

Discover[®] CoolMate[™]
Low-Temperature Microwave Synthesis System



**Operation
Manual**

Troubleshooting Guide

Condition	Possible Cause
CoolMate Error	CoolMate not turned on Accessory Cable not fully attached
Temperature Displayed on Discover Not correct	GF not entered CoolMate not communicating with Discover (see CoolMate error) Temperature = 0 °C (see Fiber Optic error)
Fiber Optic Error	Probe not attached Debris in connector Faulty probe Faulty connector cable (internal) Faulty FISO board
Fluid Leakage	Stopcock at back of instrument is open Loose connector (bottom of reservoir or vessel connections) Reaction vessel not locked into position
Fluid Leakage around Vessel Connections after Tightening	Ferrules bent or warped. Replace ferrules and/or union assembly.
Low Fluid Message	Fluid below minimum level. Add fluid. Fluid sensor required calibration (see Fluid Sensor Calibration) Partial vacuum being generated when pump is turned on (fluid level drops quickly and dramatically when pump is turned on) – remove o-ring from reservoir plug
CoolMate Display Difficult to Read	Contrast too low (see Contrast Adjustment) During rapid addition of N ₂ , the display has cooled. Resolution will return as display warms.
Pump Stopped	Fluid cooled below minimum temperature. Open top and remove cylinder plugs to permit reservoir to warm.

Limited Warranty

What is Covered:
CEM Corporation warrants that the instrument will be free of any defect in parts or workmanship and will, at its option, replace or repair any defective part (excluding consumables) or instrument.

For How Long:
This warranty remains in effect for 365 days from date of delivery to the original purchaser for all parts except those listed under the 180-day warranty period.
The following parts are warranted for 180 days: Pump Motor and Tubing Assemblies.

What is Not Covered:
This warranty does not cover parts or workmanship which have been damaged due to:

- Neglect, abuse or misuse.
- Damage caused by or to test samples.
- Damage incurred during instrument relocation.
- Damage caused by or to any attached equipment.
- Use of incorrect line voltages or fuses.
- Fire, flood, "acts of God" or other contingencies beyond the control of CEM Corporation.
- Improper or unauthorized repair, or
- Any other damage caused by purchaser or its agents.

Responsibilities of Purchaser:
To ensure warranty coverage, purchaser must:

- Use the instrument according to directions.
- Connect the instrument properly to a power supply of proper voltage.
- Replace blown fuses.
- Replace consumables and
- Clean the instrument as required.

How to Get Service:
Purchaser should contact the Service Department of CEM Corporation or his distributor for return authorization and for proper crating and shipping instructions to return instrument. (freight prepaid, for service. On-site repairs by an authorized service technician are available through the CEM Service Department. Travel costs will be charged to the purchaser for on-site repairs.)
CEM Corporation
3100 Smith Farm Rd.
Matthews, NC 28105
800.726.5551 (telephone within the US)
01.704.821.7015 (telephone outside the US)
01.704.821.7894 (fax)
service@cem.com (E-mail)

Warranty Disclaimer:
CEM Corporation hereby excludes and disclaims any warranty of merchantability or fitness for any particular purpose. No warranty, express or implied, extends beyond the face hereof. CEM Corporation shall not be liable for loss of use of instrument or other incidental or consequential costs, expenses or damages incurred by the purchaser or any other user.

Purchaser's Rights Under State Law:
This warranty gives the purchaser specific legal rights, and the purchaser may also have other rights which vary from state to state.

4. Remove the slide assembly from the attenuator cover.



Figure 63

5. Remove the attenuator cover from the attenuator.



Figure 64

6. Support the bottom of the glass jacket. Using a spatula or small screwdriver, remove the jacket collar from the jacket. Once the collar has been removed, the jacket will be removed from the attenuator.



Figure 65

Maintenance

1. Prior to each initial addition of cooling media (liquid nitrogen or dry ice), remove all water from the dry ice cylinders. CEM Corporation recommends using a long pipette or paper towels to remove water.
2. For long-term storage of the instrument, follow the procedures outlined in "System Storage."

- Using the two (2) screw-spring assemblies from step 5, secure the vessel slide. Tighten each screw with a screwdriver.



Figure 53



Figure 54

- Using the tubing with the installed nuts and ferrules, slide one piece of the Teflon tubing into each of the large openings in the attenuator as illustrated below. Secure the tubing with the black nuts.



Figure 55



Figure 56

Note: If the blue union nut assembly is attached to the top of the tubing, ensure that the fittings are on the appropriate sides (refer to Figure 56).

- If necessary, place the short lengths of silicone tubing onto the jacket arms. Attach this tubing to the tubing installed in step 8.



Figure 57



Figure 58



Figure 59. Fully Assembled Jacket/Attenuator

Disassembly of Jacket/Attenuator

- Disconnect the vessel assembly from the CoolMate Accessory and, if necessary, remove the reaction vessel.
- Remove the silicone tubing from the Teflon tubing.



Figure 60



Figure 61

- Remove the Teflon tubing from the attenuator.



Figure 62

2. Place the jacket collar (168360) around the jacket, so that it secures the jacket in the attenuator.
Note: The ring should slide into position with a clicking or locking sound.



Figure 45



Figure 46

3. Position the attenuator cover (168355) so that the underside is visible. Place the red o-ring (BR853000) over the center opening as illustrated below.



Figure 47

4. Place the attenuator cover, with the o-ring installed, onto the attenuator as illustrated below.



Figure 48

5. If necessary, assemble the two (2) screw-spring assemblies.

- a. Position the spring (BR016853) over the slide post (168345).



Figure 49

- b. Place the slide post cover (168350) over the spring to cover the slide post.



Figure 50

- c. Install the screw (BR199414) into the covered assembly so that the head of the screw faces the large end of the slide post.



Figure 51

- b. Place the vessel slide (168340) on the attenuator cover so that the slot aligns with the small screw holes in the attenuator.



Figure 52

Screen Contrast Adjustment

1. With the Main Menu displayed, the screen will show "IDLE." Press the "Mode" key. The screen will display "System Setup/Contrast."
2. Press the "Mode" key. The screen will display "Contrast/Set = Start."
3. Press the arrow keys to adjust the screen contrast.
4. Once the screen contrast is adjusted properly, press the "Start" key.

Fluid Sensor Calibration

1. With the Main Menu displayed, the screen will show "IDLE." Press the "Mode" key. The screen will display "System Setup/Contrast."
2. Press the "up" arrow key. The screen will display "System Setup/Liquid Detector."
3. Press the "Mode" key. The screen will display "Detector = On/Select = Start."
4. Ensure that the liquid level in the Tank Level gauge tube is above the "min" level. If the liquid is not above the minimum level, add sufficient fluid to bring the level above the minimum point.
5. Press the "Start" key. The screen will display "Apply Fluid/Start = Set (X.XX)."
6. Press the "Start" key. The screen will display "Remove Fluid/Start = Set X.XX."
7. Remove the "cap" from the liquid level detection tube. Place the right thumb over the end of the tube and move the liquid level detection tube down through the gauge so that the liquid level in the tube is below minimum.
8. Press the "Start" key. The screen will display "xxx C/Idle."
9. Pull the liquid level tube back through the gauge (sensor) so that the end of the tube is approximately 4" (10 cm) above the gauge (sensor). Remove the thumb from the top of the tube and replace the "cap" on the liquid level detection tube.

Jacket/Attenuator Assembly

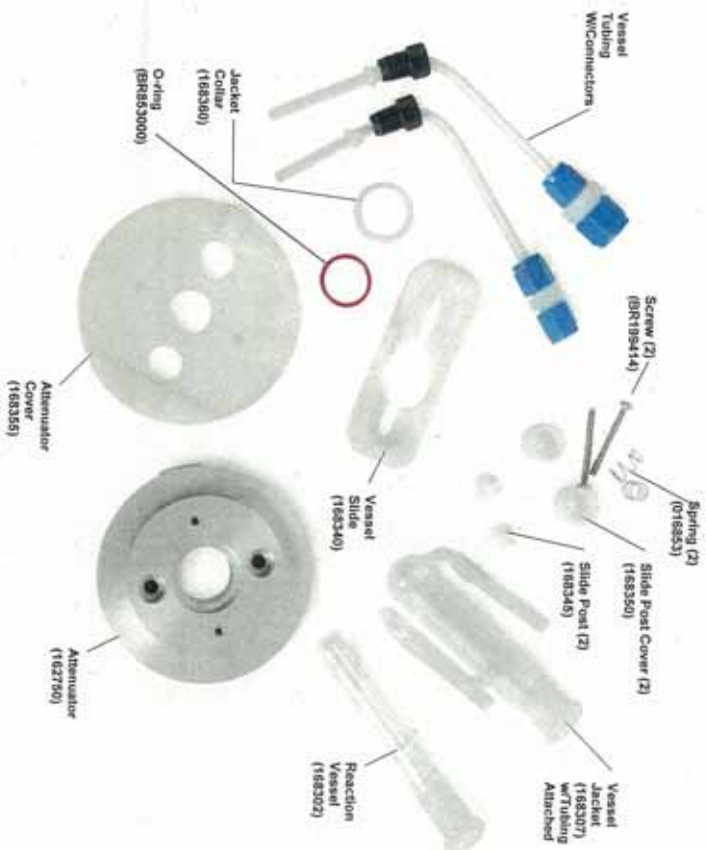


Figure 43. Vessel Assembly Components

- Note: Complete vessel assembly should not be necessary except when the jacket is replaced or cleaned.
1. Place the jacket through the center opening of the attenuator as illustrated below.



Figure 44.

System Storage

1. For short-term storage, the instrument can be stored with the fluid in the reservoir. To store the instrument with the fluid in the reservoir, place an empty reaction vessel into the jacket and secure it with the vessel slide.
2. Remove the fiber optic probe from the CoolMate and store it in its container.



Figure 39

3. Remove the vessel (with the tubing attached) from the cavity and place it in the vessel holder.
4. For long-term storage or to remove the fluid for short-term storage, position the instrument to permit access to the back of the instrument. Remove the tubing from the coil (Figure 41).



Figure 40



Figure 41

5. Position an empty container slightly below the instrument.
6. Place the tubing into the container and open the stopcock. The fluid will begin to drain from the reservoir (Figure 42).



Figure 42: Draining of Fluid

24

7. Permit the fluid to completely drain from the instrument.
8. Once all fluid is drained, disconnect the vessel from the tubing and store it in the vessel holder. Seal the drained fluid in an airtight container.

25

- d. Permit the vessel to purge until the desired atmosphere is attained.

Note: Parafilm® or other sealing film, can be used to ensure an air-tight seal between the vessel top and the reaction vessel.

7. The same ports can be used for liquid reagent addition prior to beginning the microwave method or for the placement of an inert gas line during the reaction. **Note:** If an inert gas line is used, ensure that the needle utilized does not extend below the bottom of the vessel top during the reaction.

Vessel Removal

1. Once the reaction is complete, turn the pump off.

NOTE

Removing the vessel before stopping the pump will cause fluid to flow out of the jacket.

2. Remove the fiber optic probe from the reaction vessel.
3. Remove the vessel from the jacket by positioning the vessel slide so that the large opening is over the reaction vessel (forward the user in the illustration below).



Figure 35

4. Push the slide forward so that it dislodges the reaction vessel from the jacket.



Figure 36

5. Remove the reaction vessel from the jacket.

6. Once the vessel is removed, another vessel can be inserted into the jacket as described in "Vessel Assembly." Continue performance of reactions by repeating the steps outlined in "Instrument Operation."

Note: If a second operation is not to be performed immediately, place an empty reaction vessel into position to prevent excess moisture from accumulating in the fluid.



Figure 37



Figure 38

Inert Operation

1. To operate under an inert atmosphere, place the reaction vessel, thermowell and stir bar, if applicable, into an oven to dry.

Note: Do not place the vessel top or septa into the oven.

2. Place the septa onto the vessel top.



Figure 28



Figure 29

WARNING
The glassware (reaction vessel, stir bar and thermowell) may be hot when removed from the oven. To prevent the possibility of burns, the user should wear insulated gloves and proper attire.

3. Once the glassware has dried, place the thermowell through the center opening in the vessel top so that it extends through the septa.



Figure 30



Figure 31

4. Place the stir bar into the reaction vessel. Place the vessel top with the installed thermowell and septa onto the reaction vessel. Ensure that the thermowell is installed properly so that it is near the bottom of the vessel, but not touching the stir bar.



Figure 32

5. If solid reagents are used, they can be added at this time prior to purging the vessel.
6. If applicable, purge the vessel with an inert gas source. Four openings are positioned around the perimeter of the vessel top for this purpose. Each of these openings is signified by a small silver dot on the vessel top.



Figure 33

- a. Pierce the septa with a needle connected to an inert gas (either argon or nitrogen).
- b. Position a second needle (not attached to the inert gas source) through the septa and into a second opening in the vessel top.



Figure 34

- c. Clamp the inert gas line so that the inert gas is forced to enter the reaction vessel and through the needle installed in step a and exit through the open needle installed in step b.



Figure 24

9. Insert the fiber optic probe into the thermowell until it touches the bottom of the thermowell.



Figure 25

10. Prior to beginning a reaction, ensure the pre-cool temperature is set. The pre-cool temperature is the temperature to which the vessel will cool prior to beginning irradiation. The pre-cool temperature is set in the Discover System Setup menu. From the Discover Main Screen, press EDIT. Using the right arrow key, scroll through the options until "Pre-Cool Temp" is displayed. Press ENTER. The temperature is displayed and can be edited by pressing EDIT. The temperature parameter can be toggled between a negative value and a positive value by pressing the Temperature hokey.

11. Using the keypad on the Discover, program a method as outlined in the Discover operation manual. As with the pre-cool temperature, a negative temperature can be selected by entering the number as usual, then changing it to a negative number using the Temperature hokey.

12. Press START on the Discover to begin the pre-cool step. The instrument will prompt the user to ensure that the vessel is in place. Visually ensure that the vessel is correctly installed with the tubing lines attached. Press START to activate the pump.

Note: The CoolMate can be started individually (without the Discover) Press START/STOP on the keypad of the CoolMate. The screen of the CoolMate will prompt the user to check the vessel to ensure that it is in the proper position. Inspect the vessel to ensure that it is installed correctly and securely fastened. Press START/STOP again. The pump will begin operation.

Note: If the vessel temperature exceeds +40°C or the reservoir temperature exceeds +35°C, the microwaves will be turned off.



Figure 26

13. The vessel will immediately begin to fill and cool. Once the vessel has cooled to the programmed pre-cool temperature, the microwave irradiation step will begin.

Note: If the pump was started from the CoolMate, a method will need to be programmed and started from the Discover to apply microwave power.



Figure 27

14. The CoolMate System permits the user to set the pump speed as well as microwave power and temperature. Use the "up" and "down" arrows on the CoolMate keypad to adjust the pump speed (1-10). The number of bars on the bottom of the display indicates the current pump speed.

4. Four openings are positioned on the outside of the vessel top for liquid reagent addition prior to beginning a method, if desired. Placement of each of these openings is signified by a small silver dot on the vessel top.



Figure 22

Instrument Operation

Note: Approximately 20-30 minutes prior to performing a reaction, fill the cylinders with dry ice or liquid nitrogen as described in the Instrument Setup instructions, providing ample time for the fluid to cool.

1. Using the power switch on the right rear of the instrument, turn on the CoolMate.
2. Using the power switch on the left rear of the instrument, turn on the Discover.

Note: If the top of the display reads "COOLMATE," communication has been established between the Discover and CoolMate. Proceed to step 7. *If the display reads anything other than "COOLMATE," perform the procedures outlined in steps 3 through 6.*

3. To establish communication between the CoolMate and the Discover system, press the "EDIT" key on the Discover.
4. Using the right arrow key, toggle to "System Options." Press "ENTER" to select the first option, "Peripherals."
5. Using the right arrow key, toggle through the options until "COOLMATE" appears. Press "ENTER" to select "COOLMATE." The system will display a series of screens indicating the connection process. Once the communication has been confirmed, the Main Screen will be displayed on the Discover and the top line will read "COOLMATE."
6. Place the attenuator in the cavity and turn it clockwise to lock it into position.
7. Insert the reaction vessel assembled with a stir bar, the vessel top and thermowell into the jacket/attenuator assembly.



Figure 23

8. Grasp the sides of the vessel slide, pull upward and move the slide forward so that the vessel is locked under the slide.

Addition of Cooling Medium

WARNING

Proper precautions must be taken when using either liquid nitrogen or dry ice. Protective gear should be worn as outlined in the user's safety program for hazardous materials and the medium manufacturer's material safety data sheet. Refer to these guidelines for proper handling and disposal of cooling medium. To prevent the possibility of burns or frostbite, ensure that insulated gloves and protective gear as outlined in the user's safety program are worn during instrument operation.

- Open the top and remove the plugs covering the two cooling media cylinders (Figure 15). Insert the cooling media funnel provided with the instrument into the cylinder opening (Figure 16) to simplify the addition of either dry ice or liquid nitrogen.



Figure 15. Removal of Cylinder Cover



Figure 16. Placement of Cooling Media Funnel

- Using the funnel on the top of the instrument, place the cooling medium, either dry ice or liquid nitrogen, in each of the cylinders. Once the first cylinder is filled, the funnel should be moved to the second cylinder. Fill each cylinder only to the top of the metal cylinder, keeping the medium below the level of the funnel when possible.

CAUTION

Use **ONLY** dry ice or liquid nitrogen to fill the instrument cylinders. Use of other media will void the manufacturer's warranty.

Overfilling the cylinders will cause excess frost to build on the top of the instrument.

Note: If the fluid temperature in the reservoir drops below -80°C , a warning will appear. If the temperature continues to drop to a level below -90°C , a second warning will appear, instructing the user to stop adding liquid nitrogen. If the temperature drops below -100°C , the pump will turn off.

Thermowell Assembly

- Position the septa on the vessel top.



Figure 18



Figure 18

- Insert the thermowell through the center opening in the vessel top so that it extends through the septa.



Figure 19



Figure 20

- Place the stir bar into the reaction vessel. Place the vessel top on the reaction vessel with the attached thermowell and septa. The thermowell should be positioned near the bottom of the reaction vessel, but not touching the stir bar.



Figure 21

Tubing Connections

1. Place the jacket/attenuator assembly with a reaction vessel in place into the cavity of the Discover System, ensuring that the jacket arms and attached tubing are positioned properly, and turn the attenuator clockwise to lock it into the cavity. Note: Each of the two (2) lengths of tubing extending from the CoolMate System are assembled with a compression fitting which is capped with a blue nut.
2. Beginning with the tubing extending from the back left of the CoolMate (Fluid Out), remove the blue nut and the two (2) ferrules. Remove the ferrules from the blue cap. (Ensure that the ferrules did not fall out of the cap.)

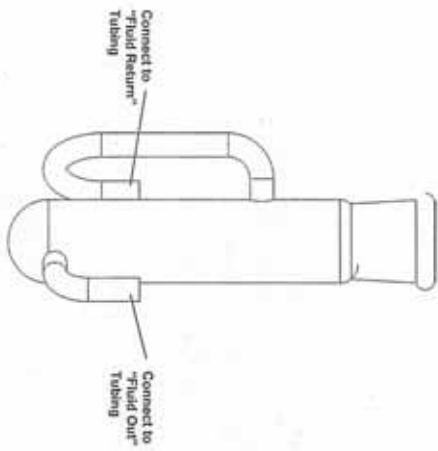


Figure 12

3. Connect the tubing from step 2 to the tubing on the side of the vessel with the arm extending toward the bottom of the vessel.
4. Install the blue nut, the back ferrule and the front ferrule on the tubing extending from the vessel.

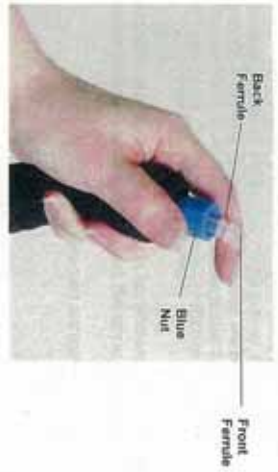


Figure 13

5. Connect the nut to the clear union.



Figure 14

6. Repeat steps 2 through 5 for the tubing extending from the back right side of the CoolMate (Fluid Return).
7. Turn the pump on and check for leakage around all connections.

6. Connect the fiber optic probe to the port on the top of the CoolMate. To properly position the probe, insert the end of the probe into the port on the CoolMate. The probe attaches to the instrument with a locking "collar" on the sensor. Push the "collar" in, twist it clockwise and release it to lock the probe into the module.



Figure 6: Connect of Probe to Top of CoolMate System



Figure 7: Correctly Positioned and Locked Fiber Optic Probe

7. Establish communication between the microwave instrument and CoolMate, then enter the temperature constant (GF Number) for the fiber optic probe as follows. The GF Number is recorded on the label attached to the fiber optic probe as well as the label on the case in which the probe is shipped.
 - a. Using the Discover keypad, press EDIT.
 - b. Press the right arrow key twice to access "System Setup." Press ENTER. The "Peripheral Settings" option screen will be displayed.
 - c. Press ENTER.
 - d. Press the right arrow key to toggle through the options until "CoolMate" appears. Press ENTER. The system will display a series of screens indicating the connection process. Once communication has been confirmed, the Main Screen will appear and the top line will read "COOLMATE."
 - e. If a fiber optic probe has not been used with the Discover system, the system will automatically require and ask for the calibration value. The calibration value (GF XXXXXXXX) is located on the white label attached to the fiber optic probe. To enter this value, press EDIT. Enter the number.
 - f. If a fiber optic probe has been used with the Discover, the value of the new probe must be entered. From the Discover Main Screen, press EDIT. "Temperature" will appear on the screen. Press ENTER. "Enter Calibration Value" will appear on the screen. Press ENTER. The GF number corresponding to the previously used fiber optic probe will be displayed. Press EDIT to revise this number to the new GF number for the CoolMate probe. Enter the new GF number from the label attached to the probe. Press HOME twice to return to the Main Screen.

Filling of Reservoir

1. Open the top of the CoolMate. Remove the white cap (positioned to the left of the two cylinders on top of the instrument), and insert the fluid funnel provided with the instrument (Figures 8 and 9).



Figure 8: Removal of Plug Figure



Figure 9: Funnel Inserted into Fill Hole

2. Add the fluid provided with the instrument to the reservoir.



Figure 10: Fluid Addition

3. As fluid is added, observe the fluid level in the tubing on the back right of the instrument. Continue filling until the fluid level is near, but not above, the maximum level.



Figure 11: Appropriate Fill Level

- Note:** The fluid level must be maintained above the minimum level while in operation. If the fluid level falls below the minimum level, the pump will immediately stop and provide a message to add more fluid.
4. Remove the attenuator from the Discover cavity.



Figure 2

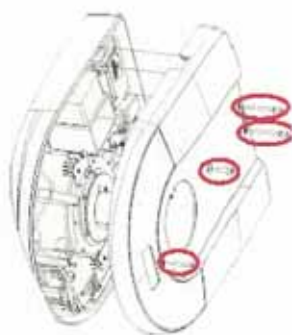


Figure 3

5. Remove the top cover lid by pressing lightly on the secure tab at the rear center of the lid while slightly lifting and pulling backward on the lid to disengage the front insert tabs (Figure 2).
6. Remove the four (4) screws securing the top cover assembly (Figure 3).
7. Unplug the pressure sensor and all other connections from the back of the instrument.
8. Lift the top cover from the instrument, leaving all electrical wiring connected.
9. Remove the E-PROM from the CPU board. Note the "notch" in the end of the E-PROM for proper positioning of the new E-PROM.
10. Install the new E-PROM on the CPU board, ensuring that the pins are positioned to prevent bending or breaking any pins during installation on the connector. Also ensure that the "notch" of the E-PROM is positioned in the same position as the removed E-PROM.
11. Install the top cover on the instrument. Secure the lid with the four (4) screws removed in step 6.
12. Plug the instrument into the electrical outlet. Turn the instrument on.
13. From the instrument main menu, press EDIT to access the "System Setup" screen. Press ENTER to access the "Calibrate Temperature" screen. Press ENTER to display the temperature calibration slope value. Press EDIT to change the temperature (slope) values to those recorded in step 3. Press the HOME key.
14. If using a computer with the ChemDriver software, connect the serial cable into COM1.

Connection of System Modules (CoolMate and Discover)

1. Position the Discover and CoolMate to permit access to the connections on the back of both instruments.
2. Plug the communication cable supplied with the CoolMate into the port on the back of the CoolMate, then into port COM2 on the back of the Discover (Figure 4).



Figure 4: Back of Discover and CoolMate with Communication Cable Installed

3. Attach the power cord to the back of the CoolMate, and plug it into the electrical outlet.
4. Reposition both instruments to permit access to the front of the instruments.
5. Remove the blue fiber optic probe from the protective packaging. Remove the protective cover from the end of the probe (Figure 5).



Figure 5: Removal of Protective Cover

Accessories



System Assembly

CoolMate Vessel Holder Attachment

1. Position the CoolMate™ on the desired side of the Discover® instrument. The vessel holder can be attached to either side of the CoolMate, so that is located between the Discover and the CoolMate, or on the far side of the CoolMate.
2. Tilt the CoolMate to access the bottom of the instrument. Using the two (2) screws provided, attach the vessel holder to the CoolMate. (Figure 1)



Figure 1

3. Position the CoolMate in an upright position beside the Discover.

Replacement of Discover E-PROM

1. Turn the Discover instrument off.
2. Turn the instrument on and observe the instrument screen for display of the "Clock Frequency," "Firmware Version," and "CPU Version." Record the Firmware Version.

Note: If the part number of the firmware is 201A03 or higher, replacement of the E-PROM is not required. Proceed to "Connection of System Modules." If the firmware version is 201A02 or below, replace the E-PROM as outlined below.

3. From the instrument main menu, press EDIT to access the "System Setup" screen. Press ENTER to access the "Calibrate Temperature" screen. Press ENTER to display the temperature calibration slope value. Record the Slope Value for re-entry.
4. Turn the instrument off and disconnect the power cord from the electrical outlet.

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Introduction

The CoolMate™ Accessory is designed to expand the range of chemistries that can benefit from microwave enhancement. The addition of the CoolMate to the Discover® Microwave System broadens the temperature range in which a reaction can be performed while still achieving the same rate enhancements associated with other microwave reactions.

The Discover® CoolMate System can perform standard temperature-sensitive reactions including the use and formation of highly reactive reagents and intermediates, all while maintaining the security of constant temperature control. The safe use of highly reactive species in a microwave system is an area previously believed to be out of reach with microwave-enhanced synthesis.

Because microwave energy is transferred kinetically, not thermally, it can accelerate reactions while maintaining a low temperature. The CoolMate proprietary, jacketed reaction vessel and cooling media are both microwave transparent, ensuring the full energy transmission directly to the reactants. The vessel and cooling technology keep the temperature of the reactants low, preventing thermal degradation of the product. Temperature is measured with a fiber optic probe inserted directly into the reaction mixture to ensure fast, accurate and convenient reaction control.

In order to maintain the constant temperature control, CoolMate uses two items:

- **Heat Transfer Fluid:** a microwave transparent fluid added to the reservoir to cool the reaction vessel
- **Liquid Nitrogen or Dry Ice (Cooling Medium):** coolants used to cool the heat transfer fluid and reduce the operating temperature. CoolMate uses only one of these coolants based on the reaction temperatures required.

The intuitive software of the CoolMate enables simple translation of conventional methods to microwave conditions. The compact system (Discover and CoolMate) fits into a standard fume hood.

Features

- Maximum Reservoir Temperature = + 35 °C
- Specialized cap enables the establishment of an inert environment
- Ground glass joint enables the attachment of additional standard glassware
- Temperature monitored with a fiber optic probe
- Automatic power manipulation to ensure a stable temperature
- Removable vessel inserts enable quick reaction changes and simple storage
- Minimum Recommended Reservoir Temperature = -80 °C
- Maximum Vessel Temperature = +40 °C
- Must be operated using Galden HT-55 PTFE fluid (available from CEM Corporation, Julabo, or Solvay Solexis).

CAUTION

Use of any fluid other than fluid(s) with specifications recommended by CEM Corporation in the CoolMate System voids the instrument warranty.

Operating Precautions

The CoolMate System™ must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for electric current. This instrument is equipped with a cord having a grounding wire with a grounding plug. The plug must be plugged into an outlet that is properly installed and grounded. Consult a qualified electrician or service technician if the grounding instructions are not completely understood or if doubt exists as to whether the instrument is properly grounded. If it is necessary to use an extension cord, use only a 3-wire extension cord that has a 3-blade grounding plug and a 3-slot receptacle that will accept the plug from the instrument. The marked rating of the extension cord must be equal to or greater than the electrical rating of the instrument.

Use of the CoolMate Instrument in any manner not specified by CEM Corporation could render the instrument operation unsafe for the operator.

This instrument complies with United States Code of Federal Regulations 21CFR Part 1030.10 (C) for microwave leakage. A verification report is on file. This instrument complies with FCC Requirements in the United States Code of Federal Regulations (47CFR Part 18) – Industrial, Scientific and Medical (ISM) Equipment – emissions requirements. A verification report is on file.

Warnings and Cautions

Warnings, cautions and notes are included throughout this manual and should be read thoroughly and strictly followed.

WARNING: A warning is inserted for essential information used to emphasize dangerous or hazardous conditions to the operator, cleaning and maintenance of the instrument which may result in personal injury.

CAUTION: A caution is inserted for essential information used to emphasize procedures which, if not strictly followed, may result in damage or destruction to the instrument or improper instrument operation.

NOTE: A note is inserted for emphasis of procedures or conditions that may otherwise be misinterpreted or overlooked and to clarify possible confusing situations.

WARNING

If damage to the instrument is noted upon receipt, do not attempt to operate the instrument.

Proper precautions must be taken when using either liquid nitrogen or dry ice. Protective gear should be worn as outlined in the user's safety program for hazardous materials and the medium manufacturer's material safety data sheet. Refer to these guidelines for proper handling and disposal of cooling medium.

To prevent the possibility of burns or frostbite, ensure that insulated gloves and protective gear as outlined in the user's safety program are worn during instrument operation.

Disconnect the instrument from the AC power source prior to performing any service procedure.

Prior to using any cleaning or decontamination method except those recommended by the equipment manufacturer, the user should check with the manufacturer that the proposed method will not damage the equipment.