If the column heater module you selected is not connected or a connection is faulty, you cannot edit the temperature fields.
- The control module does not accept temperature limits above 150 °C.

7. In the Set point field, enter the desired operating temperature, in degrees and tenths of degrees (*nnn.n*), and then press Enter.

**Recommendation:** For proper operation of the control module, specify the set point temperature a minimum of 5 °C above ambient.

8. In the Lower limit field, enter the desired lower temperature limit, in degrees and tenths of degrees (*nnn.n*), and then press Enter.

**Result:** The display responds by showing the measured temperature for that channel, which the control module then begins to control.

9. To set the temperature for another column heater module, repeat steps 3 through 8, above.

To reset the system, follow the procedure in [“Automatic shutdown of the column heater module” on page 3-14](#).

### Correcting an erroneous entry

If you err when entering temperature values and did not yet press Enter, press Clear. The temperature display reverts to the value originally displayed for that parameter. Reenter the desired value, and then press Enter.

If you already pressed Enter, press the ▲ and ▼ keys, or press Enter until the appropriate field is highlighted. Then enter the corrected value, and press Enter.

## Changing the existing set temperature under data system control

When operating under the control of Empower software or Millennium<sup>32</sup> software, you can modify the existing temperature in two ways:

- Modify the instrument method, and save the method under the same name.
- From the Run Samples window, edit the temperature, and save the method under the same name.

To modify the existing set temperature, follow the instructions in the Empower Help or Millennium<sup>32</sup> Help.

## Verifying the temperature setting during operation

### To verify the set or limit temperature of a column heater module

1. Press MENU, and then press 1 Temperature settings.
2. From the Temperature Settings menu, press the number that corresponds to the module for which you want to verify the temperature setting.

**Result:** The module temperature settings are displayed.

#### Notes:

- Initially, the upper limit, lower limit, and IEEE address are the factory-set defaults. After the first use, the module displays the upper limit, lower limit, and IEEE address that was in effect before it was last powered-off.
- If a channel is connected to a column heater module, the Set Point and Temp °C fields display the status message None. If a module is connected, but is not turned on, the Set Point field displays the status message Off and the Temp °C field displays the current module temperature.

## Changing the control module's display contrast

### To change the display contrast

1. On the module's front panel, press MENU.
2. From the Main menu, press 2 Display contrast.
3. Press and hold the ▲ and ▼ keys to adjust the display contrast.

## Displaying system information

Using the system information function, you can display information about the temperature control module: the serial number, the software version number (with a checksum), and the version date (if applicable).

### To display system information

1. On the module's front panel, press MENU.
2. From the Main menu, press 3 System information.
3. From the System Information screen, press Enter to restore the Main menu.

## Resetting to factory defaults

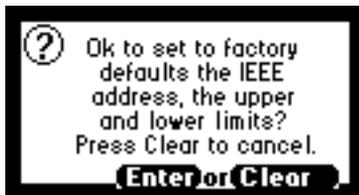
Using the Reset to Factory Defaults function, you can reset to default settings the control module's IEEE-488 address and upper and lower temperature limits.

**Note:** The module's factory-set default IEEE-488 address is 14. If you reset to factory defaults, you must repeat the process of setting the IEEE-488 address to be appropriate for your system (see [“Changing the IEEE-488 address” on page 3-7](#)).

### To reset to factory defaults

1. On the module's front panel, press MENU.
2. From the Main menu, press 4 Reset to factory defaults.

#### Reset to factory defaults screen



3. Press Enter to reset the defaults.

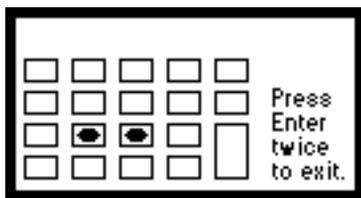
## Testing the keypad

### To test the keypad

1. On the module's front panel, press MENU.
2. From the Main menu, press 5 Display & keypad test.
3. From the Display and Keypad menu, press 1 Test keypad.

**Result:** A bitmap representation of the keyboard appears.

### Keypad test screen



4. Press any key to begin the test, and then press each key until you have tried all of them.

**Result:** If the keypad is operating properly, each key location fills, and then clears with a second press of the key. If any key does not respond when pressed, contact your Waters service representative.

5. Press Enter twice, to close the test screen.

## Testing the display

### To test the display

1. On the module's front panel, press MENU.
2. From the Main menu, press 5 Display & keypad test.
3. From the Display and Keypad menu, press 2 Test display

**Result:** The display fills from top to bottom and right to left. It then redisplay the Display and Keypad menu. If the display does not completely fill, horizontally or vertically, contact your Waters Service Representative.

4. From the Display and Keypad menu, press 3 to restore the Main menu.

## Turning off the column heater module

### To turn off the column heater module

1. From the Home screen, press the Enter key until the appropriate column heater module's Set Point field is highlighted.
2. Press 0 and Enter.
3. Repeat steps 1 and 2 to power-off each of the remaining column heater modules, as needed.

## Automatic shutdown of the column heater module

If the actual temperature of a column heater module exceeds the upper temperature limit, the temperature control module automatically turns that module off, sounds an alarm, and displays a text message indicating the faulty module.

If the actual temperature of a column heater module falls below the lower limit, the temperature control module automatically turns that module off. If the module restarts with a temperature outside the valid temperature range, the temperature control module allows one hour for the module to return to the valid temperature range. If the module does not return to the valid temperature range within the hour, the temperature control module automatically turns the module off, sounds an alarm, and displays a text message indicating the faulty module.

### To reset the temperature control module after a limit shutdown

1. Confirm the set temperature and both upper and lower limits.
2. Correct the problem or enter new values.

## Equilibrating the column heater module

---

Before initiating a run, allow a minimum of 30 minutes for the column heater module to stabilize at any set temperature.

**Note:** Column equilibration times vary with temperature. Adequate time is necessary for consistent chromatography.

## Operational error messages

---

The following table alphabetically lists error messages that prevent operation.

### Error messages preventing operation

Error message	Description	Corrective action
Heater (1, 2, or 3) over the high limit	The current temperature of the designated column heater module has exceeded the high limit value.	Assess the module's temperature parameters. Recycle power to the temperature control module. If the error persists, contact Waters Technical Service.
Heater (1, 2, or 3) under the low limit	The current temperature of the designated column heater module has dropped below the low limit value.	Assess the module's temperature parameters. Recycle power to the temperature control module. If the error persists, contact Waters Technical Service.
Heater (1, 2, or 3) is Absent	The designated column heater module is not physically connected to the temperature control module.	Power-off both the temperature control module and column heater module; connect the column heater cable to the control module, and power-on both units. If the error persists, contact Waters Technical Service.
Heater (1, 2, or 3) Hardware Failure	This message indicates a column heater module or temperature control module electronics failure.	Power-off both the temperature control module and column heater module; verify the column heater cable connection to the control module, and power-on both units. If the error persists, contact Waters Technical Service.

## Maintenance

---

There are no operator-serviceable or replaceable parts inside the temperature control module. If the unit is not functioning, contact your Waters service representative.

**Note:** To clean the outside of the temperature control module, use only a soft lint-free paper or cloth dampened with mild soap and water.

### Replacing fuses

Both the temperature control module and column heater module have replaceable fuses.

The temperature control module's fuse receptacle is located on the rear panel (see the figure on [page 2-5](#)). The column heater module's fuse receptacle is located on the side, just under the green indicator light.

To replace the fuse, use a small screwdriver to install a properly rated fuse (see below).

Component	Nominal voltage	Frequency range	Fuse
Temperature control module	250 VAC	50/60 Hz	F 3.15 A
Column heater module	120/240 VAC	50/60 Hz	2.5 A

# A Safety Advisories

Waters instruments display hazard symbols designed to alert you to the hidden dangers of operating and maintaining the instruments. Their corresponding user guides also include the hazard symbols, with accompanying text statements describing the hazards and telling you how to avoid them. This appendix presents all the safety symbols and statements that apply to the entire line of Waters products.

## Contents

Topic	Page
<a href="#">Warning symbols</a>	<a href="#">A-2</a>
<a href="#">Caution symbol</a>	<a href="#">A-5</a>
<a href="#">Warnings that apply to all Waters instruments</a>	<a href="#">A-5</a>
<a href="#">Electrical and handling symbols</a>	<a href="#">A-12</a>

# Warning symbols

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Warning symbols alert you to the risk of death, injury, or seriously adverse physiological reactions associated with an instrument's use or misuse. Heed all warnings when you install, repair, and operate Waters instruments. Waters assumes no liability for the failure of those who install, repair, or operate its instruments to comply with any safety precaution.

## Task-specific hazard warnings

The following warning symbols alert you to risks that can arise when you operate or maintain an instrument or instrument component. Such risks include burn injuries, electric shocks, ultraviolet radiation exposures, and others.

When the following symbols appear in a manual's narratives or procedures, their accompanying text identifies the specific risk and explains how to avoid it.



**Warning:** (General risk of danger. When this symbol appears on an instrument, consult the instrument's user documentation for important safety-related information before you use the instrument.)



**Warning:** (Risk of burn injury from contacting hot surfaces.)



**Warning:** (Risk of electric shock.)



**Warning:** (Risk of fire.)



**Warning:** (Risk of needle puncture.)



**Warning:** (Risk of injury caused by moving machinery.)



**Warning:** (Risk of exposure to ultraviolet radiation.)



**Warning:** (Risk of contacting corrosive substances.)



**Warning:** (Risk of exposure to a toxic substance.)



**Warning:** (Risk of personal exposure to laser radiation.)



**Warning:** (Risk of exposure to biological agents that can pose a serious health threat.)

## Warnings that apply to particular instruments, instrument components, and sample types

The following warnings can appear in the user manuals of particular instruments and on labels affixed to them or their component parts.

### Burst warning

This warning applies to Waters instruments fitted with nonmetallic tubing.



**Warning:** Pressurized nonmetallic, or polymer, tubing can burst. Observe these precautions when working around such tubing:

- Wear eye protection.
- Extinguish all nearby flames.
- Do not use tubing that is, or has been, stressed or kinked.
- Do not expose nonmetallic tubing to incompatible compounds like tetrahydrofuran (THF) and nitric or sulfuric acids.
- Be aware that some compounds, like methylene chloride and dimethyl sulfoxide, can cause nonmetallic tubing to swell, which significantly reduces the pressure at which the tubing can rupture.

### Mass spectrometer flammable solvents warning

This warning applies to instruments operated with flammable solvents.



**Warning:** Where significant quantities of flammable solvents are involved, a continuous flow of nitrogen into the ion source is required to prevent possible ignition in that enclosed space.

Ensure that the nitrogen supply pressure never falls below 690 kPa (6.9 bar, 100 psi) during an analysis in which flammable solvents are used. Also ensure a gas-fail connection is connected to the LC system so that the LC solvent flow stops if the nitrogen supply fails.

## Mass spectrometer shock hazard

This warning applies to all Waters mass spectrometers.



**Warning:** To avoid electric shock, do not remove the mass spectrometer's protective panels. The components they cover are not user-serviceable.

This warning applies to certain instruments when they are in Operate mode.



**Warning:** High voltages can be present at certain external surfaces of the mass spectrometer when the instrument is in Operate mode. To avoid non-lethal electric shock, make sure the instrument is in Standby mode before touching areas marked with this high voltage warning symbol.

## Biohazard warning

This warning applies to Waters instruments that can be used to process material that might contain biohazards: substances that contain biological agents capable of producing harmful effects in humans.



**Warning:** Waters's instruments and software can be used to analyze or process potentially infectious human-sourced products, inactivated microorganisms, and other biological materials. To avoid infection with these agents, assume that all biological fluids are infectious, observe Good Laboratory Practices and, consult your organization's biohazard safety representative regarding their proper use and handling. Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

## Chemical hazard warning

This warning applies to Waters instruments that can process corrosive, toxic, flammable, or other types of hazardous material.



**Warning:** Waters instruments can be used to analyze or process potentially hazardous substances. To avoid injury with any of these materials, familiarize yourself with the materials and their hazards, observe Good Laboratory Practices (GLP), and consult your organization's safety representative regarding proper use and handling. Guidelines are provided in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*.

## Caution symbol

---

The caution symbol signifies that an instrument's use or misuse can damage the instrument or compromise a sample's integrity. The following symbol and its associated statement are typical of the kind that alert you to the risk of damaging the instrument or sample.



**Caution:** To avoid damage, do not use abrasives or solvents to clean the instrument's case.

## Warnings that apply to all Waters instruments

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When operating this device, follow standard quality control procedures and the equipment guidelines in this section.



**Attention:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Important:** Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

**Achtung:** Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbezugnis des Systems führen.

**Avvertenza:** qualsiasi modifica o alterazione apportata a questa unità e non espressamente autorizzata dai responsabili per la conformità fa decadere il diritto all'utilizzo dell'apparecchiatura da parte dell'utente.

**Atencion:** cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

**注意:** 未經有關法規認證部門允許對本設備進行的改變或修改,可能會使使用者喪失操作該設備的權利。

**注意:** 未经有关法规认证部门明确允许对本设备进行的改变或改装,可能会使使用者丧失操作该设备的合法性。

**주의:** 규정 준수를 책임지는 당사자의 명백한 승인 없이 이 장치를 개조 또는 변경할 경우, 이 장치를 운용할 수 있는 사용자 권한의 효력을 상실할 수 있습니다.

**注意:** 規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザーとしての承認が無効になる可能性があります。



**Warning:** Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use tubing that has been severely stressed or kinked.
- Do not use nonmetallic tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause nonmetallic tubing to swell, which greatly reduces the rupture pressure of the tubing.

**Attention:** Manipulez les tubes en polymère sous pression avec précaution:

- Portez systématiquement des lunettes de protection lorsque vous vous trouvez à proximité de tubes en polymère pressurisés.
- Éteignez toute flamme se trouvant à proximité de l'instrument.
- Évitez d'utiliser des tubes sévèrement déformés ou endommagés.
- Évitez d'utiliser des tubes non métalliques avec du tétrahydrofurane (THF) ou de l'acide sulfurique ou nitrique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

**Vorsicht:** Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.



**Attenzione:** fare attenzione quando si utilizzano tubi in materiale polimerico sotto pressione:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Spegnere tutte le fiamme vive nell'ambiente circostante.
- Non utilizzare tubi eccessivamente logorati o piegati.
- Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrati.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamenti nei tubi non metallici, riducendo notevolmente la pressione di rottura dei tubi stessi.

**Advertencia:** se recomienda precaución cuando se trabaje con tubos de polímero sometidos a presión:

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.

**警告:** 當在有壓力的情況下使用聚合物管線時，小心注意以下幾點。

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。



**警告:** 当有压力的情况下使用管线时, 小心注意以下几点:

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。

要了解使用二氯甲烷及二甲基亚砜会导致非金属管线膨胀, 大大降低管线的耐压能力。

**경고:** 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

- 가압 폴리머 튜브 근처에서는 항상 보호 안경을 착용하십시오.
- 근처의 화기를 모두 끄십시오.
- 심하게 변형되거나 꼬인 튜브는 사용하지 마십시오.
- 비금속(Nonmetallic) 튜브를 테트라히드로푸란(Tetrahydrofuran: THF) 또는 농축 질산 또는 황산과 함께 사용하지 마십시오.

염화 메틸렌(Methylene chloride) 및 디메틸설폭시드(Dimethyl sulfoxide)는 비금속 튜브를 부풀려 튜브의 과열 압력을 크게 감소시킬 수 있으므로 유의하십시오.

**警告:** 圧力のかかったポリマーチューブを扱うときは、注意してください。

- 加圧されたポリマーチューブの付近では、必ず保護メガネを着用してください。
- 近くにある火を消してください。
- 著しく変形した、または折れ曲がったチューブは使用しないでください。
- 非金属チューブには、テトラヒドロフラン(THF)や高濃度の硝酸または硫酸などを流さないでください。

塩化メチレンやジメチルスルホキシドは、非金属チューブの膨張を引き起こす場合があります、その場合、チューブは極めて低い圧力で破裂します。



**Warning:** The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

**Attention:** L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

**Vorsicht:** Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwendung des Gerätes die eingebauten Sicherheitseinrichtungen unter Umständen nicht ordnungsgemäß funktionieren.

**Attenzione:** si rende noto all'utente che l'eventuale utilizzo dell'apparecchiatura secondo modalità non previste dal produttore può compromettere la protezione offerta dall'apparecchiatura.

**Advertencia:** el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrían ser insuficientes.

**警告:** 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

**警告:** 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

**경고:** 제조업체가 명시하지 않은 방식으로 장비를 사용할 경우 장비가 제공하는 보호수단이 제대로 작동하지 않을 수 있다는 점을 사용자에게 반드시 인식시켜야 합니다.

**警告:** ユーザーは、製造元により指定されていない方法で機器を使用すると、機器が提供している保証が無効になる可能性があることに注意して下さい。



**Warning:** To protect against fire, replace fuses with those of the type and rating indicated in the “Replacing fuses” section of the Maintenance section of Chapter 3.



**Attention:** pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués dans la rubrique "Remplacement des fusibles" du chapitre traitant des procédures de maintenance.



**Vorsicht:** Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.



**Attenzione:** per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate nel paragrafo "Sostituzione dei fusibili" del capitolo "Procedure di manutenzione".



**Advertencia:** Para evitar incendios, sustituir los fusibles por aquellos del tipo y características indicados en la sección "Sustituir fusibles".



**警告:** 為了避免火災，更換保險絲時，應使用「維護步驟」章節中「更換保險絲」所指定之相同類型與規格的保險絲。



**警告:** 为了避免火灾，应更换“维护步骤”一章的“更换保险丝”一节中介绍的相同类型和规格的保险丝。



**경고:** 화재의 위험을 막으려면 유지관리 절차 단원의 “퓨즈 교체” 절에 설명된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.



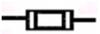
**警告:** 火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。

# Electrical and handling symbols

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## Electrical symbols

These can appear in instrument user manuals and on the instrument's front or rear panels.

	Electrical power on
	Electrical power off
	Standby
	Direct current
	Alternating current
	Protective conductor terminal
	Frame, or chassis, terminal
	Fuse
	Recycle symbol: Do not dispose in municipal waste.

## Handling symbols

These handling symbols and their associated text can appear on labels affixed to the outer packaging of Waters instrument and component shipments.

	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!



# B Specifications

## Contents

Topic	Page
Temperature Control Module II	B-2
Column Heater Module	B-3

## Temperature Control Module II

---

### Operational specifications

Condition	Specification
Programmable temperature limits	0 to 150 °C column heater module; the temperature control module cannot be programmed below room temperature, and the set point should be at least 5 °C above ambient
Environmental data	Operating temperature: 4 to 40 °C Storage temperature: -40 to 70°C Humidity: 10 to 90% noncondensing Maximum altitude: 2000 m
Safety features	Audible alarm/Error message Over/under temperature alert: 150 °C for the column heater module
Accuracy	+/-0.5 °C at set point
Dimensions	Height: 20.8 cm Length: 38.6 cm Width: 15.0 cm
Weight	Weight: 4.54 kg

### Electrical specifications

Condition	Specification
Protection class <sup>a</sup>	Class I
Oversvoltage category <sup>b</sup>	Category II
Pollution degree <sup>c</sup>	Degree 2
Moisture protection <sup>d</sup>	Normal (IPXO)
 Line voltage	Grounded AC, 100 to 240 +/-10%
Input frequency range	50/60 Hz

## Electrical specifications (Continued)

Condition	Specification
Maximum VA input	60 VA
Fuse	F 3.15 A

- a. Protection Class I – The insulating scheme used in the instrument to protect from electrical shock. Class I identifies a single level of insulation between live parts (wires) and exposed conductive parts (metal panels) in which the exposed conductive parts are connected to a grounding system. In turn, this grounding system is connected to the third pin (ground pin) on the electrical power cord plug.
- b. Overvoltage Category II – Pertains to instruments that receive their electrical power from a local level such as an electrical wall outlet.
- c. Pollution Degree 2 – A measure of pollution on electrical circuits, which can produce a reduction of dielectric strength or surface resistivity. Degree 2 refers only to normally non-conductive pollution. Occasionally, however, expect a temporary conductivity caused by condensation.
- d. Moisture Protection – Normal (IPXO) – IPXO means *no* ingress protection against any type of dripping or sprayed water exists. The X is a placeholder that identifies protection against dust, if applicable.

## Column Heater Module

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### Operational specifications

Condition	Specification
Power consumption	Nominal 240 W
Environmental data	Operating temperature: 4 to 40 °C Storage temperature: –40 to 70 °C Humidity: 10 to 90% noncondensing
Safety features	Line fusing Grounding Solvent spill drainage
Operating temperature range	Ambient 0 to 150 °C
Dimensions	Height: 9.6 cm Width: 17.8 cm Length: 46.4 cm Weight: 6.35 kg

## Electrical specifications

Condition	Specification
Protection class <sup>a</sup>	Class I
Oversvoltage category <sup>b</sup>	Category II
Pollution degree <sup>c</sup>	Degree 2
Moisture protection <sup>d</sup>	Normal (IPXO)
 Line voltages, nominal	Grounded AC

- a. Protection Class I – The insulating scheme used in the instrument to protect from electrical shock. Class I identifies a single level of insulation between live parts (wires) and exposed conductive parts (metal panels) in which the exposed conductive parts are connected to a grounding system. In turn, this grounding system is connected to the third pin (ground pin) on the electrical power cord plug.
- b. Oversvoltage Category II – Pertains to instruments that receive their electrical power from a local level such as an electrical wall outlet.
- c. Pollution Degree 2 – A measure of pollution on electrical circuits, which can produce a reduction of dielectric strength or surface resistivity. Degree 2 refers only to normally non-conductive pollution. Occasionally, however, expect a temporary conductivity caused by condensation.
- d. Moisture Protection – Normal (IPXO) – IPXO means no ingress protection against any type of dripping or sprayed water exists. The X is a placeholder that identifies protection against dust, if applicable.

# C Spare Parts

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## Temperature Control Module II

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### Recommended spare parts

Description	Part number
Fuse: F 3.15 A (250 V) Fuse carrier for F 3.15 A fuse	WAT163-16 WAT097559

## Column Heater Module

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### Recommended spare parts

Description	Part number
Column heater module extension cord, 10 ft	WAT038131
Inlet tubing	WAT038159
Silicon gasket	WAT043094
Fuse, 2.5 A	WAT072919
Cover latch	WAT010135
Column joining tubes	WAT038154
Column heater insert kits (old column design): 4 mm × 15 cm columns 4 mm × 25 cm columns 4 mm × 30 cm columns 8 mm × 25 cm columns 8 mm × 30 cm columns 7 mm × 30 cm columns	WAT038121 WAT038122 WAT038123 WAT038124 WAT038125 WAT038126
Column heater inserts (new column design): 4 mm × 15 cm columns 4 mm × 30 cm columns	WAT019886 WAT019887

**Note:** You should use only Waters-certified spare parts. To order spare parts for the temperature control system, call your Waters service representative.

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