





FARRAR™

TRANE
TECHNOLOGIES™

**4000 Series
23 cubic feet/659 liters
CONTROLLED RATE UPRIGHT FREEZER
-80C TO +40C**

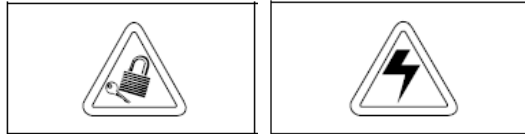


	<p>This symbol alerts the user to important operating and/or maintenance instructions. It may be used alone or with other safety symbols. Read the accompanying text carefully.</p>
	<p>Potential electrical hazards. Only qualified persons should perform the instructions and procedures associated with this symbol.</p>
	<p>Extreme temperature hazards, hot or cold. Instructions associated with this symbol should only be carried out when using special handling equipment or when wearing special, protective clothing.</p>
	<p>Potentially hazardous energy. Equipment being maintained or serviced must be turned off and locked off to prevent possible injury. Reference O.S.H.A. Regulation 1910-147.</p>

Read This Instruction Manual.

Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance.

CAUTION! All internal adjustments and maintenance must be performed by qualified service personnel.



When plugged in, there is high voltage present on terminals inside the machine space. Proper care must be taken if the side panel is removed to perform any kind of maintenance.

The material in this manual is for information purposes only. The contents and the product it describes are subject to change without notice. Farrar Scientific makes no representations or warranties with respect to this manual. In no event shall Farrar Scientific be held liable for any damages, direct or incidental, arising out of or related to the use of this manual.

Important operating and/or maintenance instructions. Read the accompanying text carefully. Equipment being maintained or serviced must be turned off and locked off to prevent possible injury



Always dissipate high or low temperatures, especially inside of the control space before performing any maintenance on the unit.

Always use the proper protective equipment (clothing, gloves, goggles, etc.)

- ***Always dissipate extreme cold or heat and wear protective clothing.***
- ***Always follow good hygiene practices.***
- ***Each individual is responsible for his or her own safety.***

4000 Series

Rate Chamber Instruction Manual

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1.0 Receiving

1.1 Preliminary Inspection

This item was thoroughly inspected and carefully packed prior to shipment and all necessary precautions were taken to ensure safe arrival. Immediately upon receipt, before the unit is moved from the receiving area, carefully examine the shipment for loss or damage. Unpack the shipment and inspect both interior and exterior for any in-transit damage.

1.2 Visible Loss or Damage

If any loss or damage is discovered, note any discrepancies on the delivery receipt and call the delivering carrier and request that their representative perform an inspection. Do not discard any of the packing material and do not move the shipment from the receiving area.

1.3 Responsibility for Shipping Damage

For products shipped F.O.B. Marietta, Ohio, the responsibility of Farrar Scientific ends when the merchandise is loaded onto the carrier's vehicle. On F.O.B. Destination shipments, Farrar Scientific's and the carrier's responsibility ends when your Receiving Department personnel sign a free and clear delivery receipt.

2.0 Introduction:

The 4000 Series Farrar Scientific controlled rate freezer is designed to freeze or thaw product quickly or at a controlled rate. The controlled rate freezer operates using specific ramp and soak profiles tailored to the customer product requirements. The controller can be configured to ramp down and up in temperature and hold the set temperature for a specified time. The unit incorporates scroll refrigeration compressors, hot gas and electric resistance heaters to maintain temperature control.

3.0 Specifications:

- a. Size External: 75"W x 38"F-B x 80"H (190.2 x 96 x 2029 cm)
- b. Material External: Galvanized steel painted with Powdura Hybrid powder coat. Color: beige.
- c. Size Internal: 34"W x 27"F-B x 43"H (86.4 x 69.8 x 109 cm)
- d. This product is for Indoor Use Only.
- e. Material Internal: 304 Stainless Steel, including ducts, plenum and shelves.
- f. Inner door frame gasket: PVC
- g. Outer door frame gasket: Silicon
- h. Door interior panel: Galvanized steel painted with Powdura Hybrid powder coat. Color: Beige
- i. Control enclosure: Cold rolled steel, stainless steel, aluminum powder coated black, drain tube stainless. Evaporator fan motor mount aluminum.
- j. Net weight: 1010 lbs. (458kg)
- k. Shipping weight: 1597 lbs. (724.4kg)
- l. Internal air exchanges: 1/second
- m. Temp range: +40C to -80C
- n. Ambient Temperature Range: +18C to +30C
- o. Ambient Humidity: Less than 75% RH.
- p. Control Watlow: PM 8 ramp and soak controller
- q. Control method: Proportional hot gas and resistance heat
- r. Refrigeration: Cascade scroll compressors 5hp and 3.5hp
- s. Heat: 2600 Watts
- t. Shelves: Quantity 2, adjustable on .595" centers plus bottom of chamber
- u. Power requirement- North America: 208-230 Volt, 3 phase, 31 amps, 40 amp circuit required. Maximum mains supply fluctuation +/- 10%. Hubbell Locking Plug, Hubbell part number: CS8365C 50A rated, 250VAC, 3P4W. Requires Receptacle Hubbell part number: CS8369.
- v. Power requirement- Europe 400 Volt, 3 phase, wye connected, 24 amps. 30 amp fuses required. Maximum mains supply fluctuation +/- 10%. IEC 60309 (6H) 30 Amp 200/415V receptacle required.
- w. This unit is Overvoltage Category II
- x. This unit is Pollution degree 2
- y. Thermal room load:

Air cooled system: 36,860 BTU/Hr/11KWmaximum during chamber warm up (maximum)

Water cooled system: 1706BTU/0.5KW (maximum)

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- z. Drain: External with heated evaporator pan, powered from the cabinet.
- aa. Water Supply for water cooled condenser model 4102/4105

Water at $\leq 60\text{F}$ (16C) and approximately 20 psi differential (1.38 Bar):
Water supply flow rate = 6 gpm (22.5 liters/ min)

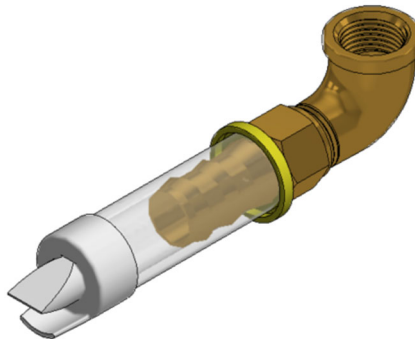
Water connections are $\frac{1}{2}$ " FPT
4105 – a $\frac{1}{2}$ " MPT x M20 x 1.5 female adapter is provided

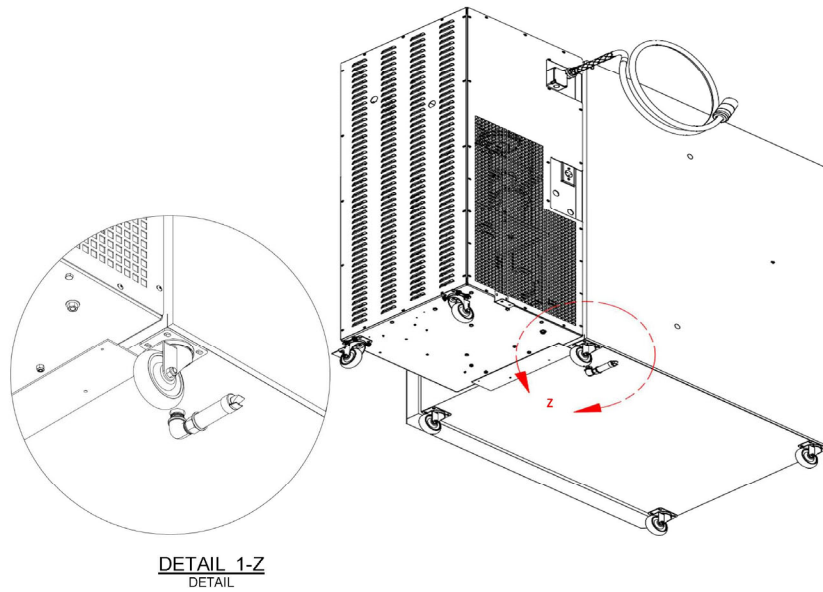
4.0 Setup/ Installation:

1. Note: The receptacle for this unit must be positioned such that this unit can be rolled on its casters to achieve the following receptacle spacing: At least a 3 foot clearance in front of the receptacle, with a 30" wide working space, and headroom at least the height of the equipment.
2. Roll the unit into place near the required power connection. Allow for 6" (15.3 cm) of clearance from the back and sides for air flow and door opening clearance. If lifting the unit, place lift forks under center of enclosure.
3. Remove the foam wrapped (2) shelves (10) shelf clips and the evaporator pan from the unit interior and unwrap.
4. Remove the (4) spring feet from the packaging and install on the evaporator (4) bottom projections of the evaporator pan (small end first). (see photo below)



5. Chamber drain tubing.





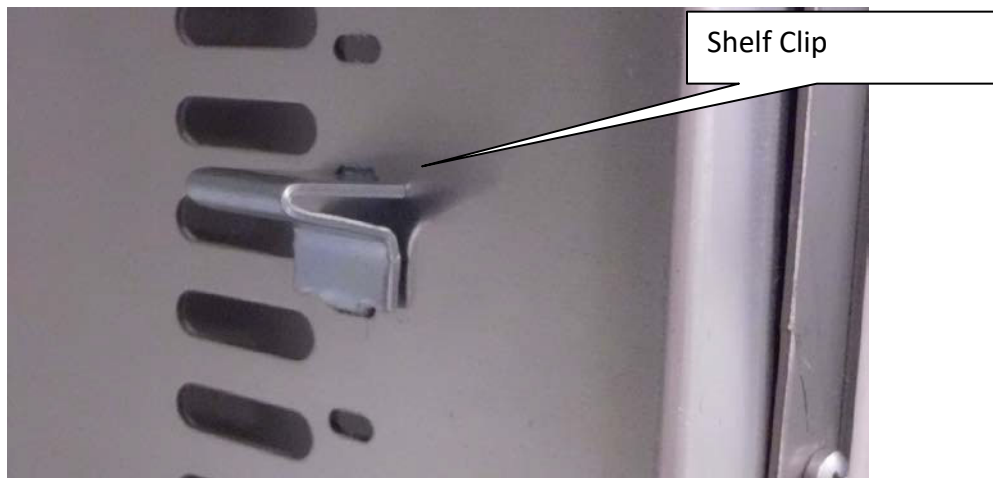
6. Screw the chamber drain tube with duckbill onto the threaded cabinet drain connector.



7. Connect the supplied electrical cord to the evaporator pan receptacle and plug the other end in to the dedicated receptacle on the rear of the cabinet. (see photo below)



8. Install (4) shelf clips in the duct sheet for each shelf (2) front and (2) in rear at the desired height. Spacing is approximately 0.5" (1.3 cm) for each shelf.



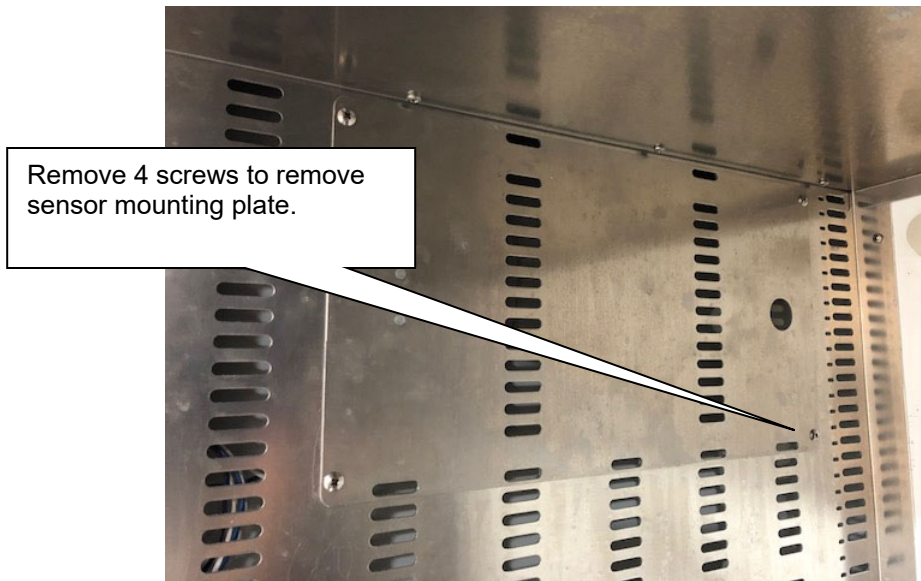
9. Place the shelves on the clips with the down flange facing the door opening. (see photo below)

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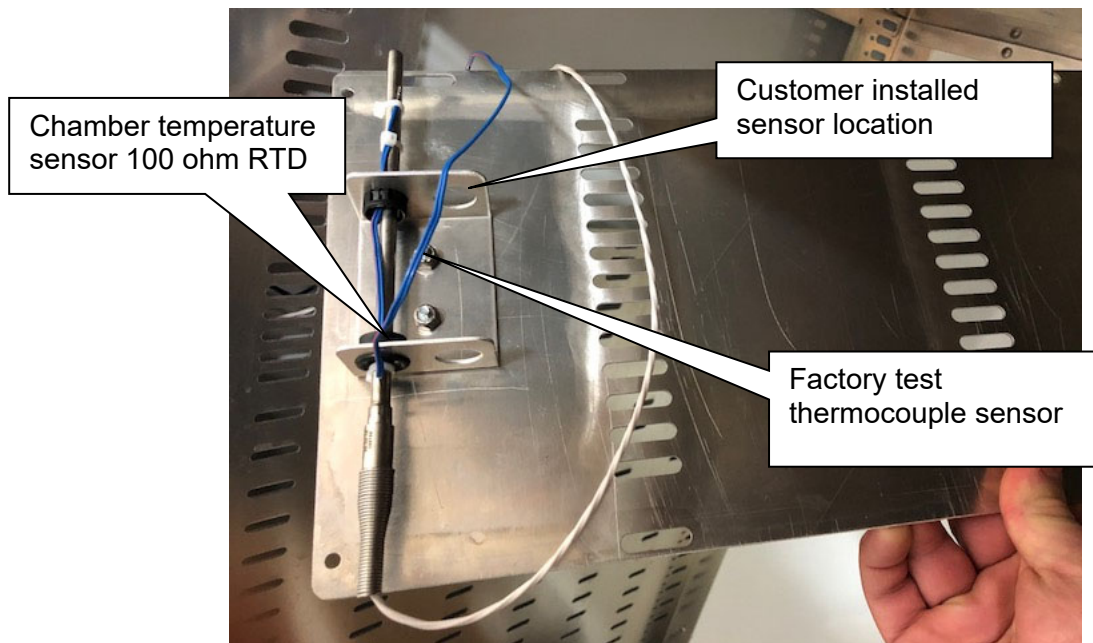


10. Three chamber (0.875" (2.22 cm)) access ports are provided; two on the rear of the cabinet and one on the left side. These ports may be used for customer provided chamber or sample monitoring. The ports are filled with insulation and both ends are plugged to reduce moisture infiltration. After monitoring sensors are installed, replace the insulation and seal the port inside and outside of the cabinet. Refer to the Cabinet Layout Drawing at the end of the manual for port locations.

Interior view, sensor mounting plate

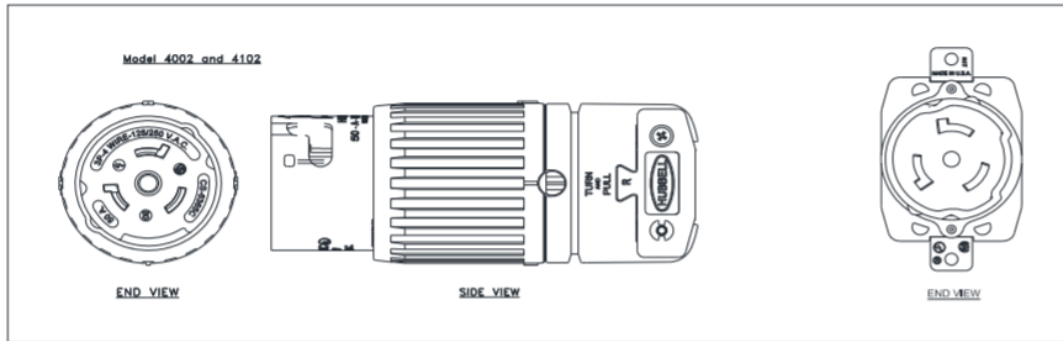


Temperature Sensor Mount



The sensor mount will accept 0.125 to 0.250" (3.2 mm to 6.35 mm) diameter sensors with a minimum length of 3.0" length. Reinstall the sensor mount with the sensor tip pointing down.

11. **North America Electrical Plug:** The unit comes installed with a Hubbell Locking Plug, Hubbell part number: CS8365C. Plug the unit into the matching receptacle Hubbell part number: CS8369 (not provided). The plug is 50A rated, 250VAC, 3P4W. Note: The rate chamber is powered by three phase and the refrigeration compressors are required to operate in a specific direction. The unit incorporates a phase monitor to protect the compressors. If the unit does not turn on (no indicator lights) when the power switch is turned on the first thing to do is switch 2 of the phase legs in the receptacle or power panel.



European Plug: Connect the unit to an IEC 60309 (6H) 30 Amp 200/415V receptacle, such as an ABL Sursum F52S33A.

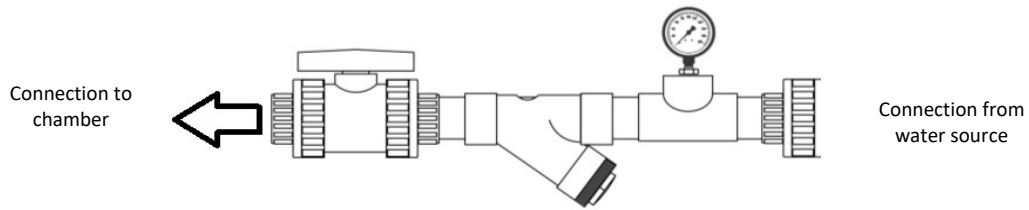
Note: The rate chamber is powered by three phase and the refrigeration compressors are required to operate in a specific direction. The unit incorporates a phase monitor to protect the compressors. If the unit does not turn on (no indicator lights) when the power switch is turned on the first thing to do is switch 2 of the phase legs in the receptacle or power panel.



12. 4102/4105 – Water cooled condenser only. Inlet and Outlet chilled or tower water connections are located at the rear of the 4102/4105, each connection are 1/2" FPT (Female Pipe Tread). For the 4105, a 22mm, 1.5 adapter is provided (refer to the Chamber Layout drawing at the end of the manual for connection locations).
- a) We recommend the use of industrial 1/2" flexible hose grade with a minimum 8 feet (2.5 meter) in length. The use of flexible hose for the water inlet and outlet allows easy movement of equipment during service and troubleshooting.
Hard piping of equipment is not recommended.

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- b) We strongly recommend installation of ½" ball valve at 4102/4105 inlet (chilled or water tower) along with strainer and pressure gauge for trouble shooting and equipment testing purpose. The ball valve needs to be accessible during trouble shooting of equipment and can also be used for testing and servicing equipment.



- c) Connections to unit: Apply Teflon tape to inlet and outlet connection, and tighten each connection accordingly.



- d) After each hose connections have been firmly tightened, slowly turn on water supply to unit and check for leaks at all connections.
- e) Verify water pressure is adequate for equipment operation, along with nominal flow and temperature requirements as follow:

Tower water: $\leq 85^{\circ}\text{F}$ (29.5°C). ≥ 20 PSI differential (1.4 bar)

Water flow rate at maximum load = 7 gpm (26.5 L/min)

Water flow rate at average load = 4.5 gpm (17 L/min)

Chilled water: $\leq 45^{\circ}\text{F}$ (7.5°C). ≥ 20 PSI (1.4 bar)

Water flow rate at maximum load = 3.5 gpm (13.2 L/min)

Water flow rate at average load = 2.0 gpm (7.6 L/min)

5.0 Control System:

The unit consists of heating, cooling components, fans, and control components. The major cooling components include a compressor (heat moving component), condenser (heat rejection part), evaporator (heat absorption part) and expansion valve (refrigerant flow control devices). Heating is accomplished with the use of resistance heaters imbedded in the evaporator assembly. Controls consists of a circulation fan, Watlow Ez Zone® ramping controller, RTD temperature sensors, stepper motor control hot gas control, solid state relay and misc. other hardware.

6.0 Operation:

Control panel:

1) POWER SWITCH

- Turns the unit ON and OFF
- When in the OFF position, internal control heater power will be OFF, evaporator fan will be off, condensate evaporator pan will be off, compressors will be in pump down mode only (1st stage refrigeration compressor will turn on and off automatically to remove refrigerant from the evaporator section of the refrigeration system)

2) MODE SWITCH

- Selects the profile to be run when the CYCLE START button is pressed
- There are 3 user configurable and selectable temperature profiles that can be run

3) CYCLE COMPLETE INDICATOR

- Flashing indication light to signify the final step in a profile

4) USB CONFIGURATION PORT

- Female USB type B connector for interfacing with the Watlow controller to program profile steps
- EZ-Zone Configurator is the Watlow provided software for direct interface with the controller

5) CYCLE START PUSHBUTTON

- Used to start the temperature profile as selected by the MODE switch

6) CYCLE STOP PUSHBUTTON

- Stops all operations of the unit and returns to the OFF state
- All compressors, heat sources, and internal circulation fan will turn off

7) DEFROST BUTTON (EZ1)

- Soft key tied to the defrost function of the 4000 series unit

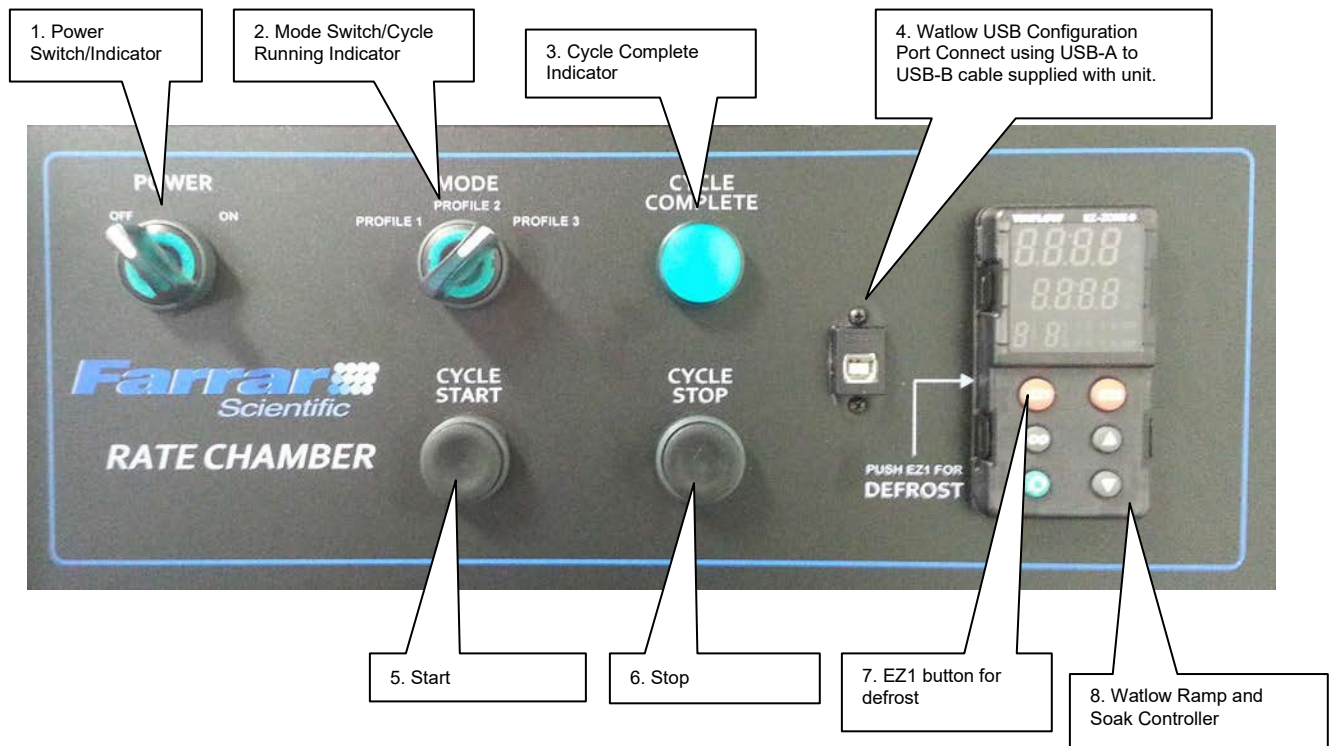


Figure 6.1

Control Description

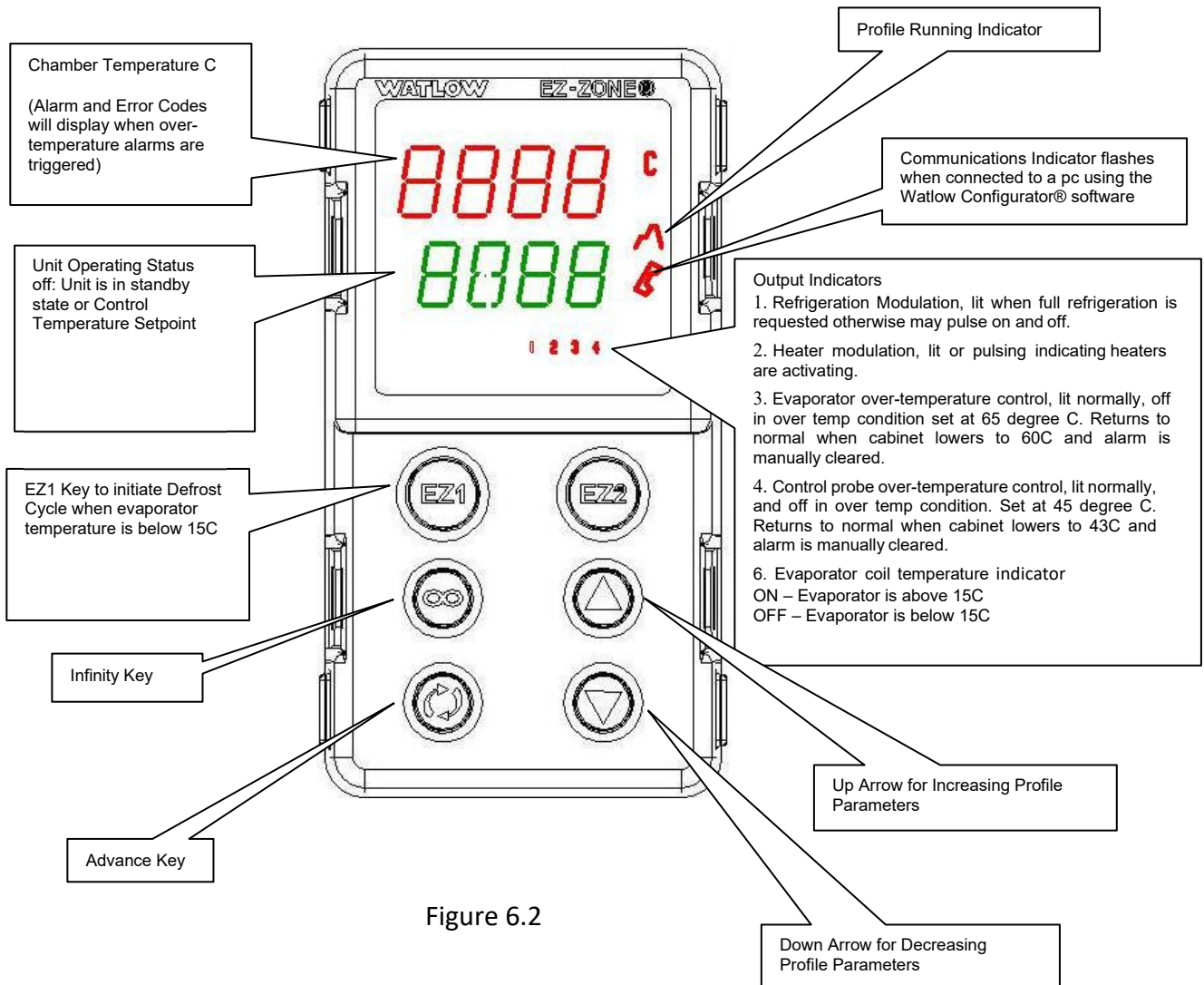


Figure 6.2

Basic Operation:

After unit setup, turn the power switch to the ON position (Figure 6.1). The green power switch will light, and the Watlow controller will light showing interior chamber temperature (top red display) and current operating status (bottom red display). Please refer to Figure 6.2 for more details on the Watlow Display.

User Selectable Profiles:

The unit is factory configured for 3 independent programmable temperature profiles, selectable from the Mode Selection Switch. Pressing the cycle start button while the unit is in standby mode (OFF displayed in the bottom green Watlow display area) will start the temperature profile that the Mode Selection Switch is set to.

Factory default temperature profiles are programmed to control the unit chamber temperature to set point (bottom green numerical display), and hold at that temperature until the Cycle Stop button is pressed. Once Profile 1, 2 or 3 has reached its final temperature, the green cycle complete indicator will flash until the cycle stop button is pressed. Below are the set-points for each factory default profile.

Profile 1: -80°C (Cycle complete light with begin flashing once chamber air temperature has reached -80°C)

Profile 2: -40°C (Cycle complete light will begin flashing once chamber air temperature has reached -40°C)

Profile 3: +25°C (Cycle complete light will begin flashing once chamber air temperature has reached +25°C)

Each of these default profiles is configured to reach the target set-point as fast as possible. The unit can also perform controlled rate temperature ramp and soak processes over the course of several minutes, or several days depending on the product need. (The configuration steps required for these type of profiles is explained in the Profiling section.)

Pressing the CYCLE STOP button at any time will cancel any process that is currently running, disable all refrigeration systems, and return the unit to the OFF state at any time.

A profile can only be started from the OFF state. Changing the position of the MODE switch, or pressing the cycle start button while a temperature profile is running will be ignored. To switch from one programmed profile to another, the CYCLE STOP button must be pressed so that OFF is displayed, and then a new profile can be initiated.

There is a cycle complete light that can be triggered as a visual indicator at any point in a profile. If the option of remote contacts is installed on the unit, this same signal is used to drive that signaling event.

In case of a power failure of over 5 minutes, during a freeze or defrost profile, the unit will stop the current profile and will need to be restarted. In cases where the power fails for less than 5 minutes the profile will restart automatically. (This time can be changed, please contact Farrar Scientific for assistance)

Defrosting the Evaporator Coil:

The defrost mode is also a profile. The steps for the defrost cycle are steps 38, 39 and 40. **These steps should never change from factory default!**

A defrost of the evaporator coil is only required after the unit has completed a freeze cycle at a chamber temperature at or below 5°C, and all product has been removed from the control space. The purpose of the defrost cycle is to remove any ice buildup on the surface of the evaporator coil to ensure reliable and consistent unit operation.

Pressing the EZ-1 soft button, while the unit is in the OFF state, will initiate a defrost cycle of the evaporator coil internal to the unit control space. This defrost cycle is internally controlled and will automatically terminate when the evaporator coil has reached a temperature of 15°C. If EZ-1 is pressed while another profile is already running, or if the evaporator temperature is at or above 15°C, a defrost cycle will not occur.

As shown in **Figure 6.2**, a display of the number 6 on the bottom right side of the Watlow display indicates that the evaporator temperature is at or above 15C.

Control Security:

The Watlow control write security can be set to disable all functions from the Watlow controller front panel. Please refer to the Watlow controller manual for detailed instructions. When write security is set to the highest write security level (level 0), configuring of the control system and profiling must be accomplished using the USB port supplied on the front of the control panel and the Watlow Configurator® software with the supplied USB cable.

The Watlow Controller Support Tool on the included flashdrive or the included manual may be used for a thorough understanding of the control system. The control used is Model PM8.

There are two over-temperature alarms programmed into the 4000 series unit. If the control probe reaches a temperature above 45C, or if the evaporator reaches a temperature of 65C. In either case, the unit will automatically shut down and an alarm message will be displayed across the front of the Watlow controller. The following steps must be followed in order safely to clear these alarms.

Step 1: Press the “Cycle Stop” button on the control panel

Step 2: Turn the power switch to the off position

Step 3: Open the door on the front of the unit for at least 5 minutes. (This step is to cool down the evaporator coil to below 60C, depending on ambient temperatures this cool down time may vary)

Step 4: Turn the power switch to the on position. If the evaporator coil has cooled sufficiently, the error will have cleared and the unit can go back into normal operation.

If the error has not cleared, turn the unit off and open the door to let the unit cool further.

7.0 Modifying or Creating Profile:

Programming the 4000 series Rate Chamber

There are two ways to interface with the 4000 series main operations Watlow PM8 controller. The first option is the use of the controllers front mounted keys to access operations menus. The second, and recommended option, is to use a Windows computer and the Watlow provided software EZ-Zone Configurator.

Installing and interfacing with the 4000 series using EZ-Zone Configurator 6

Two pieces of software need to be downloaded and installed on the windows computer to interface with the Watlow controller inside of the 4000 series unit. Watlow EZ-Zone Configurator Version 6 and the FTDI USB driver for the USB to RS485 conversion cable inside of 4000 series unit. The included thumb drive has installation files for both of these pieces of software. Below are also links to download the installation files from the internet.

Watlow EZ-Zone Configurator Version 6.1 Download:

<http://www.watlow.com/products/Controllers/Software/EZ-ZONE-Configurator-Software>

It is important to only use the most up to date version of EZ Zone configurator, Version 6.1 as of this manuals printing. If an older version is used, programming parameters will not be loaded into the unit correctly causing unwanted unit operation.

Windows FTDI driver download:

<http://www.ftdichip.com/Drivers/VCP.htm>

It is important to only use the most up to date version of the FTDI USB driver, 2.12.28 as of this manual's printing. If an older version is used, programming parameters will not be loaded into the unit correctly causing unwanted unit operation.

The following is an excerpt from the Watlow EZ-Zone Users Guide on how to connect to the Watlow controller using EZ-Zone Configurator.

Software Configuration

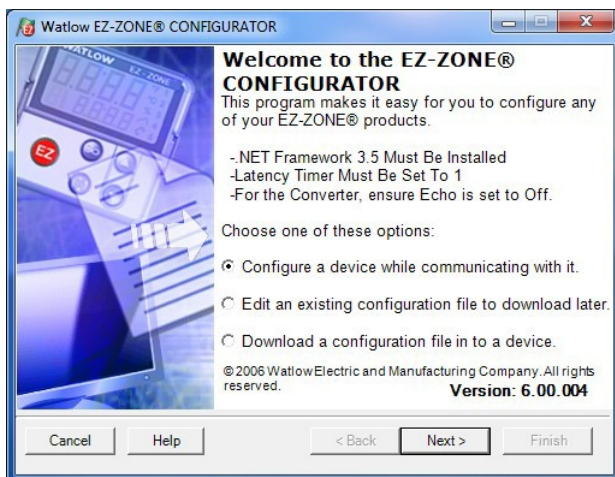
Using EZ-ZONE Configurator Software

To enable a user to configure the PM control using a personal computer (PC), Watlow has provided free software for your use. If you have not yet obtained a copy of this software insert the CD (Controller Support Tools) into your CD drive and install the software. Alternatively, if you are viewing this document electronically and have a connection to the internet simply click on the link below and download the software from the Watlow web site free of charge. <http://www.watlow.com/en/resources-and-support/Technical-Library/Software-and-Demos>

Once the software is installed double click on the EZ-ZONE Configurator icon placed on your desktop during the installation process. If you cannot find the icon follow the steps below to run the software:

1. Move your mouse to the "Start" button
2. Place the mouse over "All Programs"
3. Navigate to the "Watlow" folder and then the sub-folder "EZ-ZONE Configurator"
4. Click on EZ-ZONE Configurator to run.

The first screen that will appear is shown below.



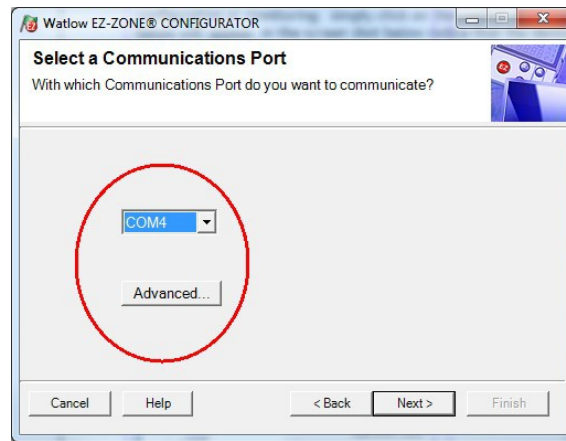
If the PC is already physically connected to the EZ-ZONE PM control click the next button to go on-line.

Note:

When establishing communications from PC to the EZ-ZONE PM control an interface converter will be required. The Standard Bus network uses EIA-485 as the interface. Most PCs today would require a USB to EIA-485 converter. However, some PCs may still be equipped with EIA-232 ports, therefore an EIA-232 to EIA-485 converter would be required.

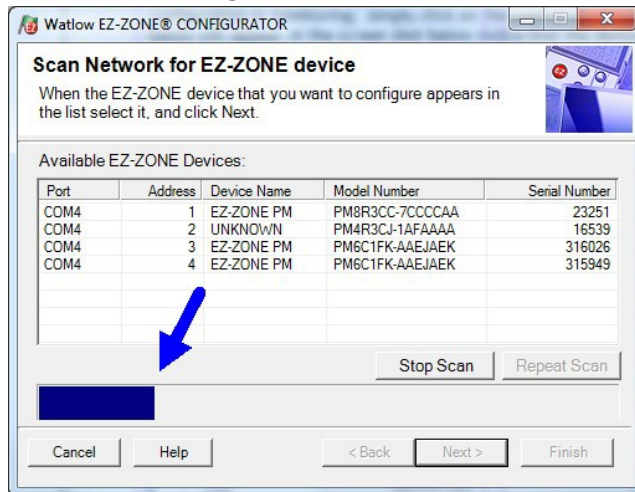
As can be seen in the above screen shot the software provides the user with the option of downloading a previously saved configuration as well as the ability to create a configuration off-line to download later. The screen shots that follow will take the user on-line.

After clicking the next button above it is necessary to define the communications port that will be used on the PC as shown below. Clicking on the drop down will allow the user to select the appropriate communications port. This will be the port assigned to the EIA-485 to USB converter when it was connected to the PC. The "Advanced" button allows the user to determine how many devices to look for on the network (1 to 17).

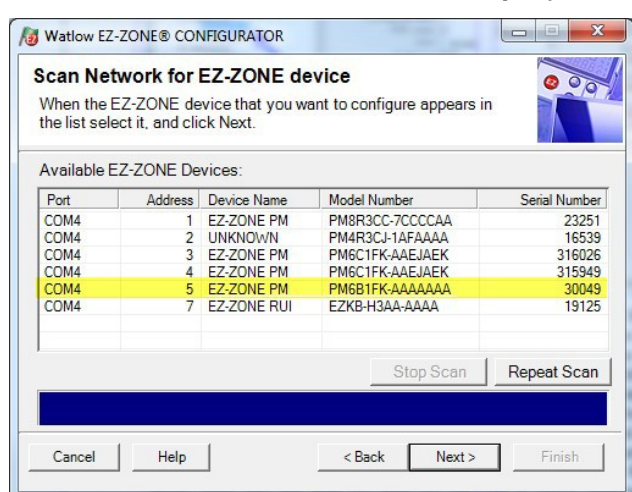


After clicking on the "Next" button, the software will scan the network for the zone addresses specified while showing the progress made (as shown in the graphic below. When complete the software will display all of the available devices found on the network as shown below.

Searching Network for Devices



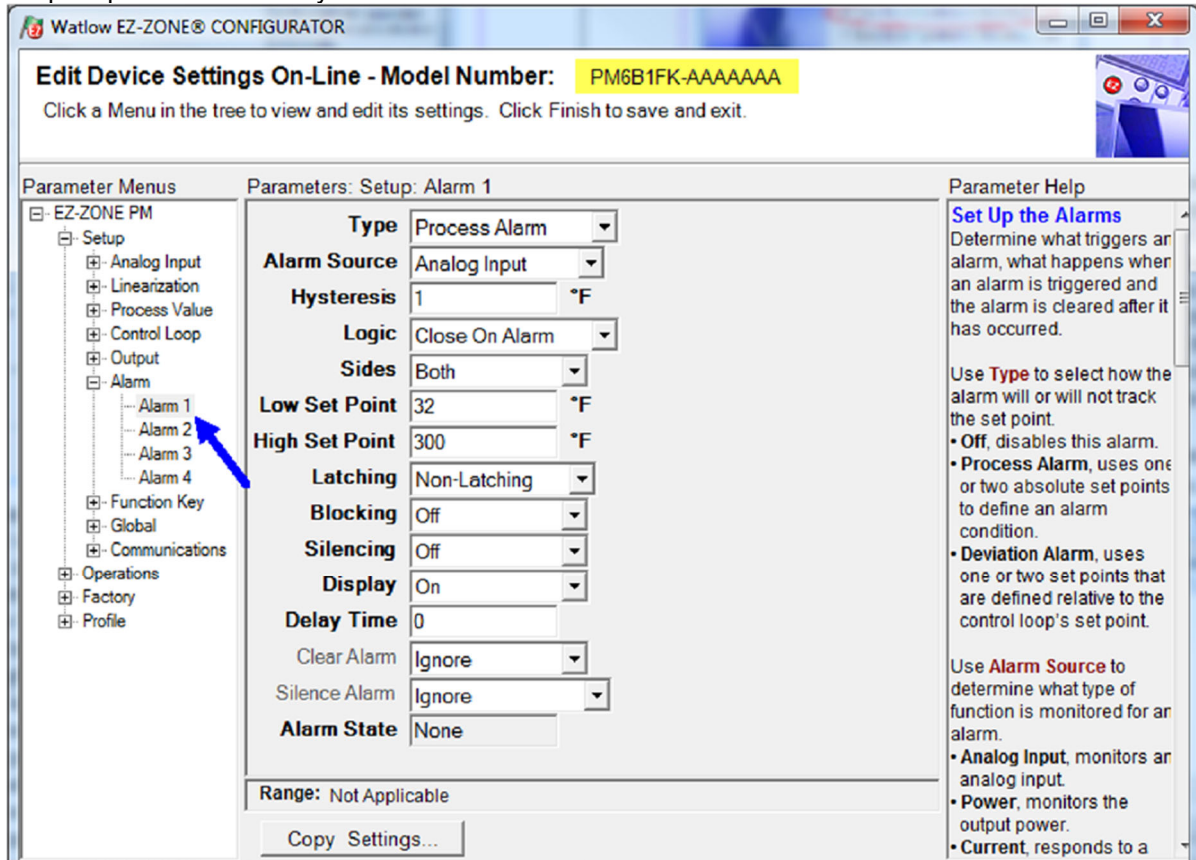
Available Network Devices Displayed



The PM8 is shown highlighted to bring greater clarity to the control in focus. Any EZ-ZONE device on the network will appear in this window and would be available for the purpose of configuration or monitoring; simply click on the control of choice. After doing so, the screen below will appear. In the screen shot below notice that the device part number is clearly displayed at the top of the page (yellow highlight added for emphasis). When multiple EZ-ZONE devices are on the network it is important that the part number be noted prior to configuring so as to avoid making unwanted configuration changes to another control. Looking closely at the left hand column (Parameter Menus) notice that it displays all of the available menus and associated parameters within the control.

The menu structure as laid out within this software follows:

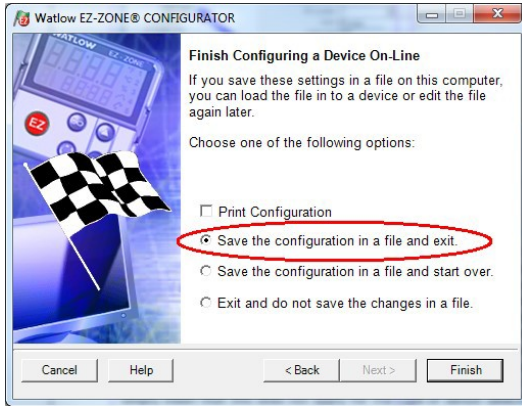
- Setup - Operations - Factory - Profile



Navigating from one menu to the next is easy and clearly visible. Simply slide the scroll bar up or down to display the menu and parameter of choice. If there is a need to bring greater focus and clarity to the parameters of interest simply click on the negative symbol next to any of the Menu items. As an example if it is desired to work within the Operations page click the negative sign next to Setup where the Setup Page will then collapse. Now click the plus sign next to Operations to find the menu items of choice without viewing unwanted menus and parameters. Once the focus is brought to an individual parameter (single click of mouse) as is the case for Analog Input 1 in the left column; all that can be setup related to that parameter will appear in the center column. The grayed-out fields in the center column simply mean that this does not apply for the type of sensor selected. As an example, notice that when a thermocouple is selected, RTD Leads does not apply and is therefore grayed out. To speed up the process of configuration, notice that at the bottom of the center column there is an option to copy settings. If all alarms were to be setup the same click on "Copy Settings" where a copy dialog box will appear allowing for quick duplication of all settings.

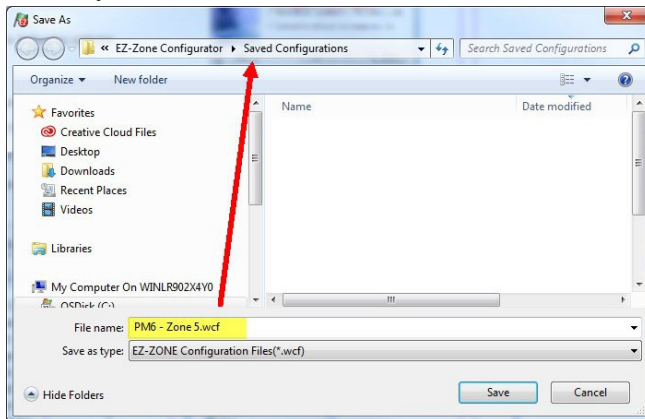
Notice too, that by clicking on any of those items in the center column that context sensitive help will appear for that particular item in the right-hand column.

Lastly, when the configuration is complete click the "Finish" button at the bottom right of the previous screen shot. The screen that follows this action can be seen below.



Although the PM control now contains the configuration (because the previous discussion focused on doing the configuration on-line) it is suggested that after the configuration process is completed that the user save this file on the PC for future use. If for some reason someone inadvertently changed a setting without understanding the impact, it would be easy and perhaps faster to download a saved configuration back to the control versus trying to figure out what was changed. Of course, there is an option to exit without saving a copy to the local hard drive. After selecting Save above, click the "Finish" button once again. The screen below will then appear. When saving the configuration, note the location where the file will be placed (saved in) and enter the file name (File name) as well. The default path for saved files follows:

Users\ "Username" \My Documents\ Watlow\EZ-Zone Configurator\ Saved Configurations The user can save the file to any folder of choice.



All safety, and operations settings are contained within the four major headings while connected to the Watlow controller using EZ-Zone Configurator.

1. Setup
2. Operations
3. Factory
4. Profile
- 5.

There are factory pre-programmed safety and operations settings contained within Setup, Operations, and Factory headings. These parameters should never be changed! At the end of this manual is a printout of all safety and operations parameters that need to be manually checked every time the unit is re-configured. Failure to complete this step can lead to unwanted unit operation, and possibly expose product to undesirable environmental conditions.

Profile Heading:

Under Profile, there are 4 Profile sections (Profile 1 Step, Profile 2 Step, Profile 3 Step, and Profile 4 Step). The steps listed under these sub-sections are a continuous list of 40 Steps that can each be individually configured into various step types to accomplish the desired profile temperature parameters. (Steps 38, 39, and 40 are reserved for the defrost function, and should not be changed from factory default. More information on the defrost is listed below)

The following table outlines the starting step of each of the 3 profiles selectable with the MODE selection Switch.

MODE Switch Positon	Profile Start Step
Profile 1	Step 1
Profile 2	Step 11
Profile 3	Step 21

There is a total of 10 steps available for Profile 1 (Step 1 – Step 10), and Profile 2 (Step 11 – Step 20). Profile 3 has a larger number of steps available (Step 21 – Step 37) if a desired temperature profile will require more than 10 steps to be programmed successfully. *(If more than 10 steps are needed for Profile 1 and Profile 2, the start steps of each of the 3 Profiles can be changed to different step numbers. Please contact Farrar Scientific for aid in changing the appropriate settings).*

A Temperature profile is made by configuring sequential steps that either change the temperature set point of the air in the chamber or maintain a previously defined set point. Each profile starts at that Profile's start step and ends with a step type that either turns the unit off, or holds a specific temperature until a user interacts with the unit to stop operation.

The available step types that can be used with the 4000 series unit, and example profiles, are listed below. Each step type has individual parameters that must be set correctly to ensure proper operation of the 4000 series unit. When the Step Type is changed on each individual step, only the parameters that can be changed will be in **BOLD**, all other parameters will be greyed, and have no effect on that step type. The parameters that need to be set for each set type are highlighted in green below.

Available Step Types:**Time Step**

Used to change the set point of the cabinet over the specified time. This is the step that can be used to slowly change the temperature of the cabinet at a controlled rate, or be used to change the temperature of the cabinet as fast as possible by using a short timespan setting. The set point will change from the current temperature of the cabinet, to the target set point over the specified time.

See below for more specifics on this step type and the format that matches what will be seen in EZ-Zone.

Step Type	Time
Target Set Point Loop 1	-80°C
Target Set Point Loop 2	-18°C
Hours	0
Minutes	0
Seconds	10
Rate	0°C

Set point for this step type

Time settings for the time the set point will change over

4000 Series

Wait For Process 1	-80°C
Wait Event 1	Off
Wait Event 2	Off
Day of Week	Every Day
Jump Step	1
Jump Count	1
End Type	User

Event 1 On

Tied to internal outputs on the controller

Event 2 Off

Event 1 must be ON and Event 2 OFF
for this step type

Soak Step

This step type will hold the cabinet at the set point temperature defined in the previous step, for the specified time.

Step Type Soak

Target Set Point Loop 1	0°C
Target Set Point Loop 2	-18°C

Hours 0

Use these parameters to set the soak
time

Minutes 10

Seconds 0

Rate	0°C
Wait for Process Instance	1
Wait For Process 1	0°C
Wait Event 1	Off
Wait Event 2	Off
Day of Week	Every Day
Jump Step	1
Jump Count	1
End Type	User

Event 1 On

Tied to internal outputs on the controller

Event 2 Off

Event 1 must be ON and Event 2 OFF
for this step type

Wait for Process

This step type is used to guarantee the chamber temperature is at a specific temperature before moving on to the next step in the profile. The "Wait for Process 1" parameter is where this temperature is defined at.

Step Type Wait For Process

Target Set Point Loop 1	-80°C
Target Set Point Loop 2	-18°C
Hours	0
Minutes	0

4000 Series

Seconds	0	
Rate	0°C	
Wait for Process Instance	1	Must always be 1 for this step type
Wait For Process 1	-80°C	The temperature waiting to be reached
Wait Event 1	None	
Wait Event 2	None	
Day of Week	Every Day	
Jump Step	1	
Jump Count	1	
End Type	User	
Event 1	On	Tied to internal outputs on the controller
Event 2	Off	Event 1 must be ON and Event 2 OFF for this step type

Wait for Event

This step type is configured in a way that will hold the previous steps set point until a user presses the CYCLE STOP button. This step will only be used at the end of a profile.

Step Type	Wait for Event
Target Set Point Loop 1	40°C
Target Set Point Loop 2	-18°C
Hours	0
Minutes	0
Seconds	0
Rate	0°C
Wait for Process Instance	1
Wait For Process 1	40°C
Wait Event 1	On
Wait Event 2	Off
Day of Week	Every Day
Jump Step	1
Jump Count	1
End Type	User
Event 1	On
Event 2	On

End

An end step will turn off all functions in the unit, and return the unit to the standby state. The temperature in the unit will no longer be controlled while in the stand by state.

Step Type	End
Target Set Point Loop 1	-18°C
Target Set Point Loop 2	-18°C

4000 Series

Hours	0
Minutes	0
Seconds	0
Rate	0°C
Wait for Process Instance	1
Wait For Process 1	-18°C
Wait Event 1	Off
Wait Event 2	Off
Day of Week	Sunday
Jump Step	1
Jump Count	1
End Type	Off

Event 1	Off
Event 2	Off

Event 1 and Event 2 must both be set to OFF in this step type.

Unused Step

This step type is completely skipped by a running profile. All of the parameters will be greyed out except for the step type.

Step Type	Unused Step
-----------	-------------

Profile Examples

Default profile 1 example

Click on Profile1 step then Profile 1 Step 1. This step is the first to use when configuring profile 1. Note, the only options available for the Step Type (Time) are Target Set Point 1, Hours, Minutes, Seconds, Event 1 and Event 2. All others are grayed out. When selecting other Step Types other options selectable will be in dark characters.

Screen 5

Watlow EZ-ZONE[®] CONFIGURATOR

Edit Device Settings On-Line - Model Number: PM8B2FC-CREJAAA

Click a Menu in the tree to view and edit its settings. Click Finish to save and exit.

Parameter Menus **Parameters: Profile: Profile 1 Step 1**

<ul style="list-style-type: none"> [-] EZ-ZONE PM <ul style="list-style-type: none"> [-] Setup [-] Operations [-] Factory [-] Profile <ul style="list-style-type: none"> [-] Profile 1 Step <ul style="list-style-type: none"> Profile 1 Step 1 Profile 1 Step 2 Profile 1 Step 3 Profile 1 Step 4 Profile 1 Step 5 Profile 1 Step 6 Profile 1 Step 7 Profile 1 Step 8 Profile 1 Step 9 Profile 1 Step 10 [-] Profile 2 Step [-] Profile 3 Step [-] Profile 4 Step 	<p>Step Type Time</p> <p>Target Set Point Loop 1 -80 °C</p> <p>Target Set Point Loop 2 -17.8 °C</p> <p>Hours 0</p> <p>Minutes 0</p> <p>Seconds 10</p> <p>Rate 0.0 °C</p> <p>Wait for Process Instance 1</p> <p>Wait For Process 1 27 °C</p> <p>Wait Event 1 Off</p> <p>Wait Event 2 Off</p> <p>Day of Week Every Day</p> <p>Jump Step 1</p> <p>Jump Count 1</p> <p>End Type User</p> <p>Event 1 On</p> <p>Event 2 Off</p>
---	--

Screen 5 description: Profile 1 Step 1 is a time step and will ramp down to the -80C set point in 10 seconds. Event 1 is on, turning on the refrigeration liquid, hot gas solenoid valves and turning on the profile running indicator on the mode switch. Event 2 is off.

Screen 6

4000 Series

Watlow EZ-ZONE CONFIGURATOR

Edit Device Settings On-Line - Model Number: PM8B2FC-CREJAAA

Click a Menu in the tree to view and edit its settings. Click Finish to save and exit.

Parameter Menus **Parameters: Profile: Profile 1 Step 2**

- [-] EZ-ZONE PM
 - [-] Setup
 - [-] Analog Input
 - [-] Linearization
 - [-] Process Value
 - [-] Digital I/O
 - [-] Control Loop
 - [-] Output
 - [-] Alarm
 - [-] Function Key
 - [-] Global
 - [-] Communications
 - [-] Real Time Clock
 - [-] Operations
 - [-] Factory
 - [-] Profile
 - [-] Profile 1 Step
 - Profile 1 Step 1
 - Profile 1 Step 2**
 - Profile 1 Step 3
 - Profile 1 Step 4
 - Profile 1 Step 5
 - Profile 1 Step 6
 - Profile 1 Step 7
 - Profile 1 Step 8
 - Profile 1 Step 9
 - Profile 1 Step 10
 - Profile 2 Step
 - Profile 3 Step
 - Profile 4 Step

Step Type Wait For Process

Target Set Point Loop 1 -80 °C

Target Set Point Loop 2 -17.8 °C

Hours 0

Minutes 0

Seconds 0

Rate 0.0 °C

Wait for Process Instance 1

Wait For Process 1 -80 °C

Wait Event 1 None

Wait Event 2 None

Day of Week Every Day

Jump Step 1

Jump Count 1

End Type User

Event 1 On

Event 2 Off

Screen 6 description: Profile 1 Step 2 is a wait for process step, the Wait for Process Instance 1 monitors the chamber temperature to reach the Wait for Process 1 temperature of -80C. Event 1 is on which continues to activate the refrigeration liquid, hot gas solenoid valves and profile running indicator on the mode switch. Event 2 is off. Note the only selectable options for this step are Wait for Process Instance, Wait for Process 1, Event 1 and Event 2.

Wallow EZ-ZONE® CONFIGURATOR

Edit Device Settings On-Line - Model Number: PM8B2FC-CREJAAA

Click a Menu in the tree to view and edit its settings. Click Finish to save and exit.

Parameter Menus **Parameters: Profile: Profile 1 Step 3**

<ul style="list-style-type: none"> [-] EZ-ZONE PM <ul style="list-style-type: none"> [-] Setup <ul style="list-style-type: none"> [+] Analog Input [+] Linearization [+] Process Value [+] Digital I/O [+] Control Loop [+] Output [+] Alarm [+] Function Key [+] Global [+] Communications [+] Real Time Clock [-] Operations [-] Factory [-] Profile <ul style="list-style-type: none"> [-] Profile 1 Step <ul style="list-style-type: none"> Profile 1 Step 1 Profile 1 Step 2 Profile 1 Step 3 Profile 1 Step 4 Profile 1 Step 5 Profile 1 Step 6 Profile 1 Step 7 Profile 1 Step 8 Profile 1 Step 9 Profile 1 Step 10 [-] Profile 2 Step [-] Profile 3 Step [-] Profile 4 Step 	<p>Step Type Wait for Event</p> <p>Target Set Point Loop 1 0 °C</p> <p>Target Set Point Loop 2 -17.8 °C</p> <p>Hours 0</p> <p>Minutes 0</p> <p>Seconds 0</p> <p>Rate 0.0 °C</p> <p>Wait for Process Instance 1</p> <p>Wait For Process 1 0 °C</p> <p>Wait Event 1 On</p> <p>Wait Event 2 Off</p> <p>Day of Week Monday</p> <p>Jump Step 1</p> <p>Jump Count 1</p> <p>End Type Hold</p> <p>Event 1 On</p> <p>Event 2 On</p>
--	---

Screen 7 description: Profile 1 Step 3 is a Wait for Event step, the Wait for Event monitors the Wait for Event 1 and 2 if either is on then the profile waits at that step until the stop button is pressed. Event 1 is on which continues to activate the refrigeration liquid, hot gas solenoid valves and profile running indicator on the mode switch. Event 2 is on which activates the cycle complete indicator.

Sample Profile

Note this is a sample profile only and is not loaded into the controller. The step type settings from above should be followed to guarantee proper profile configuration.

A profile controls the heating, cooling and internal circulation fan. This unit contains 40 profile steps broken down into 4 profiles of 10 steps each, profile 1 steps 1 thru 10, profile 2 steps 11 thru 20, profile 3 steps 21 thru 30 and profile 4 steps 31 thru 40. A single profile can use all of the available steps in sequence except steps 38, 39 and 40 which are reserved for defrost and should not be changed. Example profile steps can go from profile 1 step 10 to profile 2 step 11 without creating a new profile. A typical profile will ramp in a specified time (ti), wait (Wpr) for the chamber to reach the control temperature and Soak SoAh that temperature for a specified time.

Profile 1 step 1: Ramp set point in 10 Seconds from the current display temperature to -70C. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle running indicator turns on.

Profile 1 step 2: Wait at the set point of -70C until the chamber actual temperature reaches -70C before continuing to step 3. Event 1 must be On. This turns on the compressor and internal circulation fan.

Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 3: hold (soak) at -70C for 3 hour before continuing to step 4. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 4: Ramp set point in 10 Seconds from current display temperature to 0C. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 5: Wait at the set point of 0C until the chamber actual temperature reaches 0C before continuing to step 6. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 6: hold (soak) at 0C for 1 hour before continuing to step 7. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 7: Ramp set point in 10 Seconds from current display temperature to -5C. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 8: Wait at the set point of -5C until the chamber actual temperature reaches -5C before continuing to step 9. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be Off. Cycle Running indicator is on.

Profile 1 step 9: hold at -5C indefinitely or until stop is pressed. Event 1 must be On. This turns on the compressor and internal circulation fan. Event 2 must be On. With Event 1 and 2 on the Cycle Complete indicator will be flashing and the Cycle Running indicator will be on.

Pressing Stop initiates a compressor pump down cycle, turns off the control outputs and extinguishes the green Cycle Running and Cycle Complete indicators.

Modifying or creating a profile via the Watlow control panel pushbuttons

Note Modifying or creating a profile will over write the existing profile. Mode Switch Profile 1 must start on (Watlow Profile 1 Step 1), Mode Switch Profile 2 must start on step (Watlow Profile 2 step 11) and Mode Switch Profile 3 must start on (Watlow Profile 3 Step 21) to operate properly. Event 1 must be set to on when modifying or creating a profile, 37 total steps may be used. The last step in a profile should be a wait event (W.E) 1 this will allow the unit to hold the last step indefinitely until the stop button is pressed, at which time all control functions will stop. Step 38-40 are reserved for defrost the defrost profile.

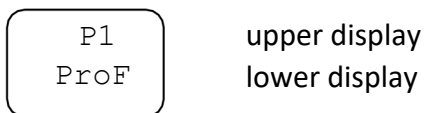
From figure 5.2 the following keys will be used to create a profile.

1. Infinity key
2. Advance key
3. Up Arrow key
4. Down Arrow key

The following step types are available in the profiling page. A step that cannot be used on this unit is Wait for Both.

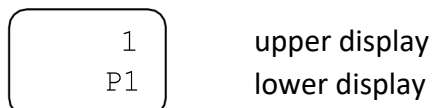
- | | |
|----------|------------------|
| 1. UStp: | Unused Step |
| 2. End: | End Step |
| 3. JL: | Jump Loop Step |
| 4. Cloc: | Wait for Time |
| 5. W.bo: | Wait for Both |
| 6. W.Pr: | Wait for Process |
| 7. W.E: | Wait for Event |
| 8. SpAH: | Soak |
| 9. Ti: | Time |

Access the profile setup page by pressing the advance key for 3 seconds or until the display shows



The P1 indicates profile 1. Prof indicates profile selection menu options are 1 through 4 using the arrow keys. Always start the profile using Profile 1.

Press the advance key once.



The 1 indicates step 1 in profile 1. Other steps may be selected using the arrow keys. Range step 1 to 10.

Press the advance key once. If 1 and P1 were left in the previous step then the lower display will look like the figure below.



t1 is a temperature step, other options are in order when pressing the up arrow.

UStP= unused step

SoAh= Soak at a predetermined temperature for a period of time.

WE= Wait for Event (No events are programmed, but are used to hold a temperature indefinitely.

WPr= Wait for process. This step waits until the process temperature equals value set in this step before proceeding to the next step.

Wbo= Wait for both temperature and event. Do not use this type of step.

JL= Jump Loop is used to move to a new step in a profile.

End= End profile. As the unit is configured do not use the End type step unless stopping all control functions is desired.

CLoC= Starts a profile on a day of the week at a specific time,

Each one of the above steps incorporates other parameter which will require setting such as temperature, hours, minutes, seconds, loop quantities. The available parameters will be displayed for the particular step type during the profile setup. Further explanation can be found in the supplied Watlow manual.

Overview of control system and usage of cabinet:

After the unit is turned on and a profile is selected the unit is ready to run the profile, load the unit with product you wish to condition, close and latch the door. Press the start button. When the start button is pressed the first items to occur are the liquid and hot gas solenoids energize along with the evaporator fan via the Watlow control output D11 and Micro Controller output O2, releasing refrigerant into the interstage heat exchanger. The condenser fan(s) and compressor turn on via 1-MS, (the condenser fans are stage started on depending on the head pressure of the high stage compressor) and the Watlow control lower display (green) ramps to the desired set point, a (1) at the bottom of the display comes on solid indicating full cooling is taking place, if control point is below 5 degrees C a (3) will light on the bottom of the display indicating the sub cooling solenoid valve has turned on adding refrigeration capacity to the system, as the unit nears set point the (1) will begin flashing indicating the control is reducing refrigeration capacity. When the unit stabilizes at set point the (1) may stop flashing and a (2) may begin flashing indicating heat is being added to the system to maintain set point. During a warming part of a profile the (1) will be off and the (2) will be on until nearing set point at which time (1) and 2 may begin flashing.

8.0 Sensor Validation:

Control/display sensor validation may be performed by removing the sensor mounting plate, undoing the hook and loop fastener and extending the sensor cable to perform the needed validation. Refer to section 4.0 Setup and Installation item 10 for sensor mounting plate location.

9.0 Remote Contacts:

9.1 Remote contacts terminal block

The unit is supplied with remote signaling dry contacts (non-powered). Connections are made to a terminal strip on the rear of the unit inside the plastic enclosure. Terminal locations are 1 & 2, 3 & 4 and 5 & 6. Terminals 1 & 2 and 3 & 4 are Profile function contacts. The internal contacts close when a profile is started.

Terminals 5 & 6 are chamber door open contacts. The internal contacts close if the chamber door is opened while a Profile is running.

Connecting to the remote contact terminals.

Locate the terminal enclosure on the back of the control area near the power cord. Remove the cover from the enclosure by removing the 4 Philips head screws. Refer to figure 9.2.

Refer to the below chart for the state of the at various operational states of the 4000 series unit.

4000 Series Unit State – Remote Running Contacts	Contacts 1 & 2	Contacts 3 & 4	Contacts 5 & 6
Unit Unplugged	OPEN	OPEN	
Unit Plugged in - Power Switch OFF	OPEN	OPEN	
Unit Plugged in - Power Switch ON - Controller in "off" state - no profile or defrost running	OPEN	OPEN	
Profile 1,2, or 3 Initiated with Cycle Start Button	CLOSED	CLOSED	
Cycle Complete Light Flashing	OPEN	CLOSED	
Cycle Stop Button Pressed (controller goes into "off" state)	OPEN	OPEN	
Defrost Cycle is Active	OPEN	OPEN	
Unit turned on - Profile 1, Profile 2, or Profile 3 running – Chamber door closed			OPEN
Unit turned on - Profile 1, Profile 2, or Profile 3 running – Chamber door opened			CLOSED
Unit turned on – Defrost cycle running – Chamber door closed			OPEN
Unit turned on – Defrost cycle running – Chamber door opened			OPEN

Remote Running Contacts



Figure 9.2 – Remote contact terminal box with cover removed

Door open alarm – horn and strobe

In the event of a door opening while a profile is running, there is a horn and strobe light installed on the top of the unit that will activate and remote contact terminals 5 & 6 will close. See the chart below for further explanation.

4000 series Unit State - Door Open Alarm Contacts	Door Position	Strobe/Horn State	Contacts 5,6 NO
Unit turned on - In standby "off" state	CLOSED	OFF	OPEN
	OPEN	OFF	OPEN
Unit turned on - Profile 1, Profile 2, or Profile 3 running	CLOSED	OFF	OPEN
	OPEN	ON	CLOSED
Unit turned on - Defrost cycle running	CLOSED	OFF	OPEN
	OPEN	OFF	OPEN



Horn and strobe.

Turn the baffle on top of the strobe to adjust the volume of the horn.

10.0 Troubleshooting:

1. Unit connected to power source, power switch on, no light on power switch or Watlow control.
 - a) Verify input voltage on all 3 phase legs.
 - b) On initial startup check all 3 phases. The rate chamber monitors for the correct phase sequence. Switch 2 of the phase wires at the receptacle or power panel.
 - c) Check fuses F3-F5 (model 4002/4102), F2-F4 (model 4005/4105), 2.5 amp. Located on control enclosure back wall. 2.5 amp class CC fuse.



Reaching inside of the cabinet while the unit is energized can be dangerous. Always unplug the unit and lockout the power supply before performing maintenance inside of the unit

2. Unit not cooling:
 - a) Verify a freeze profile is selected and running.
 - b) Verify temperature control set point (lower display) is

- below actual chamber temperature (upper display). Cooling step in a profile.
- c) Verify door is closed. The door switch turns off the internal circulation fan, heat and refrigeration.
 - d) If unit has been run repeatedly cold, the evaporator may have iced up. Initiate a defrost cycle.
 - e) Check evaporator fan fuses F 1& F2.



Reaching inside of the cabinet while the unit is energized can be dangerous. Always unplug the unit and lockout the power supply before performing maintenance inside of the unit

3. Unit not warming at normal rate:

- a) Verify a warming profile is selected and running.
- b) Verify temperature control set point (lower display) is above actual chamber temperature (upper display). Warming step in a profile.
- c) Verify door is closed. The door switch turns off the internal circulation fan, heat and refrigeration.
- d) Check evaporator fan fuses F1 & F2. 7 amp class CC fuse.



Reaching inside of the cabinet while the unit is energized can be dangerous. Always unplug the unit and lockout the power supply before performing maintenance inside of the unit

11.0 General Maintenance

Model 4000 series GENERAL MAINTENANCE

Unit must be turned OFF & Unplugged during any and all maintenance/ service.



Hazards!

Periodic Cleaning

Beginning with the initial installation, the interior surfaces of the cabinet should be periodically wiped down with a solution of warm water and laboratory detergent. This solution will remove any odors from spillage that has occurred. The detergent should be removed using distilled water followed by a wipe down with isopropyl alcohol. The exterior of the cabinet should also be cleaned frequently with a laboratory detergent solution followed with a distilled water rinse.

All surfaces (Internal and/or external) can be cleaned using isopropyl alcohol.

NOTE: All moving parts have been permanently lubricated and will generally require no maintenance.

Cleaning the condenser (Air cooled only 4002/4005)



Warning sharp elements

For air cooled units, monthly cleaning of the condenser will aid the heat transfer characteristics of the refrigeration system and increase its efficiency. Dust, dirt, and lint will tend to accumulate on the fins of the condensing unit. This obstruction will affect the flow of air through the condenser, thereby, lowering the efficiency of the system.

- a. Remove condenser cover grill (Total 16 screws)
- b. Using a wire brush or a brush with stiff bristles can be used to loosen these particles that are attached to the fins so that they may be removed with a vacuum cleaner. Failure to keep the condenser coil clean and free of obstructions could result in temperature loss and damage to the compressor.
3. Re-install condenser cover grill (Total 16 screws)

Gasket maintenance



Periodically check the gaskets around the door for punctures or tears. Leaks are indicated by a streak of frost which forms at the point of gasket failure. Make sure that the cabinet is level. Keep the door gaskets clean and frost free by wiping gently with a soft cloth.

Defrosting the Chamber

Defrost the chamber on a regular basis. To defrost, complete the following steps:

1. Remove all products from chamber.
2. Turn off the freezer.
3. Let the freezer stand with doors open for at least 12 hours. This allows the interior to warm to room temperature. Placing absorbing towels on the floor of the cabinet.
4. Dispose of the ice and wipe out any water standing in the bottom of the cabinet.
5. If there is freezer odor, wash the interior and exterior with a solution of laboratory detergent and warm water. Rinse with distilled water.
6. Close the doors, restart the freezer.

Evaporator Inspection



The evaporator should be inspected every six (6) months. This is a visual inspection. Complete the following steps:

1. Turn off the freezer.
2. Open outer door.
3. Remove evaporator cover plate
4. Visually inspect blower wheel and check blower wheel balance via turning blower wheel manually and checking for proper balance of blower wheel.
5. Inspect evaporator coil and clean as necessary by removing particles that are attached to the fins with a vacuum cleaner.
6. Inspect heater rods
7. Inspect general area of evaporator coil for debris or any damage
8. Re-install evaporator cover plate

Water cooled condenser manually test or flushing the valve (Water cooled only 4102/4105)



The water-cooled condenser water regulating valve should be inspected every six (6) months. This is a visual and operational inspection, complete the following steps:

1. Turn off power to the freezer.
2. Remove side panel cover (20 screws)
3. Manually flush the valve and piping before and after installing, repairing, or replacing a valve to remove filings, chips, or other foreign matter. Manual flushing does not affect valve adjustment. To flush the valve, insert screwdrivers under both sides of the valve spring guide and lift upwards. (see figure 1 below)

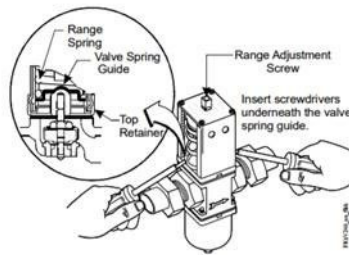


Figure 1: Manual Flushing

12.0 Factory Default Watlow Settings

Included on the flash drive is a PDF copy of the factory loaded Watlow Configuration. The file is in the “Farrar Scientific Model 4002 Documentation” folder on the flash drive. All highlighted text needs to be verified in the unit configuration before operation of the equipment. Not all parameters listed in this printout are active, dependent on higher priority settings. While connected to the unit using EZ-Zone Configurator, pertinent settings will be in **bold**, while settings that are not active for that operation type will be grey.

Important information for your future reference and when contacting Farrar Scientific or local Distributors. Please have the following information readily available:

Model Number: _____

Serial Number: _____

Date of Purchase: _____

Purchase Order: _____

IF YOU NEED ASSISTANCE:

Farrar Scientific products support team are ready to answer your questions.
In addition to technical support, we offer various accessories,
extended warranty program, and validation services.

**Visit us at www.farrarscientific.com
or
Contact us at 740.374.8300**

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