Discover® SP

600635
Rev. 4

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Manufactured in the
United States of America

Contents:

Operating Precautions

The Discover® 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.

The possibility of instrument-induced electromagnetic interference (EMI) is minimal if the instrument is operated as outlined in this manual. The instrument should not be placed close to any electrical device susceptible to EMI. The manufacturer suggests that the user post a sign warning pacemaker wearers that a microwave device is in operation. If the instrument is suspected of inducing EMI, a microwave leakage measurement should be performed as outlined in this manual. Leakage measured above the legal limit of 5 mW/cm_2 should be reported to the CEM Service Department.

Cardiac pacemakers require magnets to control their operation during checkout. Because the instrument is equipped with an electromagnetic sample stirrer which contains very high static magnetic fields, some danger exists if a pacemaker is positioned in close proximity of the instrument cavity. If the instrument is suspected of interfering with the operation of a pacemaker, the instrument should be turned off or the pacemaker wearer should move away from the instrument.

This instrument utilizes high voltages and microwave radiation. Only those trained in repair and maintenance of high voltage and microwave power systems should perform instrument service and repair.

Use of the Discover 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 operation, 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.

Introduction

The CEM Focused Microwave™ Synthesis System, Discover® SP, is designed to enhance the ability to perform chemical reactions under controlled conditions on a laboratory scale. The system facilitates either homogeneous or heterogeneous solution phase chemistry, solid phase chemistry or chemistry conducted on solid supports. It accommodates vessels ranging in working volume from 5mL to 125mL for reactions performed under atmospheric conditions and 10mL or 35mL vessels with septa in addition to 80mL vessels for reactions performed at elevated temperatures and pressures. Primary uses of the Discover are in the discovery and lead optimization phases of the new product development process.

The Discover SP system also incorporates ActiVent Technology which permits the user to release unwanted gaseous byproducts from the reaction to prevent over pressurization and vial failure from gaseous buildup. This ensures safe handling of the vial during and at the end of the reaction. The ActiVent safely bleeds the solvent/vapor from the reaction vessel and releases it through the vent tube connected to the back of the system and into a controlled environment.

Microwave energy is applied to the vessel contents (reactants, catalysts, salts, solvents and/or solid supports) to accelerate the chemical reaction. The microwave absorption properties of some liquid and solid materials, due to their polar and ionic characteristics, have the capability to significantly enhance chemical reactions relative to traditional energy application (heating) techniques. The microwave interaction properties with the reactants, intermediates, catalysts, solid supports and salts provide unique opportunities for the synthetic chemist.

The Discover System consists of:

- A continuous microwave power delivery system with operator selectable power output from 0 - 300 watts (+/- 30 watts) programmable in 1-watt increments.
- A self-adjusting, single mode microwave cavity that is manually accessed via multiple attenuator ports.
- A 256 x 128 graphics display and on-board computer for programming and operational control of the system. The memory will store and recall methods.
- 3 safety interlocks and an interlock monitoring system to prevent microwave emission when the attenuator port is not properly installed.
- One (1) serial port (1 RS 232).
- Two (2) ethernet ports for computer interface and network connection (optional configuration).
- One RJ-11 port for peripheral connection.
- An accessory kit.
- Two (2) USB slots
- **Infrared Temperature Control System** – This temperature control system uses a non-contact, infrared sensor to measure temperature. It is located below the microwave cavity floor and measures the temperature on the bottom of the vessel. The sensor is vessel volume independent and is used in a feedback loop with the on-board computer to control the temperature rise rate and control point of the vessel contents. Temperature is programmable from 0°C to 300°C.
- **Stirring Option** - The stirring option consists of an electromagnetic plate located below the floor of the microwave cavity. “Stirring” occurs when the magnetic field couples with a stir bar in the vessel. The method setup enables the stirring feature and the stirring speed. Standard stir bars appropriate to the vessel size are used.
- **Cooling Option** – The cooling option consists of necessary valves and ports to direct a cooling gas (either nitrogen or “clean” air) onto the vessel in the system cavity. This option will decrease the temperature of a 2mL solution in a 10mL Pyrex reaction vessel from ~150 ºC to ~50 ºC in less than 120 seconds. Method setup enables the cooling feature.

Instrument Description

Front View

User Interface

The user interface consists of the keypad and display. This provides the means for the user to input information into and output information from the Discover System.

The input functions are performed with the keypad and provide the ability to

- create new methods and edit existing methods,
- recall and delete methods
- change operating parameters during method operation in real time
- start, pause and stop operation
- set up a computer (optional)
- configure the sensor options and system options
- create and edit user profiles

.

The output functions are obtained from the display and computer/ethernet port. The display provides visual information of the keypad entry and permanently stored instrument information. The computer/ethernet port provides the option of using an offboard PC to program the system and to collect data

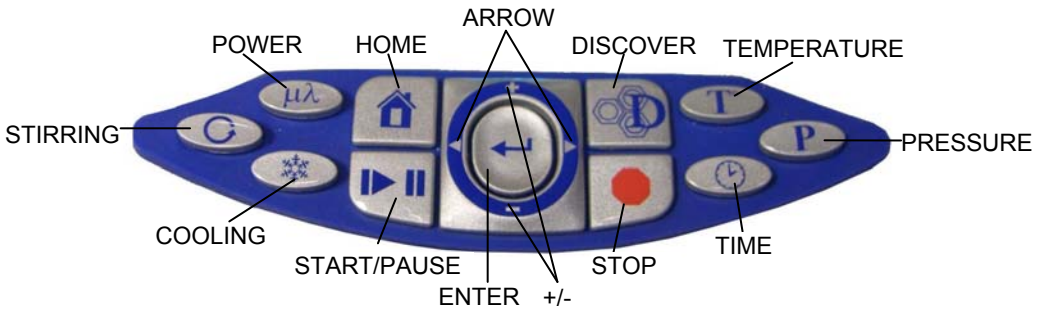
- **Display –** displays menus, method parameters and instrument status on a 256 x 128 graphics display.
- **Keypad –** allows the operator to create, edit, store and recall methods, start and stop methods and change programmed parameters during operation.
- **Attenuator –** provides access to the instrument cavity while preventing microwave leakage during operation. The attenuator can be installed or removed with a “twist-lock” action (no tools required).

WARNING

Never modify the attenuator access port or insert metallic objects such as wire into the port. Serious microwave leakage and/or electrical shock may result. The access port of the Discover is electrically grounded to the microwave cavity and is designed to prevent leakage of microwave energy.

- **Interlock Assembly –** monitors mating of the attenuator to the cavity. If the attenuator is not installed properly, the instrument will not deliver microwave power nor permit the system to operate.

Keypad



- **HOME –** Press to return to the main screen from any menu in the software. Within the System Setup portion of the software, press this key to return to the previous menu.
- **START/PAUSE –** Press to start the current method or press during method operation to pause or suspend operation. Pressing the key again will restart the method from the paused point.
- **ENTER –** Press to accept entries while editing or creating a method or in System Setup.
- **DISCOVER –** Press to load, save and create methods and review data. Pressing this key permits navigation through and selection of program options.
- **STOP –** Press to stop any process. Pressing this key when performing a method will stop microwave radiation and launch the cooling function. Pressing this key during the cooling cycle will abort the cooling cycle and return the system to the home screen.
- **ARROW** – Press to navigate through method programming or System Setup steps.
- **+/-** – Press to increase or decrease highlighted method parameters or to navigate through System Setup steps.
- **POWER –** Press this key to change the maximum applied microwave power setting prior to or during a method. Use the +/- keys to increase or decrease the setting. If this key is pressed during a method, this does not stop or pause the method but updates the setting in real time. The updated setting is not captured as part of the saved method file in the method library.
- **STIRRING –** Press this key to change the stirring setting prior to or during a method. Use the +/- keys to toggle to the appropriate setting (High, Medium, Low, Off). If this key is pressed during a method, this does not stop or pause the method but permits changing the setting in real time. The updated setting is not captured as part of the saved method file in the method library.
- **COOLING –** Press this prior to beginning a method or during a method to perform the cooling function. If this key is pressed during a method, it does not stop or pause the method but updates the setting in real time. The updated setting is not captured as part of the saved method file in the method library. If this key is pressed while the instrument is idle, the PowerMax option appears.
- **TEMPERATURE -** Press this key to change the temperature setpoint before or during a method. Use the +/- keys to increase or decrease the setting. If this key is pressed during a method, this does not stop or pause a method but updates the setting in real time. The updated setting is not captured as part of the saved method file in the method library.
- **PRESSURE –** Press this key to change the pressure set point prior to or during a method. Use the +/- keys to increase or decrease the setting. If this key is pressed during a method, this does not stop or pause a method but updates the setting in real time. The updated setting is not captured as part of the saved method file in the method library.
- **TIME –** Press this key to change the time value during or after a method. Use the +/- keys to increase or decrease the time setting. Pressing this key allows for real time changes to this value. This does not stop or pause a method but updates the setting in real time.

Method Status Bar

Current Pressure (PSI or Bar)	Current Power	Stirring Speed H-High M-Medium L-Low X-Off	Temperature Control IR-Infrared FO-Fiber Optic	Vessel Type	Cooling (On or Off)	Microwaves (On or Off)	System Accessory D-Discover E-Explorer C-CoolMate V-Voyager FO-Fiber Optic

Rear View

- **Power Cord Receptacle** – Receives the female end of the power cord.
- **Magnetron Cooling Fan** – Draws room air past the magnetron for cooling purposes.
- **Power Supply Cooling Fan** – Draws room air past the power supply for cooling purposes.
- **Fuses –** Prevent electrical power overload.
- **Electrical Connector –** Connects autosampler or other peripheral accessory to the reactor module.
- **RS232 Port –** Allows additional connection and communication.
- **Spill Tray** – Removable collection tray for cavity contents in case of a vessel failure.
- **Ethernet Port** – Allows communication and connection to an external computer for data collection, a local area network (LAN) or the Internet. (Optional).
- **Nameplate –** Lists the model, serial number, Product Tag, operating voltage, frequency and current of the instrument.

Side Views

- **Power Switch** – Turns AC power on and off to the instrument.
- **Cooling Gas Line –** Provides a hose connection for the cooling gas source.
- **7-Pin Connector** – Connects pressure measurement device to the main controller board.
- **USB Ports** – Permit installation of USB memory stick to import, export, backup and/or save instrument data.
- **RJ 11 Port** – Permits connection and use of additional accessories.

Sample Stirrer

The sample stirrer is a plate containing electromagnetic coils positioned beneath the instrument cavity floor. The electromagnetic stirring plate works in conjunction with stirring bars placed in the reaction vessel to affect stirring and ensure a homogeneous sample. An initial supply of magnetic stir bars are provided with the system. Additional stir bars can be purchased from CEM Corporation or any commercially available Teflon® coated magnetic stir bars can be used.

NOTE: The stir bars are Teflon®-coated iron oxide bars. When placed in the microwave field, the iron oxide bars will reflect the microwave energy without damaging the instrument.

WARNING

Cardiac pacemakers require magnets to control operation during checkout. If the Discover System is equipped with a sample stirrer, some danger exists if a pacemaker is positioned in close proximity to the instrument cavity. If the instrument is suspected of interfering with the operation of a pacemaker, the instrument should be turned off or the pacemaker wearer should move away from the instrument.

Cooling

The cooling feature directs a gas source onto the outside wall of the reaction vessel. This provides the ability to rapidly cool (quench) a reaction after the application of microwave energy. The cooling feature is either “on or off” and is part of the method. The feature consists of:

- “plumbing” to direct the gas from the inlet point of the Discover to the reaction vessel in the cavity, a solenoid valve connected to the CPU (controller) board to turn the gas flow on and off
- A hose fitting to connect the Discover to the gas source via a hose
- 8 feet (2.44 meters) of ¼ inch (6.35 mm) inside diameter air hose

The gas source is user supplied. CEM Corporation recommends either nitrogen or “clean” air at a minimum pressure of 25 psi (~ 1.5 bar). This will provide a flow rate of 20 liters per minute and will cool a 5mL volume of ethylene glycol in a 10mL reaction vessel from 150 °C to less than 50 °C in less than 2 minutes.

System Installation

Installation Site

The Discover System may be installed in a laboratory fume hood or on a laboratory bench with proper ventilation. Choose a location that

- Provides at least 8 in. (20 cm) of open space on each side and 6 in. (15 cm) of open space in the rear of the instrument for ventilation. The space should be at least 22 in. (46 cm) wide by 25 in. (64 cm) deep with a height clearance of at least 35 in. (89 cm).
- Is free from vibration of large equipment and/or excessive walk-through traffic.
- provides a temperature range of 41 °F (5 °C) to 104 °F (40 °C) and a humidity range of ±10-85% relative humidity.
- provides adequate space for sample handling (and computer placement if applicable), and
- permits the system to be connected to a dedicated, grounded 120 or 240 VAC outlet. The Discover System should be operated on a stabilized, constant voltage AC power supply. To operate properly, the voltage must be within 10T of the specified level.

Unpacking

Carefully remove the Discover System from its shipping carton and place it in an appropriate location in the fume hood or on a laboratory bench.

Note: Retain all packing material for use if returning the system to the manufacturer, subsidiary or distributor for service.

Inspect the instrument for shipping damage such as cracks, dents or warping.

WARNING

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

This instrument utilizes high voltages and microwave radiation. Only technicians trained in repair and maintenance of high voltage and microwave power systems should perform instrument service and repair.

Never modify the attenuator access port or insert metallic objects such as wire into the port. Serious microwave leakage and/or electrical shock may result. The access port of the Discover is electrically grounded to the microwave cavity and is designed to prevent leakage of microwave energy.

Cardiac pacemakers require magnets to control operation during checkout. Because the Discover System is equipped with a variable-speed, electromagnetic sample stirrer, some danger exists if a pacemaker is positioned in close proximity to the instrument cavity. If the instrument is suspected of interfering with the operation of a pacemaker, the instrument should be turned off or the pacemaker wearer should move away from the instrument.

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

If the instrument has been damaged in shipping, contact the freight carrier to report the damage and to file a damage report. Contact the CEM Service Department or the local subsidiary or distributor to report damage and to request service information.

Discover SP Installation

1. Place the Discover in a hood or on bench.
2. Plug the power cord into the back of the instrument.

3. Remove the vent tubing from the accessory kit and connect to the rear of the ActiVent.

4. Place the other end in the back of the fume hood or other location appropriate for solvent exposure.
5. Plug the power cord into the wall outlet.
6. To set up the air regulator:
    a. Splice the tubing supplied by CEM in half.

    b. Install one length of the tubing into the left side of the Discover by pushing in on the tubing until resistance is felt.

    c. Place the opposite end of the tubing into the regulator.

    NOTE: The regulator has an arrow printed on it to show the direction that the air must flow. Set up the regulator according to the arrow.

d. Place the second length of tubing into the opposite end of the regulator.

e. Connect the opposite end of the tubing to the air source.
f. To change the amount of air flow from the regulator:
    - Pull the knob out.
    - Rotate the knob on the regulator clockwise to increase the amount of air flow.
    - Rotate the knob on the regulator counter clockwise to decrease the amount of air flow.
    - The minimum compressed gas requirement is 25 PSI (20L/min flow)
    - The maximum flow rate is 60 PSI.

    NOTE: The air flow should remain on at all times when a reaction is being performed.

7. Check the cavity for debris.
8. Using the power switch located on the left side of the Discover, turn the instrument on.
9. The ActiVent (pressure device) will return to the home position once the Log-in screen appears. Remove the 35mL shipping device.

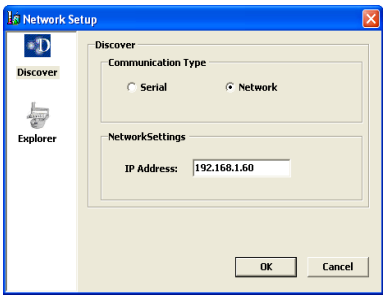
NOTE: Do not throw the 35mL shipping device away. It will be required for returning the system to CEM Corporation.

Computer Installation (optional)

1. Connect one end of the Ethernet cable to one of the Ethernet ports located at the rear of the Discover.
2. Connect the opposite end of the Ethernet cable extending from the Discover to the computer.
3. Ensure the computer is on and the Desktop is visible. Select the Synergy icon to activate the Synergy software. If the Synergy icon is not visible on the Desktop, insert the Synergy CD and follow the on-screen instructions.

NOTE: If this is the first time the software has been opened on the computer the user will be prompted to create a new account.

4. Using the pull-down menu, select the proper user name and enter the appropriate password. Select “OK.” Synergy will automatically load the user’s preferences and connect to the Discover and Explorer modules during the login process.
5. Select “Network Setup”. The following screen will appear.



6. Select the Discover icon.
7. The IP Address should read “192.168.1.60.” If the IP Address does not read as shown, highlight the IP Address, and using the computer keyboard enter the correct IP Address.
8. Select “OK.” The icons in the status bar will become green and show that the instruments are connected.

9. If the icons are red and system is not connected, follow the procedure as outlined below to assign a fixed IP address to the PC/Laptop:
    a. Right click on the “My Network Places” icon on the desktop and select “Properties”. This will open the “Network Connections” window.
    b. Right click on “Local Area Connection” and select “Properties”. This will open the “Local Area Connections Properties” window.
    c. Select the “General” tab; highlight the “Internet Protocol (TCP/IP) connection and click on the “Properties” button. This will give the Internet Protocol (TCP/IP) Properties window.
    d. Click on “Use the following IP address”.
    e. Assign 192.168.1.10 to the IP address.
    f. Press the “tab” button and the subnet mask box should populate with 255.255.0.0.

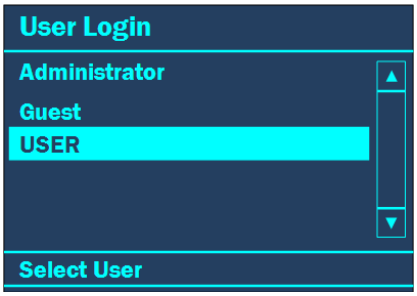
        NOTE: The IP address consists of up to 12 numeric characters. The address is broken into 4 sets of up to 3 numeric characters per set. Each set is separated by a period (.). In the Discover System, the first character after a period can be a zero(0). However the first numeric character **cannot** be a zero when entered into the PC/Laptop IP Address box. The first two sets of Fixed IP Address numbers for the PC/Laptop must match the Discover's first two sets of numbers. However the PC/Laptop’s Fixed IP Address must be unique, thus the reason to decrement the last set of numbers.

    g. Press the “ok” button. This will close out the Internet Protocol (TCP/IP) Properties window and return you to the “Local Area Connections Properties” window.
    h. Click on the “close” button and this will return you to the “Network Connections” window.
    i. Close this window to return to the Desktop.
    j. Follow the above steps, 1-8.

User Login

Before system operation can begin, the user is required to login to the Discover system. The Discover software is designed to permit use by three types of users: Standard, Administrator and Guest. The Discover is originally equipped with an “Administrator”, “User”, and “Guest”. The “Administrator” login cannot be deleted. Refer to instrument Setup for instructions to create administrative, guest and standard user profiles.

- Administrator- can add, modify, or delete users; perform tasks related to the maintenance of the system; modify all system settings and perform methods.
- Standard- can perform methods and modify all system settings.
- Guest- can perform methods.



1. When the instrument is turned on, the “Login” screen will appear. Use “+/-” keys to select the appropriate user.
2. Press the ENTER key to select the appropriate user.
3. If the user is prompted to provide a password:
    a. Use the ARROW and “+/-” keys to highlight the first letter or number of the password.

    NOTE: The “Shift” key changes the letters and/or symbols to lowercase.

    b. Press the ENTER key to accept the first letter.
    c. Continue highlighting the letters or numbers of the password and press the ENTER key for each letter/number until the password has been entered.
    d. Once the password has been entered, use the ARROW and “+/-” keys to highlight “OK.”
    e. Press the ENTER key to login.

User Logout

Once system operation is complete, the user can log out of the system. If the system is idle for 20 minutes or longer, the system will automatically go into an idle mode and the user will be required to login to continue operation.

1. To logout, press HOME key until the “Discover Home” screen appears.

2. Use the “+/-” keys to highlight “XXX-Logout”.

   NOTE: The user name will appear will the “XXX” is located.

3. Press the ENTER key to logout.

Microwave Tips

- Cover all solids in reaction vessel with liquid
  - Metal catalysts can be used, but ensure they are wetted or in solution
- Never exceed the maximum working volume of the vial
- Always use a stir bar that adequately mixes the reaction contents in the microwave
- Reactions can be performed under an inert atmosphere
  - Purge the vessel prior to performing a reaction
- Try performing the reaction neat or at higher concentrations
- When transitioning a conventional, open vessel reaction to a closed vessel reaction
  - Increase reaction temperature 25°C above the highest boiling point solvent in vial
  - Start with 150 watts and hotkey higher if necessary

When to Exercise Caution

- Anything that would be a concern conventionally, regardless of reaction size
- High concentrations of acids, bases, or salts
  - Includes other ionic or very polar species
  - Bases react more readily in a microwave
  - Generally, 10% or less is recommended
- Gases formed during the reaction
  - Increase headspace (empty volume in vessel) to accommodate the generated gas
  - Watch the reaction the first time it is performed to determine the correct venting point
  - Use an open vessel format to relieve large amounts of excess unnecessary gases

How to Cautiously Microwave

- Start with a low power input
  - 50 W or less (this can be adjusted as necessary later)
- Watch the first minute of the reaction
- Use the hotkeys during the reaction
  - Adjust the power
  - Lower the temperature and/or pressure limits
  - Raise the temperature and/or pressure limits
- If a gas forms during the reaction
  - Cool the reaction completely
  - Allow the ActiVent to release the excess gas

	Total Volume/ Vessel Name	Working Volume	Sealed/Pressurized or Open/Atmospheric
Standard Vessel	10 mL	0.200 - 7.0 mL	Sealed
	35 mL	2.0 - 25.0 mL	Sealed
Open Vessel	Open Vessel-up to 125 mL Round bottom flask with up to a 24/40 ground glass joint	75% of vessel volume	Open

Microwave Absorbance	Solvent
High (100 Watts)	DMSO, EtOH, MeOH, Propanols, Nitrobenzene, Formic Acid, Ethylene Glycol
Medium (200 Watts)	Water, DMF, NMP, Butanols, Acetonitrile, HMPA, Methyl Ethyl Ketone, Acetone and other ketones, *o*-Dicholorbenzene, 1,2-Dichloroethane, 2-Methoxyethanol, Acetic Acid, Trifluoroacetic Acid
Low (300 Watts)	Chloroform, Dichloromethane, Carbon Tetrachloride, 1,4-Dioxane, THF, Glyme, and other ethers, Ethyl Acetate, Pyridine, Triethylamine, Toluene, Benzene, Chlorobenzene, Xylenes, Pentane, Hexane and other hydrocarbons

Closed Vessel Reaction

Items Required:

10mL or 35mL Attenuator
10mL or 35mL vial
Stir bar appropriate for vial size
10mL or 35mL cap

Prepare the Vial

1. Select the vial based on the volume of reaction components being used.

NOTE: The working volume for the 10mL vial is 0.2mL to 7mL. The working volume for the 35mL vial is 2mL to 25mL.

2. Place appropriate stir bar into vessel.
3. Place the reaction components into the vessel.

WARNING

Proper precautions must be taken to avoid contact with solvents or solvent vapors. Protective gear should be worn as outlined in the user's safety program for hazardous materials and the reagent manufacturer's material safety data sheet. Refer to these guidelines for proper decontamination, handling and disposal of reagents or any hazardous materials.

4. Place the cap onto the vial.

WARNING

The Discover SP is usable only with CEM supplied 10mL and 35mL reaction vessels and caps for sealed reactions.

5. Install the appropriate attenuator assembly (based on vessel size) with the large slot positioned toward the back of the instrument.
6. Rotate the attenuator assembly clockwise until the attenuator locks into position.
7. Place the vessel into the attenuator.

Perform a Method

1. Load or create the appropriate method into the instrument on the Discover SP or the Synergy software (see section "Load Method" or "Create New Method or the Synergy software "Help" text for creating a method).
2. Press the START/PAUSE key. The ActiVent will close and lock onto the vessel. The "Waiting" screen appears prior to irradiation initiation. Once the method begins the system ramps to set-point temperature. The system continues to meet method parameters to perform the complete method.

   NOTE: If desired, during the method the "hot keys" can be pressed to edit the method parameters - temperature, time, pressure, power and stirring. Use the ARROW keys and "+/-" to enter new parameters.

   NOTE: The information across the bottom of the screen displays the parameter status
   - Pressure (Bar or PSI)
   - Power (W)
   - Stirring (H {High}, M {Medium}, L {Low} or Off (X)
   - Temperature Control (IR {Infrared} or FO {Fiber Optic)}
   - Vessel Type- If the vessel is a sealed vessel, the size will be displayed beside the picture of the vessel.
   - Cooling (Off or On)- If Cooling is "on," a snowflake is displayed.
   - Microwaves (Off, On)
   - System accessories (D {Discover}, E {Explorer}, V {Voyager}, or C {CoolMate}).

Vessel Removal

1. Once the vessel is properly cooled the ActiVent will release the vessel and “Complete” will be appear on the display.
    - If the ActiVent does not automatically release the reaction vessel, the pressure (or temperature) is above the release limit. A message will appear indicating the current temperature and pressure value. Cool the reaction vessel completely, then manually release the ActiVent.
2. Rotate the attenuator assembly counterclockwise and lift it from the instrument.

WARNING

To prevent the possibility of severe burns, ensure that insulated gloves and protective gear as outlined in the user’s safety program are worn.

3. Carefully remove the vessel from the attenuator.

NOTE: If the cap still holds residual pressure, place the cap and vial in a fume hood or other well ventilated area. Then use a needle to pierce the septa and vent.

4. Remove the cap from the vessel by pressing up on one side of the cap.

WARNING

Vessels and caps are designed for only one use. Do not use vessels and/or caps more than one time.

Open Vessel Reaction

- Items Required:
- Open Vessel Attenuator
- Round Bottom Flask
- Stir Bar appropriate to Vial size
- Teflon© disk

Prepare the Flask

1. Place all reagents into a round-bottom flask with a stir bar.

   Note: The working volume is 70% of the total volume of the round bottom flask.

2. Ensure the cavity is clean.

WARNING

The high temperature spill cup (162426) is required for reactions exceeding 200 C for Greater than 20 minutes or programmed temperature greater than 250 C. When Replacing the spill cup, the IR sensor will require verification and possibly recalibration.

3. Place the Teflon disk flat in the cavity with the hole placed over the center and the cutout over the hole in the rear of the cavity.

4. Place the round bottom flask with the reaction and a stir bar into the cavity.

5. Place the open vessel attenuator on top, allowing the neck of the round bottom flask to enter the hole in the attenuator.

6. Turn the attenuator clockwise until it locks into position (the microwave will not turn on until this is locked).

7. If applicable, attach extension glassware and/or condenser.

Perform a Method

1. Load or create the appropriate method into the instrument on the Discover SP or the Synergy software (see section "Load Method" or "Create New Method or the Synergy software "Help" text for creating a method).
2. Press the START/PAUSE key. The "Waiting" screen appears prior to irradiation initiation. Once the method begins, the system ramps to set-point temperature. The system continues to meet method parameters to perform the complete method.

   NOTE: If desired, during the method the "hot keys" can be pressed to edit the method parameters - temperature, time, power and stirring. Use the ARROW keys and "+/-" to enter new parameters.

   NOTE: The information across the bottom of the screen displays the parameter status

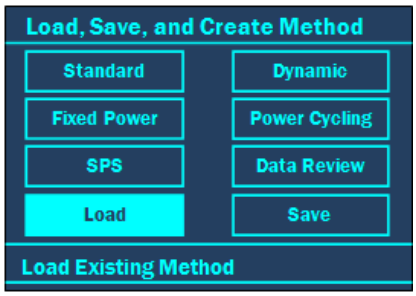
   - Pressure (Bar or PSI)
   - Power (W)
   - Stirring (H {High}, M {Medium}, L {Low} or Off (X)
   - Temperature Control (IR {Infrared} or FO {Fiber Optic)}
   - Vessel Type- If the vessel is a sealed vessel, the size will be displayed beside the picture of the vessel.
   - Cooling (Off or On)- If Cooling is "on," a snowflake is displayed.
   - Microwaves (Off, On)
   - System accessories (D {Discover}, E {Explorer}, V {Voyager}, or C {CoolMate}).

Vessel Removal

1. Upon completion of the reaction, wait until the temperature setpoint has been obtained and the cool-down cycle has terminated.
2. Remove the condenser, if necessary,
3. Remove the attenuator by turning counter clockwise.
4. The round bottom flask can then be removed from the cavity and the reaction work-up can be performed.

Load, Save, and Create a New Method

The “Load, Save, and Create a New Method” screen allows all users to create new methods, save them to the Discover’s database and Load (recall) the methods at a later time. From this screen the user can also recall data from a reaction that has been previously run on the Discover system. To access this screen press the Discover key on the Discover keypad.



Create a New Method

The Discover System has five (5) control options for programming a method – Standard, Dynamic, Fixed Power, Power Cycling and SPS. These options permit the user to control how the system applies the microwave energy to the reaction. In all control options, the user inputs control parameters to create the method. The user enters more control information as the level of control increases. The Standard control option is the recommended control technique for routine operation.

The Dynamic, Fixed Power, and Power Cycling methods allow the user to implement the ActiVent feature. The Discover SP system permits the user to release unwanted gaseous byproducts from the reaction to prevent over pressurization and vial failure from gaseous buildup. This ensures safe handling of the vial during and at the end of the reaction. The ActiVent safely bleeds the solvent/vapor from the reaction vessel and releases it through the vent tube connected to the back of the system and into a controlled environment.

If the reaction generates a gaseous byproduct or an extreme amount of pressure during the reaction, the ActiVent will vent at a specific setpoint for a pre-determined number of times.

- The “Delta Pressure” is the assigned amount of pressure to drop from the pressure set point. A delta of 25 PSI (1.7 BAR) is recommended.
- The “PressureSP” is the pressure set point at which the venting will begin. If the gaseous byproduct that is generated is the only pressure in the reaction vial (the reaction temperature does NOT exceed the boiling point of the solvent), the ActiVent pressure release can be set below the control point. If a gas is generated, but some of the pressure is due to vapor pressure, then the release point for the ActiVent must be set at or above the pressure control point.
- The “Times at SP” is the maximum number of times a reaction will vent during the assigned ramp and hold time. However, this parameter can be adjusted based on specific reaction conditions. For a typical reaction, 5 vents are recommended.

CAUTION

If the reaction temperature exceeds the solvent boiling point and too many venting actions are performed, the vial could become dry and superheat.

- The number of stages is stage at which the PressureSP will be active for a multistage method. A maximum of 5 stages can be added.

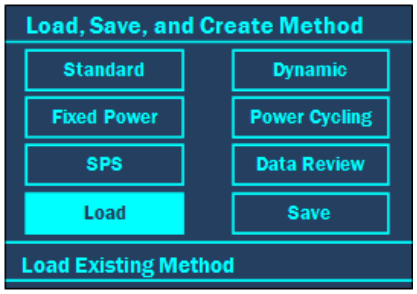
Standard

The Standard Control is a fast and simple reaction method. The user programs:

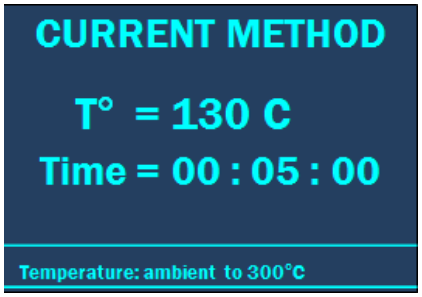
- A temperature control point and
- A run time (time held at the specified temperature).

All other method parameters are controlled by the instrument defaults. All method parameters can be edited with the Discover hotkeys.

1. With the main menu displayed, press the DISCOVER key.



2. Using the ARROWS and "+/-" keys highlight "Standard."
3. Press the ENTER key.
4. Press the temperature hotkey on the Discover keypad to modify the method.



5. Use the "+/-" keys to increase or decrease the temperature to the desired parameter. (0 - 300 °C)
6. Press the right ARROW key to highlight "Time".
7. Use the ARROW keys to select the hours, minutes, and/or seconds of time to edit. Use the "+/-" keys to increase or decrease the selected time parameter. (1 second to 99 hours, 59 minutes and 59 seconds).
8. Once the time is entered properly, press the ENTER key to accept all method parameters.

Dynamic

The Dynamic Control option provides more flexibility in how the user programs a reaction method. It applies up to a specified amount of power, defined by the user, to reach the control point. It modulates this set power automatically, based on the sensor feedback data, to ensure the control point is reached rapidly, but with limited error (temperature or pressure "overshooting"). The user programs:

- the maximum amount of microwave power that can be applied to the method,
- a temperature control point,
- a pressure control point,
- a hold time (the time the system maintains the control parameters),
- a stirring function with speed control and a pre-stir option, and
- PowerMAX (simultaneous cooling).

The ActiVent feature can be implemented in Dynamic Control. If the reaction generates a gaseous byproduct or an extreme amount of pressure during the reaction, the ActiVent will vent at a specific setpoint for a pre-determined number of times.

- The "Delta Pressure" is the assigned amount of pressure to drop from the pressure set point. A delta of 25 PSI (1.7 BAR) is recommended.
- The "PressureSP" is the pressure set point at which the venting will begin. If the gaseous byproduct that is generate is the only pressure in the reaction vial (the reaction temperature does NOT exceed the boiling point of the solvent), the ActiVent pressure release can be set below the control point. If a gas is generated, but some of the pressure is due to vapor pressure, then the release point for the ActiVent must be set at or above the pressure control point.
- The "Times at SP" is the maximum number of times a reaction will vent during the assigned ramp and hold time. However, this parameter can be adjusted based on specific reaction conditions. For a typical reaction, 5 vents are recommended.

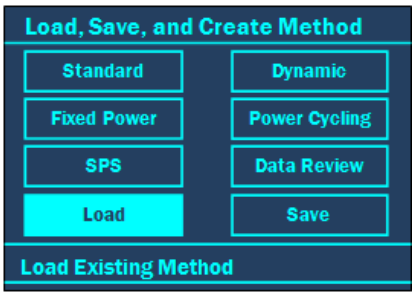
CAUTION

If the reaction temperature exceeds the solvent boiling point and too many venting actions are performed, the vial could become dry and superheat.

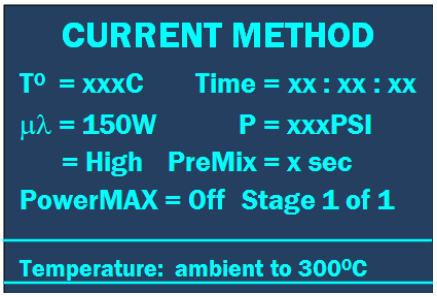
- The number of stages is stage at which the PressureSP will be active for a multistage method. A maximum of 5 stages can be added.

The Dynamic Control option can be programmed for five (5) stages for multiple irradiation steps and is a general control method for maintaining critical control points.

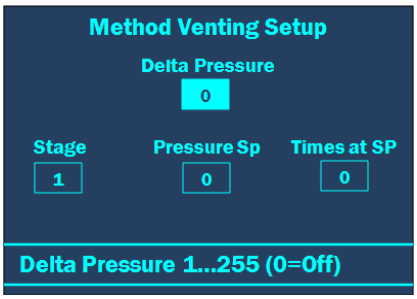
1. With the main menu displayed, press the DISCOVER key.



2. Using the ARROWS and "+/-" keys highlight "Dynamic".
3. Press the ENTER key.
4. Press one of the hotkeys to modify any of the default parameters.



5. Use the ARROW keys to navigate between temperature, time, power, pressure, stirring, PreMix, PowerMAX and number of Stages to enter the desired method parameters. Use the "+/-" keys to increase and decrease the numeric value.
   - Temperature "T°"- 0 - 300 °C
   - Time "Time"- 1 second to 99 hours, 59 minutes and 59 seconds
   - Power "μλ"- 0-300W (150W recommended)
   - Pressure "P"- 0-300PSI or 0-21Bar (250PSI recommended)
   - Stirring "□"- "high", "medium", "low" and "off" (High recommended)
   - PreMix "PreMix"- fifteen-second increments up to 120 seconds
   - PowerMAX "PowerMAX"- "on" or "off"
   - Stage "Stage"- 1-5 stages
6. Press the DISCOVER key to activate and program parameters for the ActiVent option. If the ActiVent feature is not being used, proceed to step 8.



NOTE: The ActiVent feature is not required for the Dynamic Control Option. It allows the Discover SP System to release unwanted gaseous byproducts from the reaction to prevent over pressurization and vial failure from gaseous buildup.

NOTE: If the ActiVent feature is not being used, the system will automatically release excess pressure above 300Psi or 21Bar.

7. Enter the desired vent parameters using the ARROW keys to navigate between Delta pressure, Stage, PressureSP, and Times @ SP. Use the "+/-" keys to increase and decrease the numeric value.
    - The "Delta Pressure" is the assigned amount of pressure to drop from the pressure set point. A delta of 25 PSI (1.7 BAR) is recommended.
    - The "PressureSP" is the pressure set point at which the venting will begin. If the gaseous byproduct that is generate is the only pressure in the reaction vial (the reaction temperature does NOT exceed the boiling point of the solvent), the ActiVent pressure release can be set below the control point. If a gas is generated, but some of the pressure is due to vapor pressure, then the release point for the ActiVent must be set at or above the pressure control point.
    - The "Times at SP" is the maximum number of times a reaction will vent during the assigned ramp and hold time. However, this parameter can be adjusted based on specific reaction conditions. For a typical reaction, 5 vents are recommended.

CAUTION

If the reaction temperature exceeds the solvent boiling point and too many venting actions are performed, the vial could become dry and superheat.

    - The number of stages is stage at which the PressureSP will be active for a multistage method. A maximum of 5 stages can be added.
8. Once all ActiVent parameters have been entered press the ENTER key to return to the method parameters screen.
9. Press the ENTER key to accept all method parameters.

Fixed Power

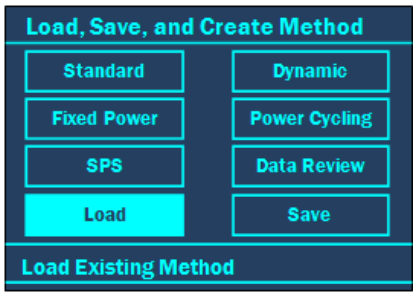
The Fixed Power Control option allows the user to apply the desired power from the beginning of the reaction without a ramping time. It provides the user the most direct method to energize reaction systems. This option applies a specified amount of energy for a specified amount of time. Maximum temperature and pressure limits alter instrument operation, either by ending the irradiation cycle or by adjusting the power, if either is reached. The user programs:

- the amount of constant microwave power applied,
- a maximum run time (the total time the system applies microwave energy),
- a maximum temperature (a temperature above which the system will not apply microwave energy), and
- PowerMAX.

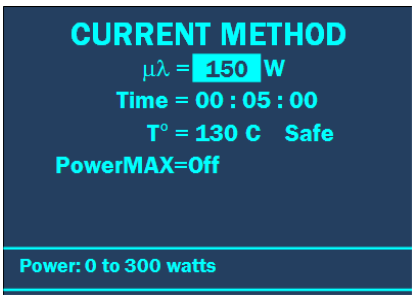
The Fixed Power Control option can be programmed in two options - Control and Safe.

- Control Fixed Power applies programmed power until the temperature setpoint is reached, then switches to a feedback loop which modulates the amount of power applied to maintain the setpoint temperature.
- Safe Fixed Power applies programmed power until the end of the programmed reaction time or until the temperature setpoint is reached.

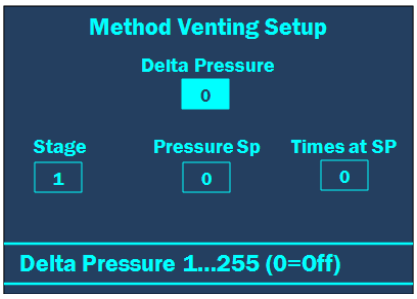
1. With the main menu displayed, press the DISCOVER key.



2. Using the ARROWS and "+/-" keys highlight "Fixed Power".
3. Press the ENTER key.
4. Press one of the hotkeys to modify the method parameters.



5. Use the "ARROW keys to navigate between power, time, temperature, temperature control type and PowerMAX to enter the desired method parameters. Use the "+/-" keys to increase and decrease the numeric value.
    - Power "μλ"- 0-300W
    - Time "Time"- 1 second to 99 hours, 59 minutes and 59 seconds
    - Temperature "T°"- 0-300°C
    - Temperature Control Type- "safe" or "control"
    - PowerMAX "PowerMAX"- "on" or "off"
    - Stage "Stage"- 1-5 stages
6. Press the DISCOVER key to activate and program parameters for the ActiVent option. If the ActiVent feature is not being used, proceed to step 8.



NOTE: The ActiVent feature is not required for the Fixed Power Control Option. It allows the Discover SP System to release unwanted gaseous byproducts from the reaction to prevent over pressurization and vial failure from gaseous buildup.

NOTE: If the ActiVent feature is not being used, the system will automatically release excess pressure above 300Psi or 21Bar.

7. Enter the desired vent parameters using the ARROW keys to navigate between Delta pressure, Stage, PressureSP, and Times @ SP. Use the "+/-" keys to increase and decrease the numeric value.
    - The "Delta Pressure" is the assigned amount of pressure to drop from the pressure set point. A delta of 25 PSI (1.7 BAR) is recommended.
    - The "PressureSP" is the pressure set point at which the venting will begin. If the gaseous byproduct that is generate is the only pressure in the reaction vial (the reaction temperature does NOT exceed the

boiling point of the solvent), the ActiVent pressure release can be set below the control point. If a gas is generated, but some of the pressure is due to vapor pressure, then the release point for the ActiVent must be set at or above the pressure control point.

- The "Times at SP" is the maximum number of times a reaction will vent during the assigned ramp and hold time. However, this parameter can be adjusted based on specific reaction conditions. For a typical reaction, 5 vents are recommended.

CAUTION

If the reaction temperature exceeds the solvent boiling point and too many venting actions are performed, the vial could become dry and superheat.

- The number of stages is stage at which the PressureSP will be active for a multistage method. A maximum of 5 stages can be added.

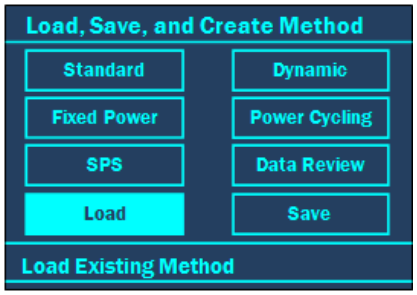
8. Once all ActiVent parameters have been entered press the ENTER key to return to the method parameters screen.
9. Press the ENTER key to accept all method parameters.

Power Cycling

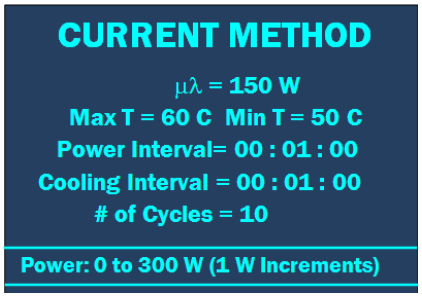
The Power Cycling Control option is the control with which the user can irradiate at a defined power to bring the reaction to the maximum temperature, then cool the sample until the minimum temperature is reached. This cycle is repeated for a user-defined number of times. The user programs:

- the maximum amount of microwave power applied,
- the maximum temperature (power interval),
- the minimum temperature (cooling interval)
- the maximum amount of time allowed to reach the maximum and minimum temperature, and the number of cycles.

1. With the main menu displayed, press the DISCOVER key.



2. Using the ARROWS and "+/-" keys highlight "Power Cycling".
3. Press the ENTER key.
4. Press one of the hotkeys to modify the method parameters.



5. Use the ARROW keys to navigate between power, maximum temperature, minimum temperature, power intervals and number of cycles until the desired method parameters are entered. Use the "+/-" keys to increase and decrease the numeric value.

- Power "μλ"- 0-300W
- Maximum Temperature "Max T°"- 0-300°C
- Minimum Temperature "Min T°"- 0-300°C
- Power Interval- 1 second to 99 hours, 59 minutes and 59 seconds

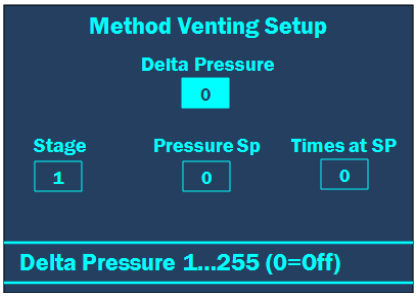
  NOTE: If the power interval is insufficient to reach the minimum temperature, the instrument will skip the cooling cycle and continue the next heating cycle until the minimum temperature is achieved.

- Cooling Interval- 1 second to 99 hours, 59 minutes and 59 seconds

  NOTE: If the cooling interval is insufficient to reach the maximum temperature, the instrument will skip the power cycle and continue the next cooling cycle until the maximum temperature is achieved.

- # of Cycles- 1-99 cycles

6. Press the DISCOVER key to activate and program parameters for the ActiVent option. If the ActiVent feature is not being used, proceed to step 8.



NOTE: The ActiVent feature is not required for the Power Cycling Control Option. It allows the Discover SP System to release unwanted gaseous byproducts from the reaction to prevent over pressurization and vial failure from gaseous buildup.

NOTE: If the ActiVent feature is not being used, the system will automatically release excess pressure above 300Psi or 21Bar.

7. Enter the desired vent parameters using the ARROW keys to navigate between Delta pressure, Stage, PressureSP, and Times @ SP. Use the "+/-" keys to increase and decrease the numeric value.
   - The "Delta Pressure" is the assigned amount of pressure to drop from the pressure set point. A delta of 25 PSI (1.7 BAR) is recommended.
   - The "PressureSP" is the pressure set point at which the venting will begin. If the gaseous byproduct that is generate is the only pressure in the reaction vial (the reaction temperature does NOT exceed the boiling point of the solvent), the ActiVent pressure release can be set below the control point. If a gas is generated, but some of the pressure is due to vapor pressure, then the release point for the ActiVent must be set at or above the pressure control point.
   - The "Times at SP" is the maximum number of times a reaction will vent during the assigned ramp and hold time. However, this parameter can be adjusted based on specific reaction conditions. For a typical reaction, 5 vents are recommended.

CAUTION

If the reaction temperature exceeds the solvent boiling point and too many venting actions are performed, the vial could become dry and superheat.

   - The number of stages is stage at which the PressureSP will be active for a multistage method. A maximum of 5 stages can be added.

8. Once all ActiVent parameters have been entered press the ENTER key to return to the method parameters screen.
9. Press the ENTER key to accept all method parameters.

SPS

The SPS Control option is the control type for the solid phase peptide synthesis applications which will irradiate at the defined power to bring the reaction mixture to the control temperature, then cycles the power on and off for the remainder of the run time as the temperature varies between the control temperature and a user defined deviation - usually 5 °C below the control temperature. The user programs:

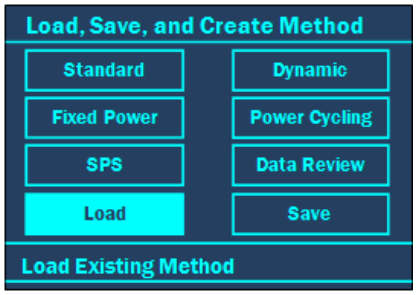
- the input power level,
- a control temperature (the temperature at which the magnetron will turn off),
- a run time (the maximum run time for a stage of the method), and
- a delta temperature (the maximum that the temperature can fall below the control temperature before the microwaves will turn on).

Recommended parameters for peptide synthesis include:

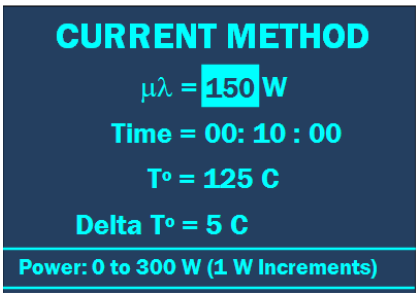
- Coupling: SPS Mode, 25 W, 75 C, delta T 5 C, 5:00 min
- Deprotection: SPS Mode, 25 W, 75 C, delta T 5 C, 3:00 min
- Cleavage: SPS Mode, 25 W, 38 C, delta T 5 C, 30:00 min

NOTE: Wattage may vary from the specified parameters. Acids (His and Cys) coupling temperatures should be performed at 50 °C. Arg coupling times should be extended to 25:00 minutes. See the Discover SPS manual for additional information on peptide synthesis.

1. With the main menu displayed, press the DISCOVER key.



2. Using the ARROWS and "+/-" keys highlight "SPS".
3. Press the ENTER key.
4. Press one of the hotkeys to modify the method parameters.



5. Use the ARROW keys to navigate between power, time, temperature, and the delta temperature until the desired method parameters are entered. Use the "+/-" keys to increase and decrease the numeric value.
   - Power "μλ"- 0-300W
   - Time "Time"- 1 second to 99 hours, 59 minutes and 59 seconds
   - Temperature "T°"- 0-300°C
   - Delta Temperature "Delta T°"- 1-50°C
6. Once the parameters are entered properly, press the ENTER key to accept all method parameters.

Save Method

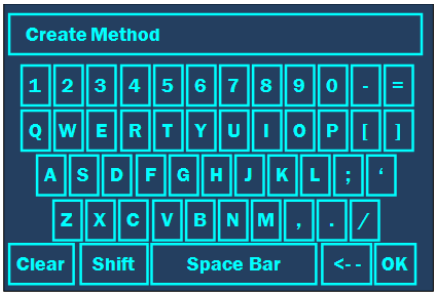
Saving a method allows the user to save/store the method so it can later be recalled. There are two (2) options to save a method: (a) press the DISCOVER key, highlight "Save" and press the ENTER key or (b) press the Play key after programming a new method.

NOTE: A method can be created and used without being saved. If not saved, once the method has been used, but before any modifications are made to the screen, the method can be saved using the (a) procedure outlined above.

NOTE: All of the current user's methods can be saved to a USB device and transferred to another instrument or placed on a personal computer. See section titled "Back Up Methods" for more information.

After programming a new method, when the PLAY key is pressed, the user is given the option to save or not save the method that is currently set to start. If "No" is selected the method that was just created will be sent to the Discover and the reaction will begin. If "Yes" is selected the method will be saved and the reaction will start immediately after the method has been saved.

1. Create a new method (see section "Create New Method")
2. Choose one option to save the method:
    a. Press the DISCOVER key, highlight "Save" and press the ENTER key
    b. Press the Play key after a new method has been created



3. A new screen will appear. Use the ARROW and "+/-" keys to highlight the first letter or number of the desired method name.

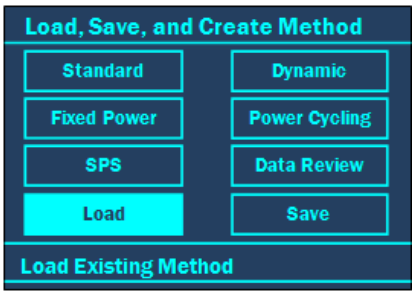
    NOTE: "Shift" changes the letters and/or symbols to lowercase.

4. Press the ENTER key to accept the first letter.
5. Continue highlighting the letters or numbers of the name and pressing the ENTER key for each letter/number until the name is displayed on the screen.
6. Once the method name has been entered, use the ARROW and "+/-" keys to highlight "OK". The method will be saved to the current user's database.

Load Method

The Load Method option gives the user the ability to recall a method previously saved under their user profile or that of another user saved on the same Discover SP System. Methods can also be transferred from one system to another using the USB memory stick supplied with the Discover SP.

1. With the main menu displayed, press the DISCOVER key.



2. Using the ARROWS and "+/-" keys, highlight "Load".
3. Press the ENTER key.
4. The current user's methods will be displayed. Use the "+/-" keys to highlight the desired method to load into the system.
5. Press the ENTER key to load the method.

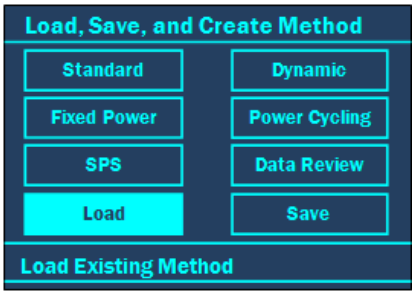
NOTE: To load a method stored for another user:

1. Use the "+/-" keys to highlight the user's name.
2. Once the user name is highlighted, press the ENTER key.
3. Use the "+/-" keys to highlight the desired method.
4. Press the ENTER key to load the method.

NOTE: The method can be saved in the user's folder by using the "Save" feature.

NOTE: To load a method stored on the USB memory stick:

1. Insert USB device with stored methods into side of system. See section titled "Backup Methods" for information on how to save methods onto the USB device.
2. Press the DISCOVER key.
3. Press the "+/-" keys to highlight "Load".



4. Press the ENTER key.
5. Use the "+/-" keys to scroll through the list until the desired user is highlighted.
6. Press the ENTER key to display the user's methods.
7. Use the "+/-" keys to highlight the desired method.
8. Press the ENTER key to load the method.

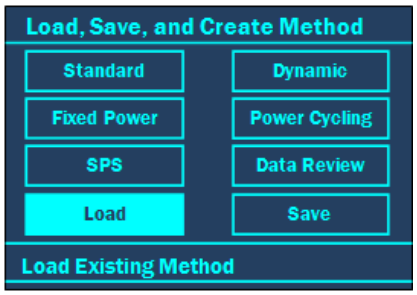
6. The main menu is displayed with the loaded method's name in the title bar.

Data Review

If the USB drive is in position on the side of the Discover during the reaction, the temperature data for each run will automatically be stored. This data can be viewed on the Discover screen later as a graph or viewed as individual data points on a computer.

NOTE: Only USB memory sticks supplied by CEM Corporation are compatible with the Discover S-Class and Discover SP systems.

1. Install the USB memory stick containing the desired method data for review.
2. With the main menu displayed, press the DISCOVER key.



3. Using the ARROW and "+/-" keys, highlight "Data Review."
4. Press the ENTER key.
5. Use the "+/-" keys to highlight the user for which the data is to be reviewed.
6. Press the ENTER key.
7. Use the "+/-" keys to highlight the data to be viewed.
8. Press the ENTER Key. A graph will appear on the screen with a temperature curve.

   NOTE: The Synergy Software provides a more detailed record of the reaction, including information such as power and pressure data in addition to the temperature data.

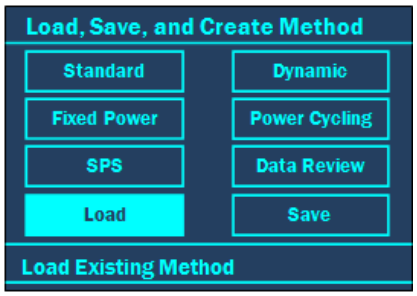
9. Press the "Home" key twice to return to the Main Menu.

   NOTE: The data file can be graphed on a computer as a CSV file.
   1. Install the USB drive which contains the reaction data into the computer.
   2. Select the "CEM" folder.
   3. Select the appropriate user's folder.
   4. Select the "data" folder.
   5. Select the appropriate data file and open as a CSV or excel document.

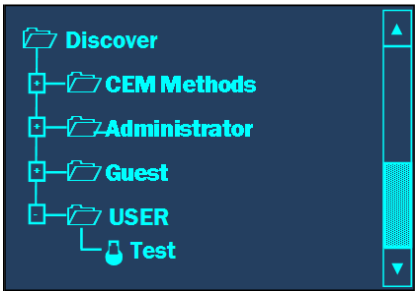
Delete Method

The Delete Method function allows the user to delete methods that have been stored within the Discover SP database.

1. With the main menu displayed, press the DISCOVER key.

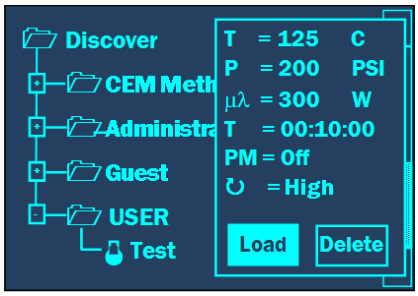


2. Using the ARROWS and "+/-" keys, highlight "Load".
3. Press the ENTER key. The current user's methods will be displayed.

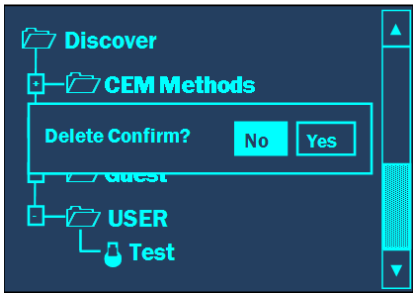


4. Use the "+/-" keys to highlight the desired method to be deleted.

5. Press the right ARROW key.



6. Use the ARROW keys to highlight “Delete”.
7. Press the ENTER key.



8. Use the ARROW keys to highlight “Yes” or “No”.
9. Press the ENTER key. If “yes” was selected the method will be permanently deleted. If “No” is selected the previous screen will appear.

Discover Home

The Discover home screen allows the users to set operations parameters within the Discover firmware. The Discover firmware is designed to permit use by three types of users: Standard, Administrator and Guest. A Guest can perform methods. A Standard User can perform methods and modify all system settings. An Administrator can add, modify, or delete users; perform tasks related to the maintenance of the system; modify all system settings and perform methods. The Discover includes three users when shipped:

Administrator (includes all administrator privileges and is password protected
USER (includes all administrator privileges and does not include a password)
Guest (includes Guest privileges)

If the Discover is not installed by a CEM representative, contact CEM to obtain a password that will permit administrative rights.

The Discover Home screen will appear differently for users according to their user type: Guest, Standard, and Administrator.

Guest

Standard

Administrator

Rxn Programming

The Reaction Programming screen allows the user to return to the main menu screen. The user can also press the HOME key to return to the main menu.

NOTE: "Rxn programming" can be viewed by all user types (guest, standard, and administrator).

1. To view the "Discover Home" screen press the HOME key.
2. Use the "+/-" keys to highlight "Rxn Programming".
3. Press the ENTER key. The main menu screen will appear.

Logout

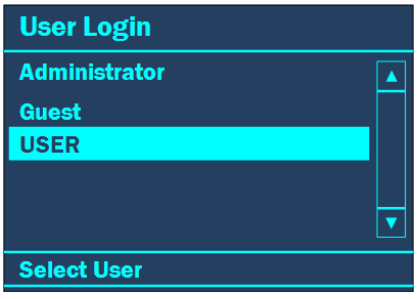
Once system operation is complete, the user can log out of the system. If the system is idle for 20 minutes or longer, the system will automatically go into an idle mode and the user will be required to login to continue operation.

NOTE: "Logout" can be viewed by all user types (guest, standard, and administrator).

1. To logout, press HOME key until the "Discover Home" screen appears.
2. Use the "+/-" keys to highlight "XXXX-Logout".

   NOTE: The username will appear will the "XXXX" is located.

3. Press the ENTER key to logout.

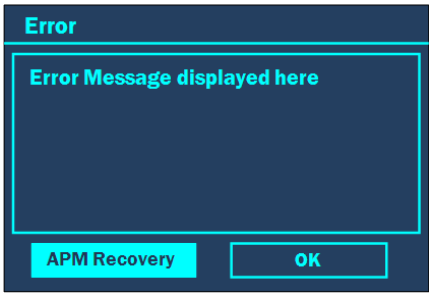


ActiVent Home, ActiVent Moving, ActiVent Closed, APM Recovery

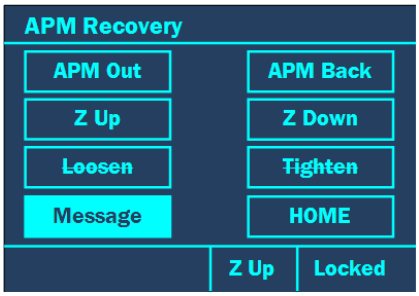
There are four (4) different messages that can appear in the 3rd line of the Discover Home screen. Each message describes the position of the ActiVent (APM).

NOTE: "ActiVent Home, ActiVent Moving, ActiVent Closed, APM Recovery" can be viewed by all user types (guest, standard, and administrator).

- **ActiVent Home**- is displayed when the attenuator is exposed and the APM is near the back of the instrument. When "ActiVent Home" is highlighted and the ENTER key is pressed the ActiVent will move to the closed position. If a vessel is not in place when the ENTER key is pressed, the Discover SP will display a "Vessel not found" message.
- **ActiVent Moving**-is displayed when the ActiVent is either going to the home or closed position.
- **ActiVent Closed**- is displayed when the ActiVent is positioned over the attenuator and the vessel is sealed. If "ActiVent Closed" is highlighted and the ENTER key is pressed the ActiVent will move to the home position.
- **APM Recovery**- is displayed if the ActiVent is unable to find the home position. If "APM Recovery" appears, first try to home the ActiVent. To home the ActiVent:
    1. Use the "+/-" keys to highlight "APM Recovery".
    2. Press the ENTER key. A new screen will appear with the current error message.



    3. Use the ARROW keys to highlight "APM Recovery".
    4. Press the ENTER key. A new screen will appear.



    5. Use the ARROW and "+/-" keys to highlight the "HOME" button.
    6. Press the ENTER key. The APM will return to the HOME position.
    7. If the APM does not return to the home position:

CAUTION

Improper use of the APM Recovery screen could result in destruction of the APM, and the warranty will become null and void.

CAUTION

The pressure assembly needs to be in the highest position before the APM is moved to the back of the instrument.

    a. Follow steps 3-5 above.

b. Use the ARROW and "+/-" keys to highlight "Z UP". Press the ENTER key. If the motor can be heard, continue to select "Z Up" until the motor no longer sounds like it is turning. This will raise the ActiVent to the highest position.
c. Use the ARROW and "+/-" keys to highlight "APM Back".
d. Press the ENTER key. If the APM appears to be moving backward, select "APM Back" until the ActiVent no longer moves backward. The ActiVent should be all the way back, away from the attenuator.

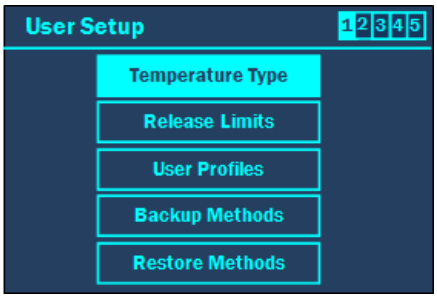
e. Use the ARROW and "+/-" keys to highlight the "HOME" button.
f. Press the ENTER key. The APM should now return to the HOME position.

System Setup
The "System Setup" function consists of five (5) "pages" that allow the user to calibrate system settings, set method defaults, clean the ActiVent feature, and view system information.

NOTE: "System Setup" can only be viewed by Standard and Administrator users.

To enter the System Setup screen:
1. Press the HOME key until "Discover Home" screen appears.
2. Use the "+/-" keys to highlight "System Setup".
3. Press the ENTER key. A new screen will appear.

User Setup
The "User Setup" page is the 1st page that appears after selecting "System Setup" from the "Discover Home" screen. This page allows the user to set up method defaults and general operating parameters for the Discover SP system.



Temperature Type
"Temperature Type" allows the user to switch between the Infrared and Fiber Optic temperature control.
1. Using "+/-," highlight "Temperature Type".
2. Press the ENTER key.
3. Using "+/-," highlight the applicable temperature control to be utilized (infrared or fiber optic).

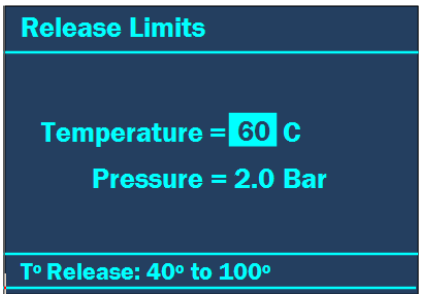
   NOTE: To utilize fiber optic control, the fiber optic temperature control option must be connected on the side of the Discover. The part number for the fiber optic assembly is 541166.

4. Press the ENTER key. The "User Setup" screen will appear again.

Release limits
Temperature and pressure release limits are the temperature and pressure at which the ActiVent will automatically open and release the vessel after cooling and the method is complete. The recommended default temperature is 60 °C. The recommended default pressure is 2.8 Bar (40 PSI).

NOTE: The default temperature should be lowered if a solvent with a low boiling point is going to be used.

1. Using "+/-," highlight "Release Limits".
2. Press the ENTER key.



3. Using "+/-" keys to increase and decrease the release limits. Use the ARROW keys to toggle between "Temperature" and "Pressure".
4. Once the parameters have been entered, press the ENTER key. The "User Setup" screen will appear again.

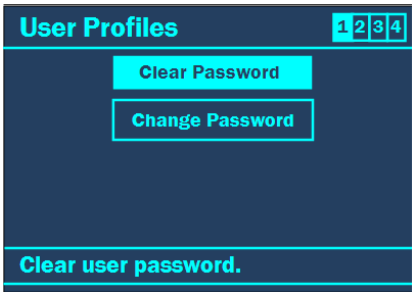
User Profiles

The User Profiles option allows the user to set defaults when creating methods, edit/change password and edit system parameters. There are 4 pages within the "User Profiles" page.

1. From the "User Setup" screen, use the "+/-" keys to highlight "User Profiles".
2. Press the ENTER key.

User Profiles

The "User Profiles" screen is the 1st page of the "User Profiles" menu. This page allows the user to clear or change their password.



Clear Password

1. Use the "+/-" keys to highlight "Clear Password". The user will be prompted to clear password: yes or no?
2. Use the ARROW keys to highlight either "Yes" to clear the password or "No" to leave the password as is.
3. Press the ENTER key.

Change Password

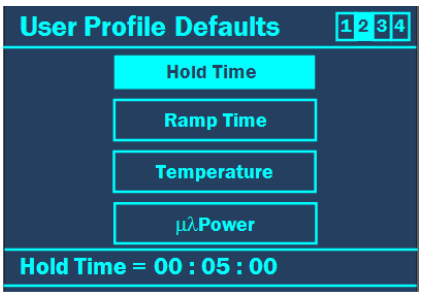
1. Use the "+/-" keys to highlight "Change Password". A new screen will appear.
2. Use the ARROW and "+/-" keys to highlight the first letter or number of the password.

   NOTE: The "Shift" key changes the letters and/or symbols to lowercase.

3. Press the ENTER key to accept the first letter.
4. Continue highlighting the letters or numbers of the password and press the ENTER key for each letter/number until the password has been entered.
5. Once the password has been entered, use the ARROW and "+/-" keys to highlight "OK."

User Profile Defaults -1

"User Profile Default" is the 2nd page of the "User Profile" menu. The "User Profile Defaults" page allows the user to program a default Hold Time, Ramp Time, Temperature and Microwave Power.



Hold Time
"Hold Time" is the default amount of time defined by the user for the instrument to maintain the control temperature or pressure. The instrument default hold time is five (5) minutes. When creating a new method the hold time can be changed from the default hold time programmed in the "User Profiles".

1. Use the "+/-" keys to highlight hold time.
2. Press the ENTER key.
3. Use the ARROW keys to toggle between hours, minutes and seconds. Use the "+/-" keys to increase and decrease the hold time (0 - 99 hours, 59 minutes, 59 seconds).
4. Press the ENTER key to accept the default hold time.

Ramp Time
"Ramp Time" is the default amount of time defined by the user for the instrument to reach the temperature or pressure. The instrument default ramp time is ten (10) minutes. The Discover System will achieve the set temperature as fast as possible; the ramp time is simply a maximum amount of time that power will be applied before switching to the hold time. When creating a new method the ramp time can be changed from the default ramp time programmed in the "User Profiles".

1. Use the "+/-" keys to highlight "Ramp Time".
2. Press the ENTER key.
3. Use the ARROW keys to toggle between hours, minutes and seconds. Use the "+/-" keys to increase and decrease the hold time (0 - 99 hours, 59 minutes, 59 seconds).
4. Press the ENTER key to accept the default ramp time.

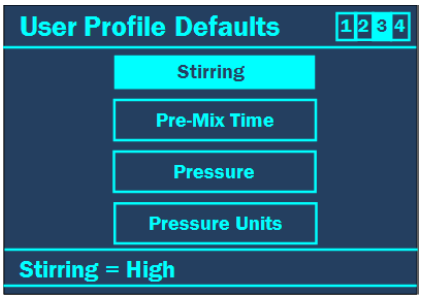
Temperature
"Temperature" is the user defined control temperature. The default Temperature is 125°C. When creating a new method the temperature can be changed from the default temperature programmed in the "User Profiles".

1. Use the "+/-" keys to highlight "Temperature".
2. Press the ENTER key.
3. Use the "+/-" keys to increase and decrease the temperature from 0-300°C.
4. Press the ENTER key to accept the default temperature.

μλPower
Microwave power is the user defined maximum power to be used during a method. The default microwave power is 150 watts. When creating a new method the microwave power can be changed from the default power programmed in the "User Profiles".

1. Use the "+/-" keys to highlight "μλPower".
2. Press the ENTER key.
3. Use the "+/-" keys to increase and decrease the microwave power from 0-300 watts.
4. Press the ENTER key to accept the default microwave power.

User Profile Defaults- 2
From the 1st "User Profile Default" screen, press the right arrow key one time to access the 2nd "User Profile Default" screen. This is also the 3rd page of the "User Profile" menu. This page allows the user to program default Stirring, Pre-Mix Time, Pressure and Pressure Units.



Stirring
"Stirring" is the user defined stirring speed for the method. The default stirring speed is high (this is also the recommended speed when performing reactions in the 10 mL or 35 mL vials). When creating a new method the stirring speed can be changed from the default stirring programmed in the "User Profiles".

1. Use the "+/-" keys to highlight "Stirring".
2. Press the ENTER key.
3. Use the "+/-" keys to increase and decrease the stirring between "High", "Med", "Low", and "Off".
4. Press the ENTER key to accept the default stirring speed.

Pre-Mix Time
"Pre-Mix Time" is the user defined time for the stirrer to mix (stir) the sample prior to the ramp time. The default pre-mix time is 0 seconds. The "Pre-Mix Time" can only be edited when creating a Dynamic method. The pre-mix time default that is created in the "User Profile" is the time that will always be used when running a reaction in the remainder of the method types.

1. Use the "+/-" keys to highlight "Pre-Mix Time".
2. Press the ENTER key.
3. Use the "+/-" keys to increase and decrease the "Pre-Mix Time" in 15 second intervals between 0 and 120 seconds.
4. Press the ENTER key to accept the default pre-mix time.

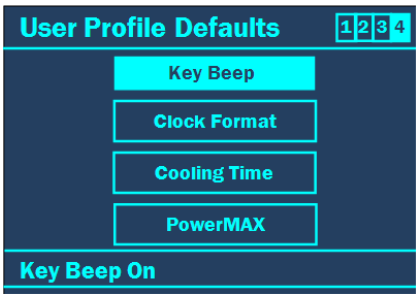
Pressure
"Pressure" is the user defined maximum control pressure. The default pressure is 250PSI or 17.2Bar. When creating a new method the pressure can be changed from the default pressure programmed in the "User Profiles".

1. Use the "+/-" keys to highlight "Pressure".
2. Press the ENTER key.
3. Use the "+/-" keys to increase and decrease the pressure from 0 -300PSI or 0-20Bar.
4. Press the ENTER key to accept the default pressure.

Pressure Units
"Pressure Units" is the user defined unit in which the pressure will be displayed. The instrument default pressure unit is "PSI".

1. Use the "+/-" keys to highlight "Pressure Units".
2. Press the ENTER key.
3. Use the "+/-" keys to change the units between "PSI" and "Bar".
4. Press the ENTER key to accept the default pressure unit.

User Profile Defaults- 3
From the 2nd "User Profile Default" screen, press the right arrow key one time to access the 3rd "User Profile Default" screen. This is also the 4th and final page of the "User Profile" menu. This page allows the user to program the Key Beep, Clock Format, Cooling Time and PowerMAX feature.



Key Beep
"Key Beep" is the option to turn an audible beep that will sound each time a key on the keypad is depressed. The key beep default setting is "On".

1. Use the "+/-" keys to highlight "Key Beep".
2. Press the ENTER key.
3. Use the "+/-" keys to change the key beep "On" or "Off".
4. Press the ENTER key to accept the key beep option.

Clock Format
"Clock Format" allows the user to set the clock format in 12 hour or 24 hour increments. The default clock format is "12 Hour".

1. Use the "+/-" keys to highlight "Clock Format".
2. Press the ENTER key.
3. Use the "+/-" keys to change the clock format between "12 Hour" and "24 Hour".
4. Press the ENTER key to accept the clock format.

Cooling Time
"Cooling Time" is the user defined maximum time for the vessel to cool prior to removal. The default cooling time is 20 minutes. The "Cooling Time" cannot be edited/changed when creating a new method. The cooling time default that is created in the "User Profile" is the maximum time that will always be used when cooling a reaction. Should the reaction reach the pre-determined release limits prior to the Cooling Time, the cooling stage will stop.

1. Use the "+/-" keys to highlight "Cooling Time".
2. Press the ENTER key.
3. Use the "+/-" keys to change the cooling time from 0-60 minutes.
4. Press the ENTER key to accept the cooling time.

PowerMAX
"PowerMAX" is the used to cool the vessel during the reaction. The default PowerMAX setting is "Off". When creating a new method the PowerMAX feature can be changed from the default PowerMAX setting programmed in the "User Profiles".

1. Use the "+/-" keys to highlight "PowerMAX".
2. Press the ENTER key.
3. Use the "+/-" keys to change PowerMAX to "On" or "Off".
4. Press the ENTER key to accept the PowerMAX change.

Backup Methods
"Back Up Methods" backs up only the methods of the current user. These methods can be transferred to another instrument or placed on a personal computer.

1. Install a CEM supplied USB memory stick into the right side of the Discover system.
2. Use the "+/-" keys to highlight "Backup Methods".
3. Press the ENTER key. If a memory stick is installed in the USB port, a screen appears indicating the percentage of the files backed up on the USB memory stick. Once all user methods are backed up, the software returns to the User Setup screen.

   NOTE: If a memory stick is not installed in one of the USB ports, the software will prompt the user to install a USB memory stick. If desired, press the "Home" key to exit the screen.

CAUTION

Do not remove the memory stick from the USB port during method backup or restoration. Removal of the USB memory stick prior to completion of method backup or restoration will corrupt the data on the memory stick and/or the system files. Wait 15 - 20 seconds after the completion of method backup or restoration prior to removal of the memory stick.

Restore Methods

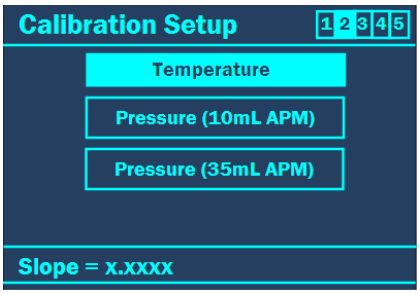
"Restore Methods" transfers "backed up" methods and information from the USB memory stick to the system file.

1. Install a CEM supplied USB memory stick into the right side of the Discover system.
2. Use the "+/-" keys to highlight "Restore Methods".
3. Press the ENTER key. If a USB memory stick is installed, a screen appears indicating the percentage of the methods restored on the USB memory stick. Once all methods are restored, the software returns to the User Setup screen.

   NOTE: If a memory stick is not installed in one of the USB ports, the software will prompt the user to install a USB memory stick as indicated above.

Calibration Setup

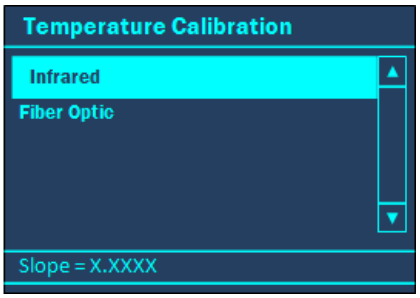
The "Calibration Setup" page is the 2nd page that appears after selecting "System Setup" from the "Discover Home" screen. This screen allows the user to calibrate or enter a calibration value for the temperature and pressure controls.



Temperature

Allows the user to enter the slope or calibrate the infrared (temperature device. The user can also enter the slope for the fiber optic, if applicable.

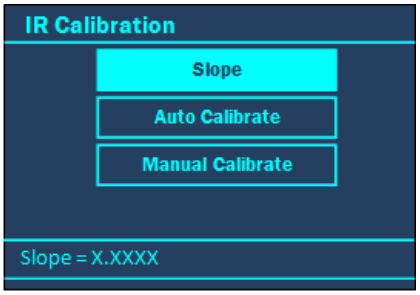
1. Using the "+/-" keys to highlight "Temperature".
2. Press the ENTER.



Infrared

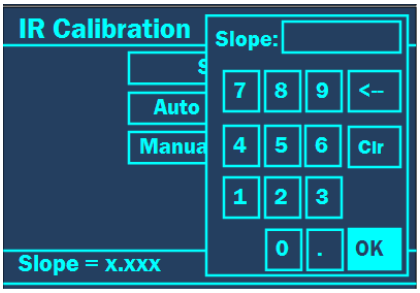
Allows the user to calibrate or enter the slope for the infrared temperature control. This is the first screen that appears after "Temperature" has been selected from the "Calibration Setup" screen.

1. From the "Temperature Calibration" screen, use the "+/-" keys to select "Infrared".
2. Press the ENTER key to enter the "IR Calibration" screen.



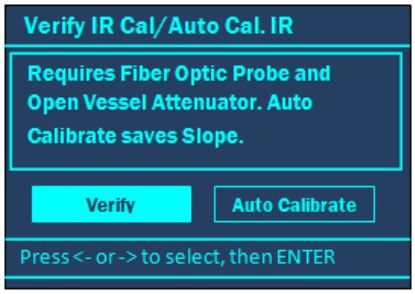
Slope
To enter a known slope for the Infrared temperature control.

1. Use the “+/-” keys to highlight “Slope”
2. Press the ENTER key.



3. Use the “+/-” keys to highlight “Clr” to delete the current value.
4. Use the ARROW and “+/-” keys to highlight and select the proper number.
5. Continue highlighting the appropriate numbers and pressing the ENTER key to accept the values.
6. Once the slope has been entered, use the ARROW and “+/-” keys to highlight “OK”.
7. Press the ENTER key to complete the IR slope entry.

Auto Calibrate
“Auto Calibrate” permits the instrument to automatically calibrate the infrared sensor or verify the infrared sensor using a solvent in an open vessel flask and a fiber optic probe. This procedure requires the use of a fiber optic temperature option. To calibrate the infrared without using a fiber optic probe, see Manual Calibrate on page_. From the “Auto Calibrate” screen, the user can either auto calibrate the instrument or verify the instrument calibration.



Auto Calibrate
“Auto Calibrate” permits the instrument to automatically calibrate the infrared sensor using a solvent in an open vessel flask and a fiber optic probe.

1. Ensure the fiber optic probe is attached and the calibration value has been entered. (See section titled “Slope” within the Fiber Optic section on page___.)
2. Use the “+/-” keys to highlight “Auto Calibrate”
3. Press the ENTER key.

NOTE: A fiber optic probe must be installed and selected in order to perform an auto calibration. Also, the fiber optic probe calibration value (GIF) must be properly entered.

4. If applicable, remove the attenuator assembly from the instrument cavity.
5. Insert the vessel stand in the instrument cavity with the standoffs pointing downward. Ensure that the vessel stand is flat against the bottom of the cavity and that the cutout in the stand is positioned over the opening in the cavity liner.
6. Place 50mL of solvent (ethylene glycol or equivalent solvent with a high boiling point) and a stirring bar into a 100mL round bottom flask.
7. Place the flask into the cavity so that it is positioned on top of the vessel stand.
8. Install the open vessel attenuator assembly with the large slot positioned toward the back of the instrument.
9. Rotate the attenuator assembly clockwise until the attenuator locks into position.
10. Insert the fiber optic probe into the vessel.
11. To utilize the automatic calibration feature, use the ARROW keys to highlight "Auto Calibrate."
12. Press the ENTER key.

NOTE: If an open vessel attenuator is not installed, a screen will appear advising the user to install an open vessel attenuator.

NOTE: The calibration temperature is the temperature to which the vessel will be heated, assuming this temperature (and therefore the fiber optic probe) is below the boiling point of the solvent. Default auto calibration temperature is 130 ºC.

WARNING
Do not use a temperature above the boiling point of the solvent.

13. Press "+/-" keys to increase or decrease the calibration temperature.
14. Press the ENTER key.
15. Press the START/PLAY key. The instrument will calibrate the IR sensor and display the IR calibration value, based on the fiber optic probe, at the bottom of the screen once the calibration is complete.
16. Press the HOME key to return to the previous screen.

Verify

"Verify" allows the users to check their infrared calibration using the fiber optic option as a temperature comparison.

1. Ensure that the fiber optic probe is attached and the calibration value has been entered. (See section titled "Slope" within the Fiber Optic section on page____.)
2. Use the ARROW keys to highlight "Verify."
3. Press the ENTER key.
4. Press "+/-" to increase or decrease the calibration temperature.

WARNING
Do not use a temperature above the boiling point of the solvent.

5. Press the ENTER key.

NOTE: The "verify" feature is used as a check to ensure that the IR temperature follows the fiber optic temperature.

NOTE: A fiber optic probe must be installed and selected in order to perform a calibration verification. Also, the fiber optic probe calibration value (GIF) must be properly entered.

6. If applicable, remove the attenuator assembly from the instrument cavity.
7. Insert the vessel stand in the instrument cavity with the standoffs pointing downward. Ensure that the vessel stand is flat against the bottom of the cavity and that the cutout in the stand is positioned over the opening in the cavity liner.
8. Place 50mL of solvent (ethylene glycol or equivalent solvent with a high boiling point) and a stirring bar into a 100mL round bottom flask.

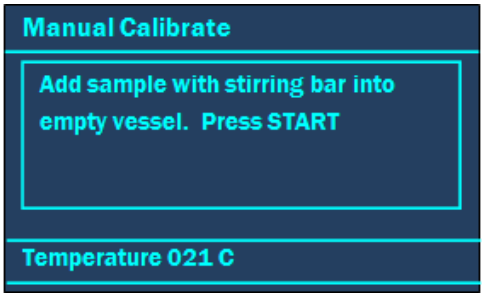
9. Place the flask into the cavity so that it is positioned on top of the vessel stand.
10. Install the open vessel attenuator assembly with the large slot positioned toward the back of the instrument.
11. Rotate the attenuator assembly clockwise until the attenuator locks into position.
12. Insert the fiber optic probe into the vessel.
13. Press the START/PLAY key. The instrument will display the fiber optic temperature as well as the IR temperature for comparison. Verify that the two temperatures are similar.

WARNING
Do not use a temperature above the boiling point of the solvent.

14. Once the IR temperature has been verified, press the HOME key two times to access the IR Calibration screen.

Manual Calibrate
"Manual Calibrate" allows the user to calibrate their infrared sensor using a thermometer. "Manual Calibration" should be used for users who do not have a fiber optic option for automatic calibrations.

1. Use the "+/-" keys to highlight "Manual Calibrate."
2. Press the ENTER key.



3. If applicable, remove the attenuator assembly from the instrument cavity.
4. Insert the vessel stand in the instrument cavity with the standoffs pointing downward. Ensure that the vessel stand is flat against the bottom of the cavity and that the cutout in the stand is positioned over the opening in the cavity liner.
5. Place 50mL of solvent (ethylene glycol or equivalent solvent with a high boiling point) and a stirring bar into a 100mL round bottom flask. Place the flask into the cavity so that it is positioned on top of the vessel stand.
6. Install the open vessel attenuator assembly with the large slot positioned toward the back of the instrument. Rotate the attenuator assembly clockwise until the attenuator locks into position.
7. Press the START/PLAY key. The instrument will heat the vessel using 300 watts.

WARNING
Do not use a temperature above the boiling point of the solvent.

8. Once the desired temperature is achieved, press the STOP key.

WARNING
Do not use place a thermometer into the vessel until the stop key has been pressed and microwaves are off.

9. Place a thermometer into the vessel and stir the sample for approximately 2-3 seconds, or until the temperature becomes stable. Measure the temperature of the sample.
10. Press "+/-" keys to select the temperature of the sample.
11. Press the ENTER key.
12. Press the HOME key to return to the Temperature Calibration screen.

Fiber Optic

The Fiber Optic menu allows the user to enter the slope for the fiber optic probe if applicable.

Slope

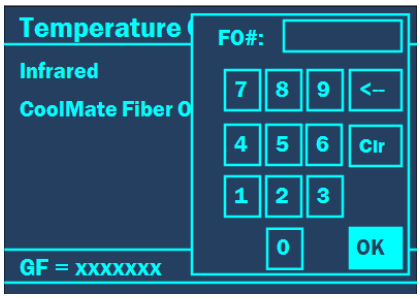
"Slope" allows the user to enter the slope for the fiber optic probe.

1. To set up the Fiber Optic option:
    a. Remove the cover from the right side of the Discover. Removal of the cover will expose 2 USB ports, 1 8-pin port, and 1 RJ-11 port.

    b. To change the communication cable (if applicable):
        i. Remove the gray communications cable (119750) from the fiber optic box by using a flat blade screwdriver to loosen the two screws and then pull cable away from the box.
        ii. Install the white communications cable (277275) to RJ-12 adapter (277225), by pushing in until a click is heard.
        iii. Install adapter to fiber optic box and tighten screws using fingers. (See Fiber Optic Instructions for further information.)
    c. Insert the temperature sensor into the temperature control module. The sensor is attached to the module with a locking "collar" on the sensor. Push the collar in, twist it clockwise, and then release it to lock the sensor into the module.

    d. Position the temperature control module on the right side of the Discover SP System (facing front of instrument) and connect the communications into the RJ-11 port on the side of the Discover.

2. To enter in the GIF value:
    a. From the "Temperature Calibration" screen, use the "+/-" keys to highlight "Fiber Optic".
    b. Press the ENTER key. A new screen will appear.



c. Use the "+/-" and ARROW keys to highlight "Clr" to clear the current slope.
d. Press the ENTER key to clear the contents.
e. Use the ARROW and "+/-" keys to highlight and select the GF Number (found on the label attached to the fiber optic probe or the label on the case in which the probe was shipped).
f. Continue highlighting the appropriate numbers and pressing the ENTER key to accept the values.
g. Highlight "OK" when all numbers have been entered.
h. Press the ENTER key.

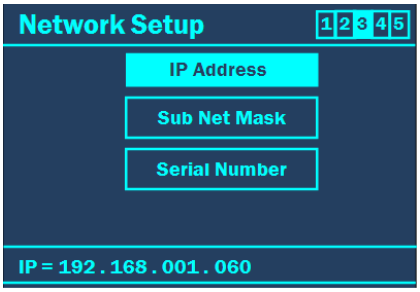
Pressure (10mL APM)
Pressure calibration of the Discover SP should only be performed by CEM Service Technicians.

Pressure (35mL APM)
Pressure calibration of the Discover SP should only be performed by CEM Service Technicians.

Network Setup

The "Network Setup" page is the 3rd page that appears after selecting "System Setup" from the "Discover Home" screen. This page allows the user to view or enter an IP Address, Sub Net Mask or Serial Number.

NOTE: The IP Address, Sub Net Mask, and Serial Number should not be modified, except by those experienced in Network Setup. Modification of these settings can interrupt communication between the Synergy Software Package and the Discover System.



IP Address

The IP Address setting allows the user to set an IP address on the Discover SP system to allow connection to the Synergy Software. The Ethernet settings should be used only when communicating via the Ethernet port. If the Discover is connected to the internet or a wireless router, the default IP address must be edited since only one unique IP address can be exposed to the network. The user should contact his/her IT department or CEM Corporation prior to any change to the IP Address.

1. Use the "+/-" keys to highlight "IP Address".
2. Press the ENTER key.
3. Use the "+/-" keys to increase and decrease the IP Address and the ARROW keys to toggle between the different number settings.
4. Once the IP address has been entered, press the ENTER key to accept the value.

Sub Net Mask

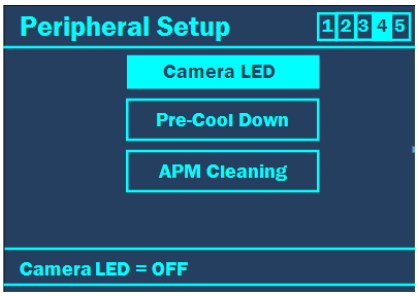
The Sub Net Mask is a method used to encode the IP address for the Ethernet interface. The user should contact his/her IT department or CEM Corporation prior to any change to the Sub Net Mask.

1. Use the "+/-" keys to highlight "Sub Net Mask".
2. Press the ENTER key.

3. Use the “+/-” keys to increase and decrease the sub net mask and the ARROW keys to toggle between the different number settings.
4. Once the sub net mask has been entered, press the ENTER key to accept the value.

Serial Number
The instrument serial number is entered by CEM at the point of manufacture. The serial number should not be altered.

Peripheral Setup
The “Peripheral Setup” page is the 4th page that appears after selecting “System Setup” from the “Discover Home” screen. This page allows the user to turn the LEDs on (Camera LED’s must be installed), program a Pre-Cool Down time (CoolMate option required), and access the APM cleaning screen.



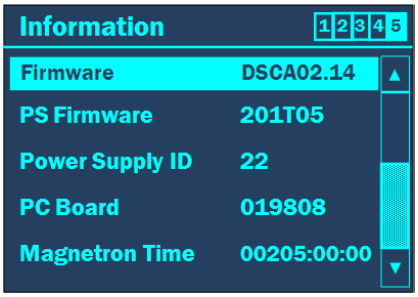
Camera LED
The Camera LED’s can only be turned “off” and “on” if the instrument is equipped with LED’s. If the instrument does not have a camera option then the instrument is not equipped with LED’s.

Pre-Cool Down
The instrument pre-cool down is only used when a CoolMate option has been connected to the Discover. The pre-cool down is the temperature at which the Discover system needs to cool before beginning a reaction. If a CoolMate is not being used, the pre-cool down value does not need to be changed. For further instruction on the Pre-Cool Down option, see the CoolMate Manual.

APM Cleaning
APM cleaning allows the user to clean the ActiVent (or APM). The ActiVent should be cleaned on a weekly basis or when venting occurs. See “ActiVent” in the “Maintenance” section for the cleaning procedure.

Information
The “Information” page is the 5th page that appears after selecting “System Setup” from the “Discover Home” screen. This page allows the user to view the following information:

- Firmware
- PS Firmware
- Power Supply ID
- PC Board
- Magnetron Time
- Temperature
- Temperature Control
- Pressure
- Vessel



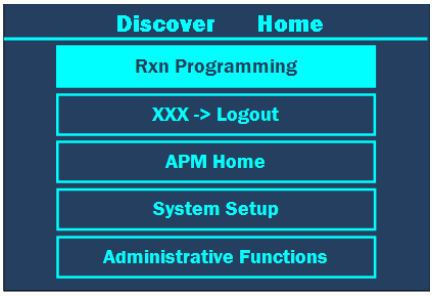
Administrative Functions

The “Administrative Functions” screen consists of two (2) “pages” that allow the user to create, edit, and delete a user and perform maintenance on the system.

NOTE: “Administrative Functions” can only be viewed by administrator users.

To enter the Administrative Functions screen:

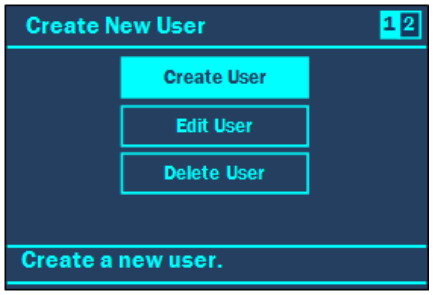
1. Press the HOME key until the “Discover Home” screen appears.



2. Use the “+/-” keys to highlight “Administrative Functions”.
3. Press the ENTER key. A new screen will appear.

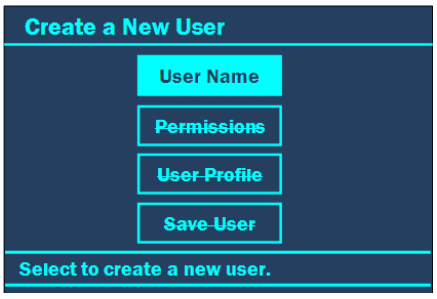
Create New User

The “Create New User” page is the first page that appears after selecting “Administrative Functions” from the “Discover Home” screen. This page allows the user to create, edit and delete new users.



Create User

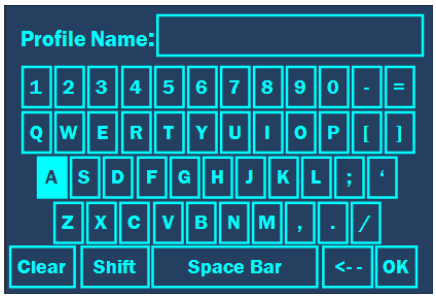
This allows the user who is currently logged in to create a new user for the system.



User Name

“User Name” allows the user to create the name for the new user.

1. Use the “+/-” keys to highlight “Create User”.
2. Press the ENTER key.
3. Use the “+/-” keys to highlight “User Name”.
4. Press the ENTER key. A new screen will appear.



5. Use the ARROW and "+/-" keys to highlight the first letter or number of the desired user name.

   NOTE: The "Shift" key changes the letters and/or symbols to lowercase.

6. Press the ENTER key to accept the first letter.
7. Continue highlighting the letters or numbers of the name and pressing the ENTER key for each letter/number until the name is displayed on the screen.
8. Once the user name has been entered, use the ARROW and "+/-" keys to highlight "OK".
9. Pres the ENTER key. The user name will be saved to the Discover System.

   NOTE: A password can be created in the User Profiles.

Permissions

The Discover software is designed to permit use by three types of users: Standard, Administrator and Guest. The Discover is originally equipped with an "Administrator", "USER", and "Guest". The "Administrator" login cannot be deleted.

1. From the "Create New User" screen, Use the "+/-" keys to highlight "Permissions".
2. Press the ENTER key.
3. Use the "+/-" keys to toggle between: "Standard User", "Guest", "Administrator".
   - Administrator- can add, modify, or delete users; perform tasks related to the maintenance of the system; modify all system settings and perform methods.
   - Standard- can perform methods and modify all system settings.
   - Guest- can perform methods.
4. Press the ENTER key to accept the appropriate user type.

User Profile

User Profile allows the user to set defaults when creating methods, edit/change password and edit system parameters. There are 4 pages within the "User Profiles" page. See section titled "User Setup" for guidance.

Save User

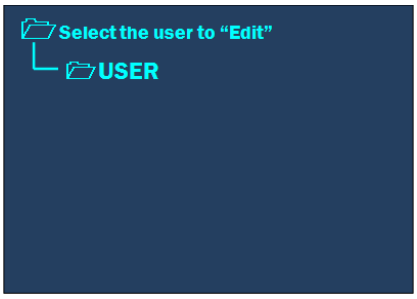
The Save User option saves the user that was created in the previous steps to the Discover SP database.

1. From the "Create New User" screen, Use the "+/-" keys to highlight "Save User".
2. Press the ENTER key.
3. Press the ENTER key to save the user.

NOTE: The user must be saved for any of the modifications above to be stored. Any information entered without selecting the "Save User" option will be lost.

Edit User

Edit User allows the user to edit the permissions and user profile of a previously created user.



Permissions
The Discover software is designed to permit use by three types of users: Standard, Administrator and Guest. The Discover is originally equipped with an "Administrator", "User", and "Guest". The "Administrator" login cannot be deleted.

1. From the "Create New User" screen, Use the "+/-" keys to highlight "Permissions".
2. Press the ENTER key.
3. Use the "+/-" keys to toggle between: "Standard User", "Guest", "Administrator".
    - Administrator- can add, modify, or delete users; perform tasks related to the maintenance of the system; modify all system settings and perform methods.
    - Standard- can perform methods and modify all system settings.
    - Guest- can perform methods.
4. Press the ENTER key to accept the appropriate user type.

User Profile
Allows the user to set defaults when creating methods, edit/change password and edit system parameters. There are 4 pages within the "User Profiles" page.

NOTE: See section titled "User Setup" for detailed information on how to set the default values.

Save User
The Save User option saves the parameters that were previously edited.

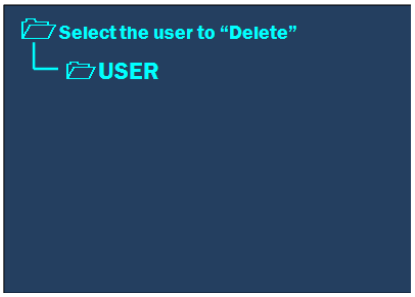
1. From the "Create New User" screen, Use the "+/-" keys to highlight "Save User".
2. Press the ENTER key.
3. Press the ENTER key to save the user.

NOTE: The user must be saved for any of the modifications above to be stored. Any information entered without selecting the "Save User" option will be lost.

Delete User

Delete User allows the user to delete a current user on the system. The user who is currently logged-in cannot be deleted.

CAUTION
A user that has been deleted cannot be restored.



1. From the "Create New User" screen, use the "+/-" keys to highlight "Delete User".
2. Press the ENTER key.
3. Use the "+/-" keys to highlight the user to be deleted.
4. Press the ENTER key.

5. The user will be given the option to “Delete Selected User?”.
6. Use the ARROW keys to toggle between “Yes” and “No”.
7. Press the ENTER key.
8. Press the HOME key to return to the “Discover Home” screen.

Administration

The “Administration” page is the 2nd page that appears after selecting “Administrative Functions” from the “Discover Home” screen. **This page allows the CEM Service department to perform maintenance on the system and should not be revised by users.**

Maintenance

This section covers routine maintenance. A routine preventive maintenance program is recommended to ensure optimum performance of the Discover System.

WARNING

Proper precautions must be taken to avoid contact with solvents or solvent vapors. Protective gear should be worn as outlined in the user's safety program for hazardous materials and the reagent manufacturer's material safety data sheet. Refer to these guidelines for proper handling and disposal of reagents.

Interlocks

Weekly, examine the cavity edge and attenuator interlocks to verify that they are clean and working properly. To examine the interlocks:

1. Turn the Discover SP off.
2. If applicable, remove the attenuator.
3. Inspect the interlocks and verify that they are clean and free of debris.

4. If the interlock appears dirty, use a cotton swab and methanol, ethanol, or acetone to clean.

5. Once the solvent is dry the attenuator can be installed.

   NOTE: If attenuator becomes difficult to turn or cannot be locked into position, please contact CEM Service: **800-726-5551** or **704-821-7015** or email **service@cem.com.**

Cavity

The cavity needs to be cleaned/inspected if any of the following occurs: Vessel Failure, material is spilled in cavity, or the cavity has not been inspected in a week or more. The spill cup protects the temperature sensor from debris in case of a vessel failure.

1. Turn the instrument off.
2. If applicable: Remove the attenuator by rotating counterclockwise. This will expose the cavity.
3. Inspect the cavity. If the cavity is clean, skip to step 10. If the cavity needs to be cleaned, continue with step 4.
4. Remove the spill cup.
5. Clean the spill cup by rinsing with water, ethanol, methanol, or acetone. If necessary, the cup can be wiped with a cloth. Once all debris is rinsed from the cup, check for cracks and/or damage.

NOTE: If spill cup appears to be damaged or cracked please contact CEM: **800-726-5551** or **704-821-7015** or email **service@cem.com** to order a replacement part. The replacement part number for the standard spill cup is 162425.

6. Wipe the cavity liner (walls) with an alcohol wipe or equivalent.
7. Inspect the cavity liner for foreign debris or charring.

   NOTE: If charring is seen on the cavity liner, please contact CEM Service: **800-726-5551** or **704-821-7015** or email **service@cem.com.**

8. Inspect the IR lens for foreign debris and/or damage. If necessary, use a swab and alcohol to clean the IR lens, taking care not to scratch the IR lens.

   NOTE: If the IR lens is in proper position, it will reflect an image similar to a mirror. If the IR lens appears to be damaged (ie. scratched), please contact CEM Service: **800-726-5551** or **704-821-7015** or email **service@cem.com.**

9. If the spill cup is not damaged, replace the spill cup once it has dried.

   NOTE: Replacement of the spill cup will require re-calibration of the IR as outlined on page____.

10. Replace the attenuator and continue operation.

ActiVent

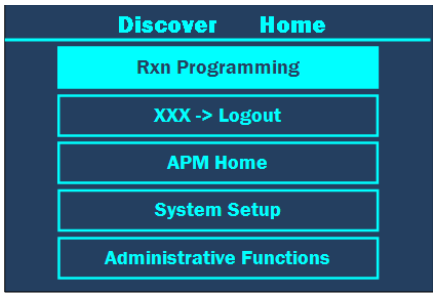
The ActiVent should be cleaned on a weekly basis or when venting occurs. There are two potential cleaning procedures, as outlined below.

APM Cleaning

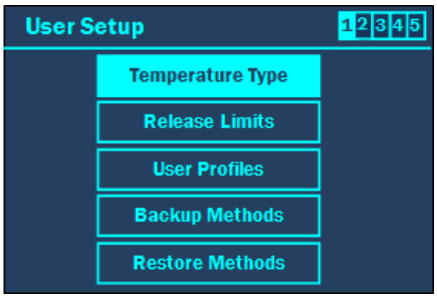
1. Remove the Discover from underneath the Explorer Autosampler Module, if applicable.

   NOTE: See Explorer manual for instructions.

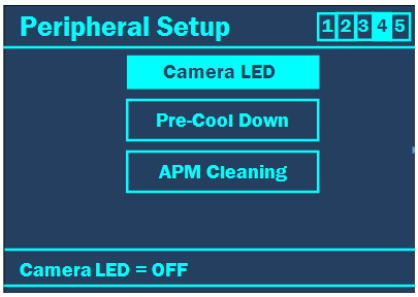
2. Press the HOME key until the “Discover Home” screen appears.



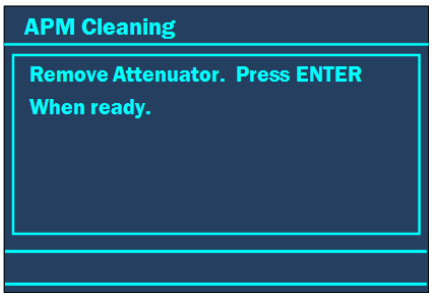
3. Use the “+/-” keys to highlight “System Setup”.
4. Press the ENTER key. A new screen will appear.



5. Press the right ARROW key 3 times. The following screen will appear.

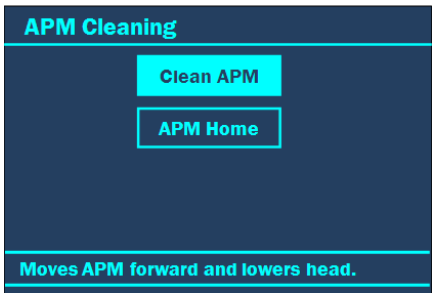


6. Use the “+/-” keys to highlight “APM Cleaning”.
7. Press the ENTER key. A new screen will appear.



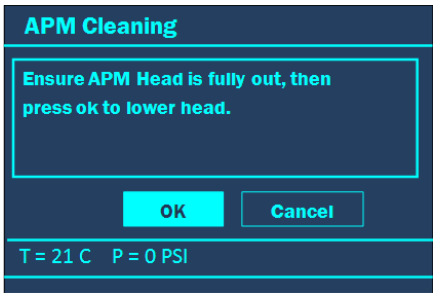
8. Remove the attenuator from the cavity.

9. Press the ENTER key. A new screen will appear.



- “Clean APM” - Moves APM forward and lowers the pressure head.
- “APM Home” - Raises pressure head and homes APM.

10. Use the “+/-” keys to highlight “Clean APM”.
11. Press the ENTER key. The pressure device will move forward.
12. Once the pressure device has moved out, the following screen will appear.



13. Pull the ActiVent forward until it cannot come out any further.
14. Press the ENTER key to select “OK”.

WARNING

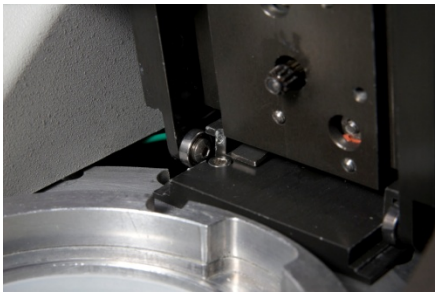
If the Pressure Head is not fully extended do not select “OK”.

15. Once the pressure device is lowered and an audible noise can no longer be heard, remove the back cover of the APM.

16. Hold the front cover of the pressure device and lift upward. The underside of the ActiVent will be exposed.

17. Use a damp cloth to wipe down the pressure device, inside and out, as well as the o-rings.

18. Once the pressure device is cleaned, lower the pressure head back down. Ensure that the pressure device is aligned on the track.



19. Use the “+/-” keys to highlight “APM Home”.
20. Press the ENTER key. The pressure head will raise and return to the home position.
21. Check the cavity for debris.
22. Return the back cover of the pressure device.
23. Return the attenuator to the locked position.
24. Return the Discover to its original position under the Explorer, if applicable, and verify the attenuator/adapter positions as necessary.

NOTE: See the Explorer manual for instructions.

Clean ActiVent Using Solvent

1. Remove the attenuator and check the cavity for debris. Replace attenuator once complete.
2. Select a solvent that will dissolve the reaction components on the pressure device.
3. Place approximately 25 mL of solvent into a 35 mL reaction vial and cap the vial.
4. Place the reaction vial into the Discover SP system.
5. Program a venting method, as described below
    - Temperature: above the solvent boiling point (bpt +75 C)
    - Hold Time: 5:00
    - Pressure 300 PSI
    - Power: 150W (general starting point)
    - PowerMAX: Off
    - Stirring: High
    - Pressure SP: 150 PSI
    - Times at SP: 10
6. Delta Pressure: 50 PSIPerform the venting method, allowing the solvent to be vented through the pressure device and clean the pressure head.
7. Once complete, stop the reaction and remove the vial once completely cooled.

    NOTE: If the temperature decreases suddenly, stop the reaction and repeat with a lower Pressure SP.

8. Remove the attenuator and rinse to remove any liquid or loose material, then dry completely.
9. Repeat as necessary until the ActiVent is completely clean.

Stirring Verification

The stirring option consists of an electromagnetic plate located below the floor of the microwave cavity. “Stirring” occurs when the magnetic field couples with a stir bar in the vessel.

Items Required for Stirring Verification:

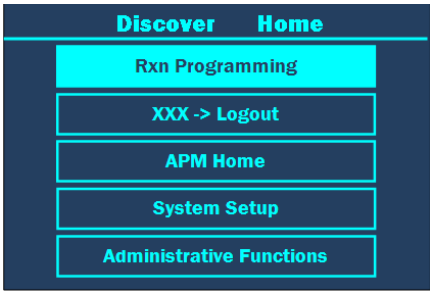
Attenuator
Stir bar appropriate for vessel size
Reaction vessel

1. Depending on vessel being used, install the appropriate attenuator.
2. Place empty vessel or round bottom flask with stir bar into the attenuator.

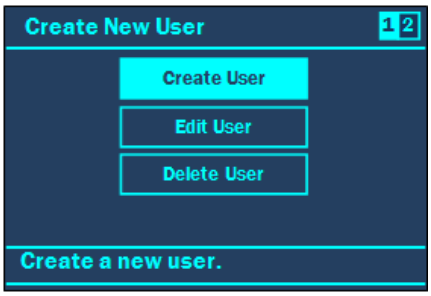
    NOTE: If a 10mL or 35mL vial is being used do not place cap on the vessel.

NOTE: Depending on the viscosity of the sample, a reaction mixture can be prepared and the above procedure can be used to determine if the sample is adequately stirring.

3. Log-in to the Discover as a user with Administrative privileges.
4. Press the HOME key to display the “Discover Home” screen.



5. Press the “+/-“ keys to highlight “Administrative Functions”.
6. Press the ENTER key.

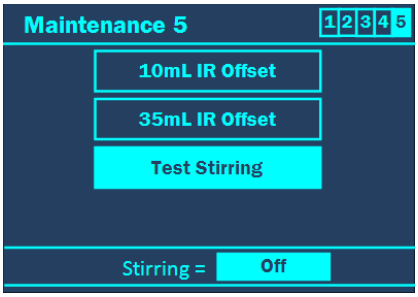


7. Press the right ARROW key one time to display the “Administration” screen.

WARNING

Proper precautions must be taken to avoid contact with solvents or solvent vapors. Protective gear should be worn as outlined in the user’s safety program for hazardous materials and the reagent manufacturer’s material safety data sheet. Refer to these guidelines for proper handling and disposal of reagents.

8. Press the ENTER key.
9. Press the right ARROW key 4 times to display the “Maintenance 5” screen.



10. Press the “+/-” keys to highlight “Test Stirring”.
11. Press the ENTER key. The stirring speed will be displayed at the bottom of the screen.
12. Press the “+/-“ keys to change the stirring speed to High, Medium, Low and Off.

NOTE: If stirring does not occur trying using a larger/stronger stir bar.

NOTE: The prepared sample can be used to determine adequate stirring speed for each sample.

NOTE: If stirring does not appear to be working properly, please contact CEM Service: **800-726-5551** or **704-821-7015** or email **service@cem.com.**

Firmware Update

The firmware should be updated when a new version is released. The firmware can be obtained from CEM's website. www.cem.com. One user should be responsible for updating the firmware.

1. Create a CEM user account. If a CEM user account has already been created proceed with step 2.
   a. Access the following website, www.cem.com.
   b. Locate "Signup" in the blue bar at the top of the screen.
   c. Fill in the customer and product information. The product tag is located on the serial tag on the back of the Discover SP.
   d. Once all information has been entered, select "Register."

NOTE: If the product tag cannot be located, contact the CEM Corporation Synthesis Department 800-726-3331 or 704-821-7015.

2. Access the CEM website www.cem.com.
3. Select the appropriate instrument model from the "Products" menu.
4. Select "Resource Library." Scroll to the "Software" Updates" section. The current version of firmware will be available for download.
5. Using a computer, create a folder named "CEM" on the USB memory stick.

CAUTION

Only the USB memory stick supplied with the Discover SP is compatible with the instrument software.

6. Copy the supplied firmware and bootloader file into the "CEM" folder on the USB memory stick.

NOTE: Bootloader files will follow the CEMLoader_X.X format, and firmware files will follow the "Evolution_DSCAXX.XX format).

7. Turn the instrument off.
8. If applicable, remove the small side cover from the right side of the Discover.
9. Place the USB memory stick into one of the USB ports on the right side of the instrument.

10. Turn the instrument on. A screen will appear with the file names listed.

NOTE: If the firmware version desired does not appear on the screen, repeat steps 1 through 5 using the second USB port. If the appropriate firmware version still does not appear on the screen, contact CEM Service.

11. Use "+/-" keys to select the appropriate bootloader version.
12. Press the ENTER key.
13. The bootloader file will automatically be loaded into the instrument and the progress will be noted with a progress bar on the bottom of the screen. Once it is complete, the screen displaying the files will again be displayed.

14. Use the “+/-” keys to select the appropriate firmware version.
15. Press the ENTER key to load the firmware onto the Discover system. A progress bar will appear to indicate the file is being loaded.

CAUTION

Do not remove the memory stick from the USB port during the firmware update. Removal of the USB memory stick prior to completion of firmware update will corrupt the data on the memory stick. Removal of the USB memory stick prior to completion of the firmware update will also corrupt the system firmware.

16. Upon completion, the Log-in Screen will appear. Wait at least 30 seconds and remove the USB memory stick.

Service

Microwave Leakage Measurement

The attenuator and cavity of the Discover are durable and are designed for reliable operation under severe laboratory conditions. External radiation checks are performed on the Discover System at several points in the manufacturing process, ensuring that leakage from the finished instrument is only a fraction of that allowed by U.S. law (5 mW/cm2).

The attenuator is equipped with a safety interlock system to stop the generation of microwave energy when the attenuator is opened or ajar. If the interlock system fails, a monitoring mechanism will blow the fuse(s) through which power is supplied to the magnetron, rendering the microwave power system inoperable.

To verify that seals and interlocks are working properly, the Discover System should be tested periodically for microwave leakage. Use the following procedure to measure microwave leakage:

1. Create a Dynamic method using 300 watts of power, 1 minute run time, 95 °C temperature set-point, stirring turned on at the "high" setting and PowerMAX on.
2. Place a round bottom flask containing 50mL of deionized water and a stir bar into the cavity.
3. Attach the attenuator to accept a 24/40 ground glass joint.
4. Load the created method and press START to begin the method.
5. Use a suitable RF field strength meter (microwave detector) such as the Holaday Model HI-1500 (available from CEM Corporation, P/N 300500). Slowly move the RF probe around the attenuator perimeter and around the fan grills to check for microwave leakage.

NOTE: CEM does not recommend use of meters available in electronics stores because they are prone to give erroneous readings and lack the necessary sensitivity to properly test an instrument for microwave leakage.

The U.S. Government defines excessive microwave leakage as 5 mW/cm2. If the instrument shows excessive microwave leakage, do not attempt further operation. Contact the CEM Corporation Service Department or the local CEM subsidiary or distributor for further instructions.

Power Test

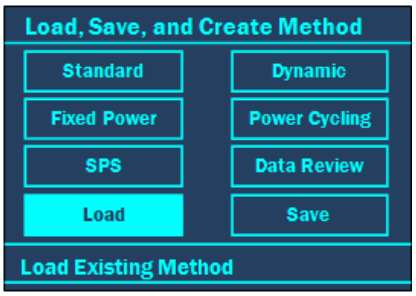
A power test can be performed to determine if the microwave is giving enough power input to heat the sample. A thermometer (manual) or a Fiber Optic probe (Auto) can be used to test the power supply.

Manual Power Test

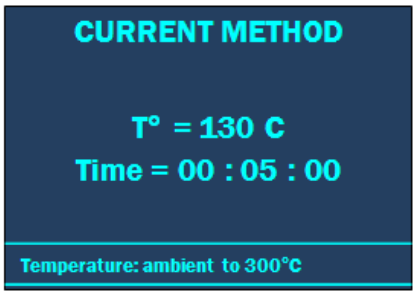
Items required for Manual Power test:

100 ml round bottom flask
100 ml water
Open vessel attenuator
Teflon vessel support
Stir bar appropriate for the round bottom flask
Thermometer

1. Log-in to the Discover as a user with Administrative privileges.
2. Press the DISCOVER key to display the "Load, Save, and Create Method" screen.



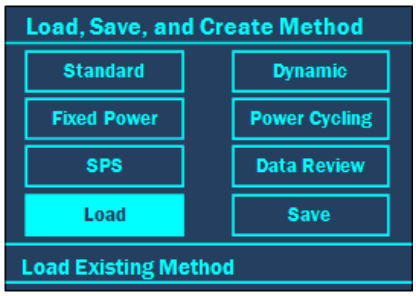
3. Press the "+/-" keys to highlight "Fixed Power".
4. Press the ENTER key to select "Fixed Power" as your method control.
5. Press the Power hotkey.



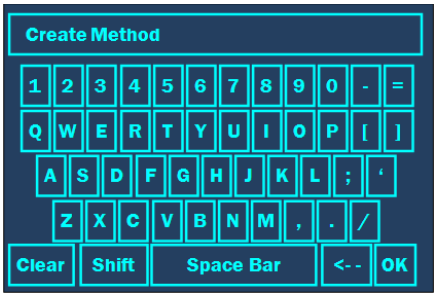
6. Use the “+/-” keys to set the power to 300 watts.
7. Press the right ARROW key to change the time to 00:01:00.
8. Press the right ARROW key to change the temperature to 100°C.
9. Press the right ARROW key to set PowerMAX to off.

NOTE: The system will time out and return the Discover screen after 10 seconds. If this occurs before all the method parameters are entered, press the Power hotkey.

10. Once all method parameters have been entered press the ENTER key.
11. Press the DISCOVER key.



12. Use the “+/-” and ARROW keys to Highlight “Save”
13. Press the ENTER key to save the method.



14. Use the “+/-” and ARROW keys to enter in the method name. Save the method as “Power Test”.
15. Once all the letters have been entered, highlight “OK”.
16. Press the ENTER key to save the method.
17. If applicable, remove the attenuator assembly from the instrument cavity.
18. Insert the vessel stand in the instrument cavity with the standoffs pointing downward. Ensure that the vessel stand is flat against the bottom of the cavity and that the cutout in the stand is positioned over the opening in the cavity liner.

19. Place 100mL of water and a stirring bar into a 100mL round bottom flask.
20. Place the flask into the cavity so that it is positioned on top of the vessel stand.

21. Install the open vessel attenuator assembly with the large slot positioned toward the back of the instrument.

22. Rotate the attenuator assembly clockwise until the attenuator locks into position.
23. Turn the cooling line connected to the Discover off.
24. Using a thermometer, take the initial temperature of the sample and record the value.

WARNING

Before starting a method the thermometer must be removed from the microwave cavity.

25. Press START/PAUSE to begin the method titled “Power Test”.
26. After the one minute time period is completed, insert the thermometer. Take the final temperature and record the value.
27. Take the initial temperature and subtract it from the final temperature. Multiply the Value times 6.9.

TF – TI = TΔ

TΔ x 6.9 = Power Output

NOTE: The Discover system is designed to apply 300 watts. If the current wattage is greater than or less than ten percent then the system is within its operating limits. If the system is not within ten percent then the unit will need to be calibrated.

NOTE: If the current wattage is not within ten percent, please contact CEM Service: **800-726-5551** or **704-821-7015** or email **service@cem.com.**

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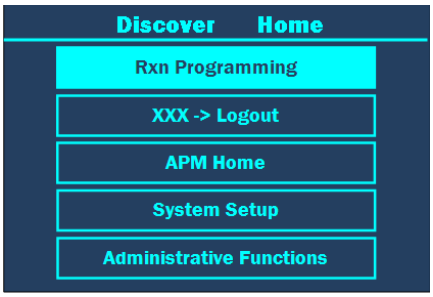
Auto Power Test

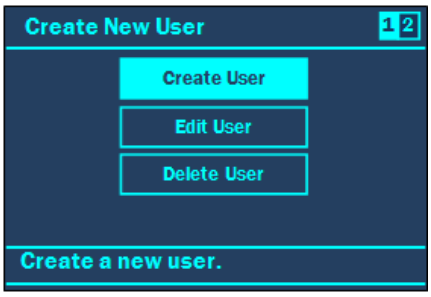
Items required for Auto Power Test:

100 ml round bottom flask
100 ml water
Open vessel attenuator
Teflon vessel support
Stir bar appropriate for the round bottom flask
Fiber optic option for the Discover SP (p/n 541165 or 541166)

1. Log-in to the Discover as a user with Administrative privileges.
2. Press the HOME key to display the “Discover Home” screen.



3. Press the “+/-” keys to highlight “Administrative Functions”.
4. Press the ENTER key to access the Administrative Functions Menu.

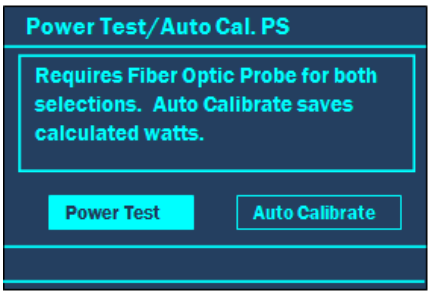


5. Press the right ARROW key one time to display the “Administration” screen.

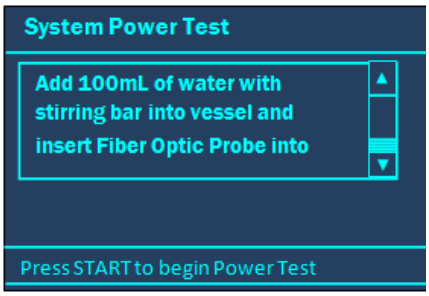
6. Press the ENTER key to enter the maintenance activities screen.
7. Press the right ARROW key three times or until “Maintenance 4” appears.

   NOTE: The system requires the fiber optic option to perform a power test. See the “Fiber Optic” section to enter the calibration and select the Fiber Optic option.

8. Press the “+/-” keys to highlight “Auto Cal. PS”.
9. Press the ENTER key.



10. Use the ARROW keys to highlight “Power Test”.
11. Press the ENTER key.



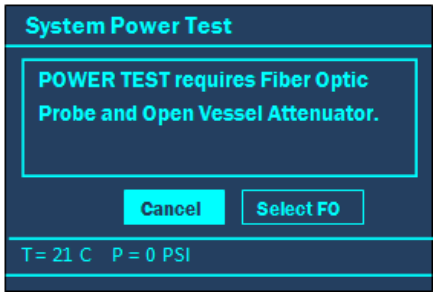
12. If applicable, remove the attenuator assembly from the instrument cavity.
13. Insert the vessel stand in the instrument cavity with the standoffs pointing downward. Ensure that the vessel stand is flat against the bottom of the cavity and that the cutout in the stand is positioned over the opening in the cavity liner.

14. Place 100mL of water and a stirring bar into a 100mL round bottom flask.
15. Place the flask into the cavity so that it is positioned on top of the vessel stand.

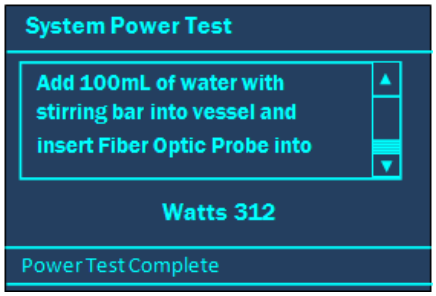
16. Install the open vessel attenuator assembly with the large slot positioned toward the back of the instrument.

17. Rotate the attenuator assembly clockwise until the attenuator locks into position.
18. Insert fiber optic probe into vessel.
19. Press the START/PAUSE key.

NOTE: If the following screen appears, please check to see if Fiber Optic option is assembled correctly. Also check to see if Fiber Optic is selected and calibration has been entered.



20. Once the START/PAUSE key is pressed the following message will appear in the bottom line of the Discover screen; “Record start temperature in 10 seconds. Once the countdown is complete the bottom line will say “Applying microwaves for 60 seconds”. After 60 seconds “Capturing end temperature” will appear. “Power Test Complete” will appear along with the correct microwave wattage that is being applied.



NOTE: The Discover system is designed to apply 300 watts. If the current wattage is greater than or less than ten percent then the system is within its operating limits. If the system is not within ten percent then the unit will need to be calibrated.

Vessel Failure Cleanup Procedure

WARNING

Proper precautions must be taken to avoid contact with solvents or solvent vapors. Protective gear should be worn as outlined in the user's safety program for hazardous materials and the reagent manufacturer's material safety data sheet. Refer to these guidelines for proper handling and disposal of reagents.

1. Turn the Discover SP off.
2. Disconnect the instrument from the AC power source prior to performing any service procedure.
3. Remove the attenuator assembly by rotating the attenuator counterclockwise.
4. Remove the spill cup.

5. If the spill cup contains glass particles or shards, ensure that the glass is placed into a proper waste container.
6. Rinse the spill cup. Once all debris is rinsed from the spill cup, check for cracks and/or damage. Wipe the spill cup with an alcohol wipe or equivalent.

   NOTE: If the spill cup is damaged, replace the spill cup.

7. Check the cavity walls for debris. Remove any debris and wipe down the walls with an alcohol wipe or equivalent.

   NOTE: If the cavity liner is damaged, please contact CEM Service: **800-726-5551** or **704-821-7015** or email **service@cem.com.**

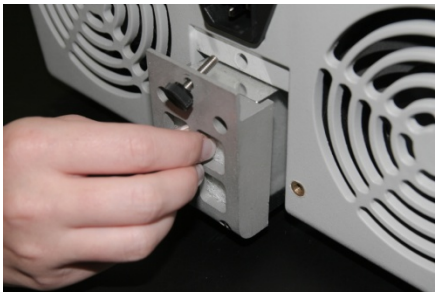
8. Examine the bottom of the spill cup to ensure that the IR lens cover is in position and undamaged. If the IR lens is not in position or damaged, call CEM Service. If the IR lens is dirty, use a cotton swab and alcohol to clean the lens.

9. Inspect the IR lens for foreign debris and/or damage. If the IR lens is in proper position, it will reflect an image similar to a mirror. If necessary, use a swab and alcohol to clean the IR lens, taking care not to scratch the IR lens.

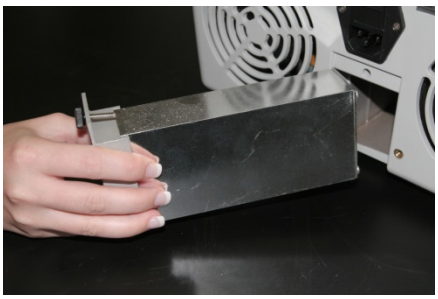
   NOTE: If the IR lens is in proper position, it will reflect an image similar to a mirror. If the IR lens appears to be damaged (ie. scratched), please contact CEM Service **800-726-5551** or **704-821-7015** or email **service@cem.com.**

10. Clean the spill tray as outlined below.
    a. Turn the Discover around so that the back of the system is visible and accessible.
    b. Remove the screw securing the spill tray to the back of the instrument cover.

    c. Carefully slide the spill tray out of the instrument.



    d. Properly dispose of the contents of the tray.
    e. Rinse the tray with an appropriate solvent and allow to dry, if necessary.
    f. Install the spill tray and secure it to the instrument with the thumb screw.



11. Allow the cavity liner and spill cup to dry.
12. If the spill cup is not damaged, install the spill cup. If the spill cup needs to be replaced, contact CEM Corporation.

    NOTE: If the spill cup is replaced, the IR sensor will need to be calibrated as outlined in this manual.

    NOTE: If the spill cup is not seated properly, the attenuator cannot be installed properly.

13. Connect the instrument to the AC power source.
14. Turn the instrument on and continue routine operation.

Troubleshooting Guide

Learn to troubleshoot common Discover SP issues. If, after following the steps, your issue is not resolved, contact CEM Service for more specific information.

Instrument inoperative

Possible Cause	Possible Solution
Instrument not plugged into electrical outlet	Plug power cord into instrument and wall outlet
Power switch not in “on” position	Turn the Discover SP system on using the power switch located on the left side of the instrument.

No microwave power

Possible Cause	Possible Solution
Instrument attenuator ajar	Remove attenuator and reinstall aligning attenuator tabs with cavity slots- rotate clockwise until “click”
Zero wattage selected	When programming a method, input a power wattage above zero (0) watts

Low microwave power

Possible Cause	Possible Solution
Incorrect wattage selected	Increase the microwave power up to 300 watts
Low power	See section titled “Power Test” within the “Service” section of this manual

Inoperative vessel stirring

Possible Cause	Possible Solution
Sample viscosity	See section titled “Stirring Verification” within the “Maintenance” section
Weak stir bar	See section titled “Stirring Verification” within the “Maintenance” section

Erratic Temperature

Possible Cause	Possible Solution
Lens dirty or blocked	See section titled “Vessel Failure Cleanup Procedure”
Infrared needs to be calibrated	See section titled “Temperature” within the “System Setup” section

No rise in temperature

Possible Cause	Possible Solution
Sample does not absorb microwave energy	Check microwave Absorbance chart within this manual
Infrared needs to be calibrated	See section titled “Temperature” within the “System Setup” section
If using fiber optic option: incorrect temperature slope	See section titled “Temperature” within the “System Setup” section
If using fiber optic option: broken probe	Check slope first then try a new probe

If the following occurs, contact CEM Service and do not continue instrument operation.

- Fuse blows when attenuator is opened
- Fuse blows repeatedly during operation
- Microwave leakage
- Erratic pressure
- No Display
- Inoperative keypad

Frequently Asked Questions:

Q. Are there any chemistry references using the microwave instruments?

A. Yes, CEM's website has a list of references of a variety of reactions that utilize microwave systems. The chemistry types includes: coupling, solvent free, cycloadditions, flow systems, heterocycles, inorganics, nanosynthesis, polymers, peptides, scale up, solid phase, enzymatic digestions…etc. There are also many peer-reviewed papers in the literature.

Q. Can resins be used in a microwave?

A. Yes, as long as the melting point is not exceeded for long periods of time. Polystyrene as well as Wang resins are commonly used.

Q. Can neat reactions be performed using a microwave?

A. Neat reactions have been successfully used in microwave enhanced synthesis. Before running a neat reaction, insure that any metals that are present are wetted or in solution due to their extreme ability to heat.

Q. What is the suggested maximum concentration allowed for use with acids and bases?

A. CEM recommends a 10% weight/volume solution when using acids, bases, or salts. As an added precaution, reduce the power to prevent over heating of the reaction mixture. A slightly stronger concentration may be used with smaller volumes and a lower power input.

Q. Are there any precautions that I should keep in mind when using a microwave?

A. Yes, anything that would be of concern conventionally; high concentrations of acids, bases, and salts; and gases formed during the reaction should all be taken into consideration. These reactions should be monitored for at least the first minute. If just starting out, a lower power should be used. During the reaction, the temperature, power, etc. can be adjusted for adequate heating. If a gas forms during the reaction, wait for the reaction to cool completely and allow the ActiVent to safely release any excess pressure.

Q. Why does "Door Open" appear when I press Play?

A. The attenuator, which holds the vessel into position, has not been properly seated in the Discover cavity. Ensure that the slots line up with the cut outs in the cavity and turn clockwise until an audible click is heard. The attenuator should now be locked into position. If the error still appears, contact CEM Service.

Q. When I run a 35mL reaction my vessel appears to be losing volume. Is this normal?

A. During the microwave process, no volume loss should be detected. Ensure the vial is not cracked and the cap has been placed on properly. If the vessel continues to lose volume during the reaction, contact CEM Service.

Q. Is there a way to save/Retrieve data?

A. Yes, a method can be saved using a USB memory device or the Synergy Software.

- If the USB drive is in position on the side of the Discover during the reaction, the temperature data for each run will automatically be stored. This data can be viewed on the Discover screen later as a graph or viewed as individual data points on a computer.
- Synergy is an application software package that provides a complete and easy control of the Discover-based Systems. This package provides a simple interface to design, save, and run methods and method sequences, as well as being able to save, organize, and compile the data.

Q. Will the reaction vial continue to hold pressure once the cap and septa have been pierced to create an inert atmosphere?

A. Yes, once a reaction vial has been purged, the user can then place the vial into the microwave cavity and maintain maximum temperature and pressure allowed by the Discover system. Reagents can also be added to the reaction vial in the same manner.

Q. How do I connect the Synergy application to the Discover system?

A. See section titled "Computer Installation".

Q. The Synergy Play key is grayed out, the Discover is connected and the instrument is not running. How do I get the Play key to reappear.

A. Close out of Synergy and reopen the application. The Play key should now appear.

Q. Is there a way to see the reaction mixture during the heating process?

A. A camera option is available that allows the addition of a digital camera and microwave compatible viewing system. This option transfers the image inside the cavity into the Synergy software allowing the user to view inside the cavity in real time (even on a computer that is remotely located with respect to the reactor). It also allows data storage in the form of still pictures taken at intervals or video.

Q. Is there a more direct way to measure temperature than IR?

A. CEM offers the ability to use fiber optic temperature control for a direct measurement of the sample temperature. This option for the Single Mode (Discover) reactors allows the user to operate the system based on fiber optic in-situ temperature measurement versus the standard infrared (IR) temperature measurement.

Q. Is there a way to perform reactions below room temperature?

A. CEM offers a low temperature option, the CoolMate. The CoolMate is an add-on to a Single Mode (Discover) reactor that consists of a low temperature bath capable of going down to -80 ^{o}C. Because microwave energy is related to a kinetic energy transfer, rather than a thermal energy transfer, reactions can be performed at lower temperatures while using microwave energy to drive the reaction to completion.

Q. Is there a way to quickly flow reactants in and out of the microwave field?

A. CEM has several modules that can flow reactants in and out of a vessel during microwave irradiation. The reaction size will determine the recommended flow cell option.

Specifications

Electrical Requirements
120 VAC (90-140 VAC), 60 Hz, 10A @ 120 VAC; 220/240 VAC (202-250 VAC), 50 Hz, 5A @ 240VAC: Detachable Power Cord with U.L., CSA & CE approvals; Variance in line voltage can affect microwave power output.

Safety Features
Three independent safety interlocks, including interlock monitoring system, plus two independent thermal switches used in each instrument to prevent instrument operation and microwave emissions in case of improper attenuator closure or misalignment. Instrument complies with HHS standards under 21 CFR, Part 1030.10, Subparts (C)(1), (C)(2), and (C)(3).

Magnetron Frequency
2455 MHz

Power Output 300 watts ±10%

Magnetron Protection
Wave Guide Design (Patent Pending) to protect magnetron from reflected energy, ensuring constant power output.

Microwave Cavity
Heavy-duty, multi-layer stainless steel

Dimensions (Overall)
(Discover SP System) 14.2" W x 16.9" D x 11.2" H (36.1 cm x 42.9 cm x 28.4 cm)

Weight
(Discover SP System) 38 lbs. (17.3 kg) (Shipping Wt. 60 lbs. or 27 kg)

Computer Compatibility
80C188 on-board computer controls all system functions. System can perform all functions with or without connection to external PC. RS 232, 9-Pin, IBM PC compatible.

Internal Diagnostic Software
BITS System (Built-In Test System) Checks/monitors line voltage, magnetron life, temperature control, status/operation, safety interlocks.

Pressure Control System
Inboard pressure control system to monitor and control System equilibrium/reaction pressure. Pressure sensed 200 times per minute. Internal pressure control system able to monitor pressures up to 508 psi (35 bar) and control vessel pressures up to 300 psi (21 bar).

Temperature Control System
Non-contact sensor for temperature measurement of vessel contents. Temperature sensor independent of vessel volume. Temperature measurement range from -80^{o}C to 300^{o}C.

Stirring
In situ electromagnetic variable speed.

Service Accessibility
One panel access to system main circuitry for convenient service and upgrading capability.

Fuses
10 AMP Fuse (F10A - 250V, 1-1/4" Type, Littlefuse #312010, CEM #BR188270)
5 AMP Fuse (F5A-250V, 1-1/4" Type, Littlefuse #312005, CEM #BR188280)
Autosampler (F2A-250V Littlefuse #217002.V, CEM #BR880006)

Patents
CEM Microwave Systems may be covered by any one of the following U.S. patents:
04835354, 04080168, 05369034, 04672996, RE034373, 05230865, 04877624, 04672996, 05206479, 05427741. Other patents pending.

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.

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.

CEM Corporation Contact Information:

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Matthews, NC 28106-0200 USA

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