LABORATORY STERILIZER – MITSUBISHI PLC CONTROL

Operators Manual

REVISION 1.2

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Table of Contents

Introduction

This section will define some key terms used in the manual and provide a quick summary of the key functions of your Sterilizer.

Standards & Specifications

The sterilizer is designed and built to comply with the following specifications and standards:

- ASME Code Section VIII Division 1 **– Pressure Vessel Code**
- ASME B31.1 & B31.3 – Pressure Piping Code
- UL 61010A-1/CSA 22.2 – Electrical Equipment for Laboratory Use
- AAMI ST-46 – Guidelines for Moist Heat Sterilization
- NEC – National Electric Code
- NPC – National Plumbing Code
- NFPC – National Fire Protection Code

Glossary of Terms

- **Calibration** – The process of checking and adjusting measuring devices to verify accuracy of measurement.
- **Chamber** – the space within the unit where the items are placed to be sterilized. The system monitors and controls temperature and pressure of this space.
- **Cycle** – a configurable string of phases that define and automate the sterilization function from start to finish.
- **Door** – the pressure containment device for the open end of the chamber.
- **Door Seal** – a silicone O-ring that is activated by compressed air when the door is completely closed. This allows the chamber to maintain an airtight seal under both pressure and vacuum.
- **HMI** – (Human Machine Interface) the touch screen device that allows the user to program, operate, and monitor the sterilizer.
- **Jacket** – a pressure containing cavity surrounding the chamber used to heat and cool the chamber walls. The system monitors and controls temperature of this cavity.
- **Load Probe** – an RTD inside the chamber that can be placed into the load being sterilized to monitor the actual temperature of the load during sterilization.
- **NIST** – (National Institute of Standards) the organization that defines and maintains measurement standards of all types.
- **Parameter** – a value that can be changed through the HMI to alter how the Phase of a Cycle operates. Each parameter's value is limited to a pre-defined range.
- **Phase** – a series of predefined machine instructions with a configurable set of parameters that define and control specific machine functions. These functions include: Cycle Start, Purge, Pre-Vac, Charge, Sterilize, Exhaust, Cool, Dry, Air Admit, Cycle End.

- **PLC** – (Programmable Logic Controller) the central processing device which controls the operation of the sterilizer by monitoring inputs, processing instructions from defined cycles, and sending signals to output devices to maintain temperature, pressure, and safety interlocks.
- **PID Control** – (Proportional-Integral-Derivative) an algorithm that attempts to correct the error between a measured Temperature or Pressure and the desired Set Points by calculating and then outputting a corrective action that can adjust the steam flow, air flow, vacuum, or exhaust accordingly.
- **Pressure Relief Valve** – a safety device designed to relieve the chamber or jacket of an over pressure condition.
- **PSIA** – (Pound per Square Inch Absolute) an expression of pressure where full vacuum is represented as 0 psia and ambient pressure is 14.7 psia at sea level. The ambient pressure changes with the altitude change, see chart at the end of this document.
- **RTD** – (Resistance Temperature Detector) these devices coupled with and RTD Transmitters are inputs to the PLC used to monitor jacket, chamber, and load temperatures. They have a measuring accuracy of 0.1°C.

Quality Assurance

All Beta Star steam sterilizers are factory tested according to Beta Star QA and Testing procedure (TP-001). The results of each test are recorded and stored on the Quality Control Record (QR-001). This testing includes: instrument calibration to NIST standards, electrical input and output verification, leak test, Bowie & Dick Test, alarms verification, hazards test, and consecutive execution of sterilization cycles to insure repeatability. Temperature control to within +/- 1.0° C is verified for all sterilization cycles.

Main Functions

The Beta Star Steam Sterilizer is designed to semi-automatically sterilize loads of various types at temperatures between 100°-138°C. The control system maintains 30 programmable cycles. There are two cycles predefined as an Automatic Leak Test, and a Bowie & Dick air removal test. The remaining 28 cycles can be individually configured in one of the following types:

- Pre-Vacuum
- Liquid
- Hard Goods
- Bio Bag

Cycles parameters adhere to the guidelines for Industrial Moist Heat Sterilization referred to in document AS ISO 11134-2003. A detail definition of these cycle types can be found in the Cycle Description section of the Manual.

Through the HMI on the sterilizer's control panel the User can select, start, monitor, and abort sterilization cycles. The HMI has 5 levels of security allowing for varying levels of process control. The HMI allows a user with Supervisor security privileges the ability to customize individual cycles to the products and goods to be sterilized. More information on this topic can be found in the Control Navigation section of the Manual.

Air Removal

Air is removed using one of two methods, gravity air removal or vacuum air removal. Gravity air removal consists of the chamber being pressurized with steam with the drain in the bottom of the vessel open for air to be pushed out. In the vacuum method, the system pressurizes the chamber with steam with the drain open, while a water ejector connected to the drain creates vacuum pulling air and steam out of the chamber.

The goal is to remove all air from the chamber to ensure complete and even steam distribution in the chamber. This is validated using the Bowie & Dick Air Removal test.

Temperature Control

Jacket Temperature is controlled by a PID algorithm which gets input from the Jacket RTD and outputs corrective action signals to the Jacket Steam Valve. The Jacket temperature set point is defined as the Sterilization set point +/-9 as set in Global Parameters. Variability target for Jacket temperature is +/- 1.0°C.

Chamber Temperature is controlled by a PID algorithm which gets input from the Chamber Drain RTD and outputs corrective action signals to the Chamber Steam Valve. The Chamber temperature set point is defined as the Sterilization set point. Tolerance for the Chamber temperature is +/- 1.0°C. Range is 100°-138°C.

Load Probe (Option)

When equipped with an optional Load Probe, all temperature is controlled as outlined above. The Load Probe is used primarily in liquid loads to insure that the load is within the acceptable range of the Sterilization set point before starting the timer. This allows the user better control over the exposure of the load at the sterilization set point. F_o is displayed and printed during a cycle whenever the load probe is selected. F_o is the equivalent exposure time at 121.11°C of the actual exposure time at a variable temperature, calculated for an ideal micro-organism with a temperature coefficient of destruction equal to 10. F_o is calculated if the load probe temperature is greater or equal to 100.0 C.

Effluent Filter (Option)

When equipped with an optional steam jacketed Effluent Filter, the filter housing temperature is controlled by the Filter PID algorithm which gets input from the Filter Jacket RTD and outputs corrective action signals to the Filter Jacket Steam Valve. The Jacket temperature set point is defined as the Sterilization set point. Variability target for Jacket temperature is +/- 1.0°C. Range is 100°-138°C.

Door Systems

The sterilizer can be provided in single or double door configurations. These doors can be:

- Manually operated radial arm doors
- Power operated vertical sliding doors
- Power operated horizontal sliding doors.

Each door system is equipped with both locking and sealing subsystems. The locking system is used to ensure that once the door reaches the closed position, it remains there until the system has reached a safe open state. The sealing system uses compressed air to activate the seal once the door is in the closed and locked state. This seal is monitored by seal pressure switch which will alarm if the pressure behind the seal drops below the set point.

Together these systems create a safety interlock that verifies the door is both locked and sealed before allowing the system to pressurize the chamber with steam. If at any time the door seal loses pressure, steam is immediately shut off to the chamber through both an electrical interlock and a pneumatic interlock.

Power operated door systems have a closing safety feature that requires the operator hold the close button until the door is in the fully closed position. Should the operator release the close button before the door is fully closed, it will auto reverse to the fully open position.

Software interlocks are provided to prevent the chamber from being unsealed or opened while chamber is under pressure.

Bulk Sterilizers with power operated horizontal sliding doors are equipped with a keyed door override switch, to prevent operation of the doors in any direction while the equipment is being maintained.

Safety

This section will explain the safety symbols used, review a list of hazards, and outline the security structure embedded in the control of your Sterilizer.

Safety Symbols

This symbol is intended to alert the user of a potential hazard. The message following the symbol explains the hazard, how to reduce the chance of injury, and the consequence for not following the instructions.

This symbol is intended to alert the user of the presence of an electrical hazard within the enclosure. The electrical hazard is significant enough to cause an electrical shock.

Device Hazard Analysis

The following table is a list of hazards associated with the sterilizer. The table outlines the hazards by type, describes a condition creating the hazard, and then describes how the system is designed to minimize the potential of the hazard occurring. The system is designed with mechanical, electrical, and pneumatic interlocks to prevent hazard conditions from occurring.

#	*Hazard Type*	*Hazard Condition*	*Equipment Safety Interlock Description*
1	Containment - Burn	Start a cycle with door open	The door must be fully closed, contacting the door close limit switch before the control will allow the cycle start sequence.
2	Containment - Burn	Steam entering chamber with door not sealed	A pressure switch (PS-1) is used to sense when the door is sealed. This switch sends in input signal to the PLC which then allows the steam valve to be opened. There is also a pneumatic interlock using the pressure from the door seal to operate a pilot operated check valve in the supply line to the chamber steam valve. If the pressure drops on the door seal, the pilot operated check valve will close, which in turn blocks the air that activates the chamber steam valve.
3	Containment - Burn	Door opening during cycle	Once a cycle is started, the door is locked in position and the door open function is disabled until it is determined that the chamber is within one psi of ambient and there is no standing water in the chamber.
4	Explosion/ Containment - Burn	Chamber or Jacket over pressurized	In the event that either the Jacket or Chamber steam control valves fail in the open state, and the steam pressure regulator fails, both pressure containing cavities are equipped with ASME Section VIII Div 1 rated pressure relief devices. NOTE: Each relief valve must be piped to an adequate relief vent to insure the pressure and heat energy is removed from the space.
5	Containment	Loss of Air Pressure supply to door seal	The door seal is equipped with a bubble tight check valve to prevent air from escaping in the event of a loss of supply air pressure. This allows the seal to be maintained until air supply can be restored. In this event the system will also close the chamber steam valve and allow the chamber to drop pressure through the slow exhaust port.

#	Hazard Type	Hazard Condition	Equipment Safety Interlock Description
6	Containment	Door Seal Valve Failure due to loss of power	The door seal valve is designed to fail in the open position allowing air supply to reach the seal regardless of power availability.
7	Pressure Control	Loss of power while chamber is under pressure	The chamber and jacket will automatically de-pressurize in the event of a power failure. The steam to chamber valve will close in the de-energized state and the residual pressure will bleed through the slow exhaust valve until it reaches ambient pressure.

Electrical Safety

The base system is designed to operate on 110vac power which is connected to the main control enclosure. Inside the enclosure the power is converted to 24vdc power to provide an intrinsically safe low voltage control system. All control devices work off this 24vdc power.

The system is equipped with either an E-Stop or an On-Off switch that will disconnect power to all outputs. The screen and inputs will remain powered to allow you to monitor the status of the machine.

If the Enviro-Vac or Integral Electric Steam Generator options are installed there will be high voltage (208/480vac) present to operate these options. This high voltage wiring will be completely separate from the low voltage control system.

****The unit should be installed with approved disconnect devices for each voltage within sight of the unit, locate these devices in case of an emergency****

Pneumatic Safety

The base system is designed to operate with 80psi compressed air which is connected to the main regulator bank which controls the pressure to the various output devices. This air is used to operate valves, pistons, and the door seal.

****The unit should be installed with an approved pneumatic supply shut off device within sight of the unit, locate this device in case of an emergency****

Water Safety

The base system is designed to operate with 60psi water which is connected to the water inlet valve of the ejector system. This water is used to generate vacuum and cool condensate going to the building drain.

****The unit should be installed with an approved water supply shut off device within sight of the unit, locate this device in case of an emergency****

Control System

This section will review the security structure and core components of the control system on your Sterilizer.

Security

The Beta Star Laboratory Series (LS) Control is designed with a flexible security structure to facilitate varying levels of access and run control. The table below outlines the basic security structure.

#	User Type	Primary Function	Access Limits
1	Guest	Observation Only	The guest user has the ability to view the run status of the machine, view the current cycle parameters, and reprint the last cycle.
2	Operator	Select and Run Cycles	All Guest privileges and the ability to select, run, and abort different preset cycles. Operators can also acknowledge and silence alarms.
3	Supervisor	Edit, Select, and Run Cycles	All Operator privileges and the ability to create new and edit existing cycles. Supervisor can also manually step a cycle.
4	Technician	System Setup, Maintenance & Troubleshooting	All Supervisor privileges and the ability to manually control outputs, and view higher level troubleshooting information. The Technician can also configure analog inputs and perform PID tuning.
5	Administrator	Security Administration	All Technician privileges and the ability to assign security privileges as well as set Global System Parameters. The Administrator also sets the system time.

Security is maintained through a Login procedure which verifies Username & Password against the security table. For Login instruction see the Main Menu – Login section of this manual. For Security Setup instruction see the Security Setup section of the manual. The system supports up to ten different users.

To ensure security is maintained it is important to Logout when you are done operating the sterilizer. The control can be configured to automatically log you out based on a time of inactivity.

HMI

The HMI, or Human machine Interface, is a 5.7" color touch screen that is programmed to provide each level of user a simple interface to perform there function while being able to monitor the operating status of the sterilizer. The HMI communicates with the PLC via an RS-422 connection. On a double door machine with dual controls, there is an HMI on both ends. The HMI also controls security functions. See Control Navigation section for instruction on using the HMI.

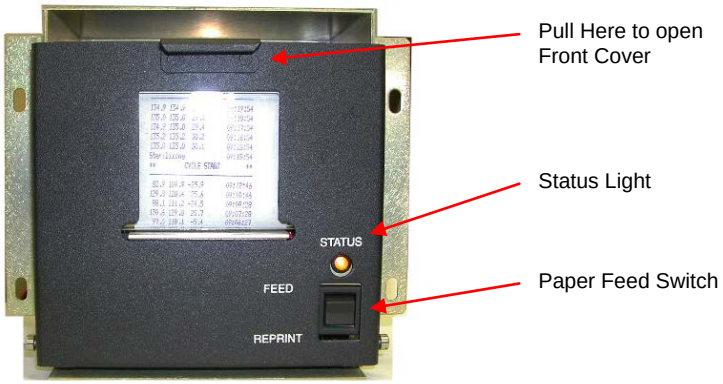
PLC

The PLC, or Programmable Logic Controller, is the processor of the control system. The PLC performs a variety of simultaneous functions.

- It stores user defined global operating parameters and cycle information.
- It collects input data from temperature and pressure monitoring devices, safety limit switches, and level switches. This information is compared against preset parameters to insure the sterilizer is operating safely and consistently.
- It outputs signals to a variety of control valves to perform a series of predefined operations as configured by the user defined cycles.
- Using a PID algorithm it controls temperature in jacket, effluent jacket, and chamber of the sterilizer based on the set points in each cycle.

Printer

The Printer is a 32 column 9 pin dot matrix impact printer. The PLC sends print instructions to the printer to record cycle set points, cycle phase changes, pressure & temperature at specified time intervals, and alarms. The printer uses easy to change roll paper and ink ribbons as consumables.



Status Light

When the LED Status Light is on, it indicates there is power to the printer. A flashing LED indicates the printer has a fault condition. The fault may be out of paper or the printer is jammed. In normal operation this LED will be on.

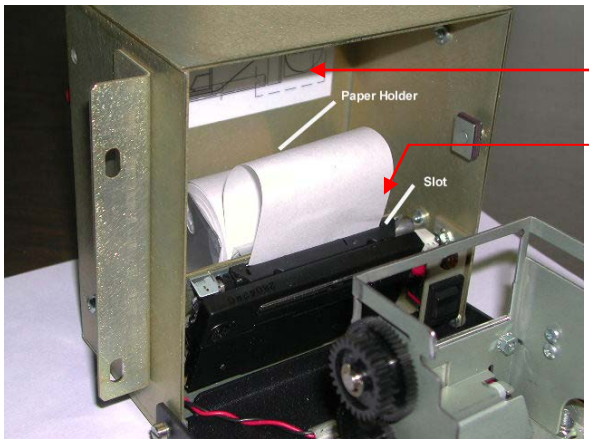
Paper Feed Switch

If the switch is actuated into the FEED position paper will be feed by the printer; if equipped the take-up will also attempt to take up paper.

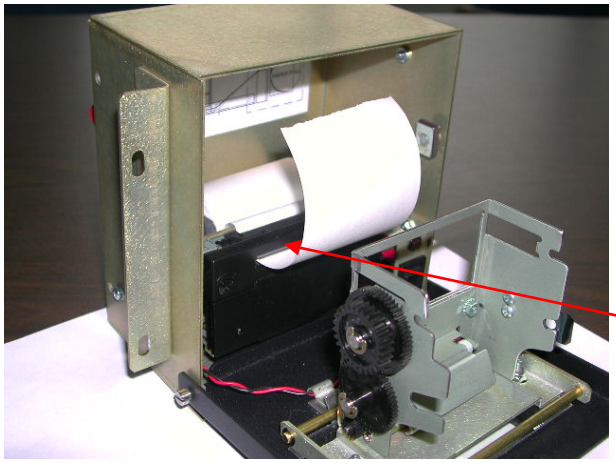
Loading Paper

Follow these steps to load the printer with a new roll of paper:

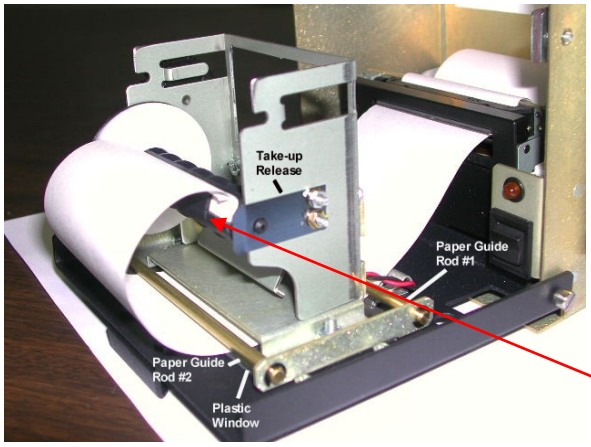
- Open front cover of printer to access paper compartment.
- Tilt the printer mechanism forward to access the paper holder. See photo below for the following steps.+



- Remove old paper core.
- Notice the loading diagram on the back of the printer case. Refer to this when loading the paper.
- Insert the new paper into the paper holder with loose end of paper placed into the slot at the top of the print mechanism. The front panel LED should be flashing.
- While holding the paper in the print mechanism, push the front panel switch to the 'Feed' position (Up). The paper should feed into the print mechanism and out the front. Refer to photo below.



- Continue feeding paper until there is about 8 inches of paper exiting the print mechanism.
- Guide the paper between paper guide rod #1 and the plastic window until it exits at the top paper guide rod #2. Make sure the paper goes around this guide correctly. Refer to photo below.



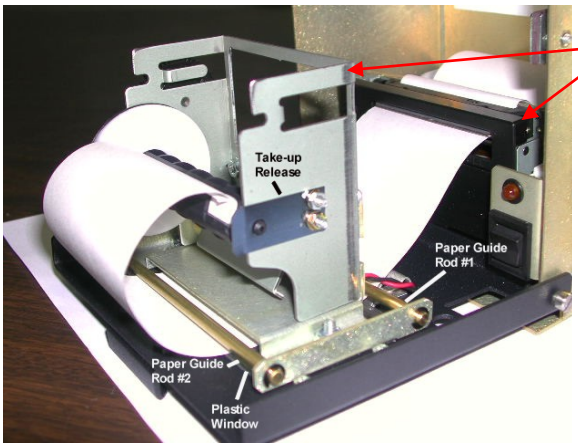
- Make a slight bend in the paper edge and place bent paper edge into the slot on the take-up spindle. Hold the paper on to the paper spindle.
- Push the front panel switch to the 'Feed' position, paper should then wrap around the spindle. If this doesn't, remove paper and repeat previous step.
- Once the take-up is loaded, push the front panel switch to the 'Feed' (up) position. This will start take up reel to keep paper tight while closing.
- Close the front cover while the print is taking place. This will keep the paper tight around the take-up.

Take-Up Reel Unloading

- When it is desired to remove the stored paper from the take-up, open the front cover of the printer.
- While grasping the take-up spindle and paper, push the take-up release slightly to the right until the spindle is free. Refer to photo above for take-up release position.
- Simply slide the paper off the open end of the take-up.
- If the paper won't release, rotate the paper counter-clockwise, while holding the spindle end bell. Then slide the roll of paper off.
- Replace the spindle on to the take-up.

Replacing Printer Ribbon

Follow the following steps to replace the printer ribbon.



Printer Ribbon – grab both sides and pull to remove

- Unload paper from print mechanism.
- Place fingers on either side of printer ribbon and pull toward take-up reel to remove.
- To load new ribbon place fingers on either side of ribbon and press into place on print mechanism.

Ordering Paper & Ribbon

The paper part number is **508212-002010**

The ribbon part number is **508212-001910**

The printer will use 1 ribbon for every 2-3 rolls of paper

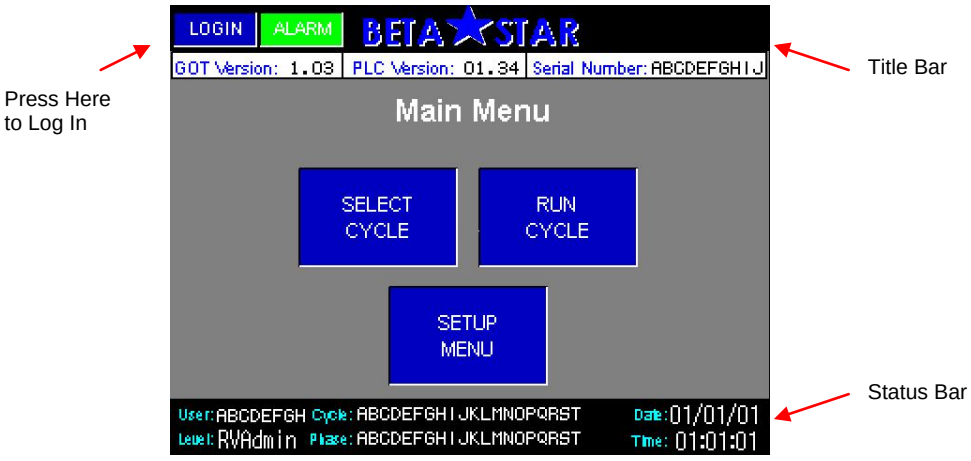
Control Navigation

This section will outline the standard screen design conventions and review how to operate the Sterilizer using the HMI.

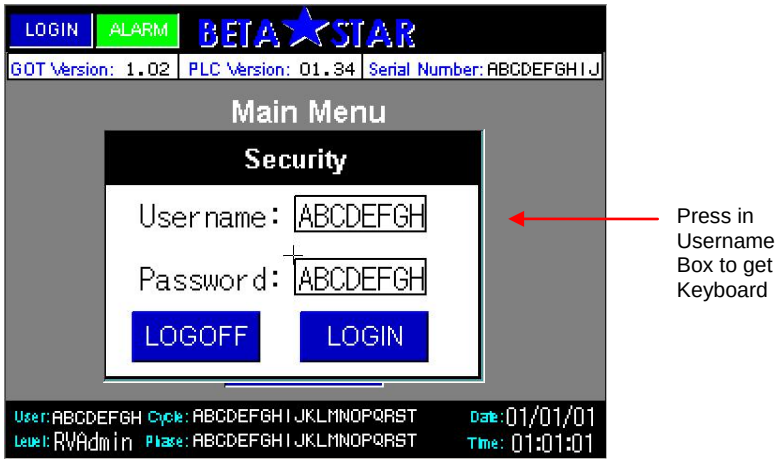
Main Menu - Login

The screen below is the Main Menu Screen of the sterilizer. This screen appears when the unit is first turned on. From this screen you can log into the system.

You will notice a title bar at the top of the screen and a status bar at the bottom of the screen. You will see this convention carried through most operator screens.

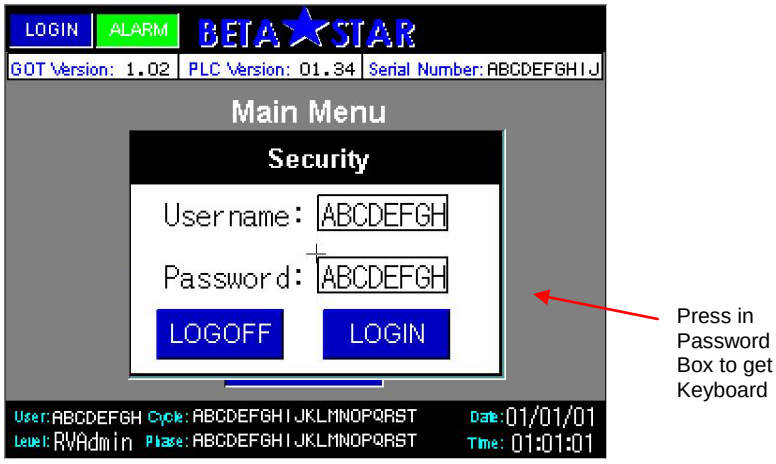


Once you press the LOGIN button the Security screen appears.



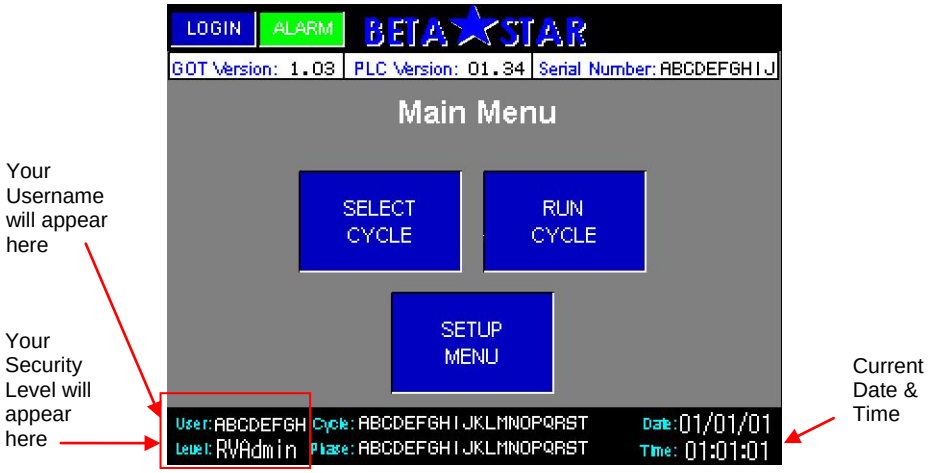
Then press the Username box and a keyboard will appear.

When you press the ENT key after typing in your Username, you will return to the Security Screen.



Press the Password box and repeat the same process to enter your Password, then press the LOGIN button.

This will take you back to the Main Menu, and you will now see your Username in the Status Bar next to the word User. Your Security Level will appear directly under your Username.

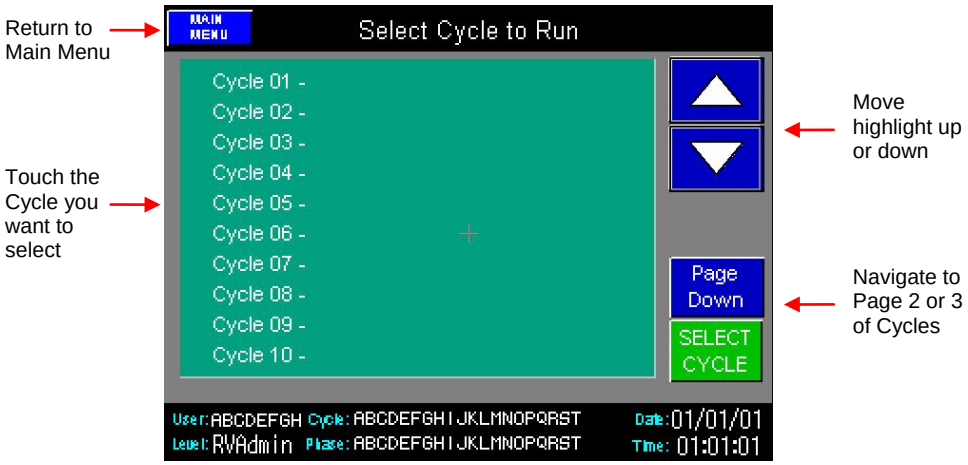


From any screen that contains the status bar, you can login or logout by pressing the area of the status bar that contains the User name and Security Level. See red box above.

Selecting a Cycle

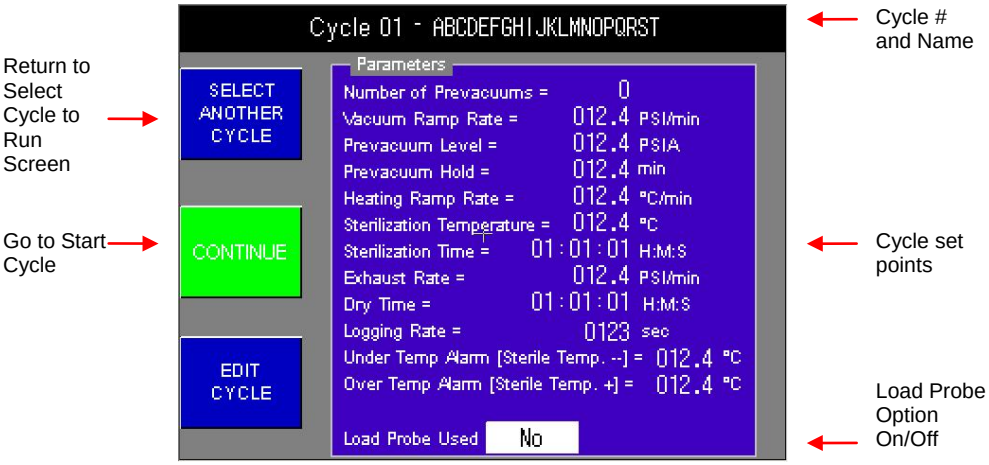
Now that you have logged into the system, you can navigate from the Main Menu to either select a cycle or run the cycle that is already selected. To enter the SETUP MENU you must have a security level of Supervisor or higher.

Press the SELECT CYCLE button on the Main Menu. This will take you from the Main Menu to the Select Cycle screen below.



To select a cycle, touch the cycle you want to select, or use the arrow buttons to move the screen highlight to the cycle you would like to select, then press the SELECT CYCLE button. You can Page Down for more options, the system holds a total of 30 cycles.

This will take you to a screen that allows you to view that cycle's parameters or set points.



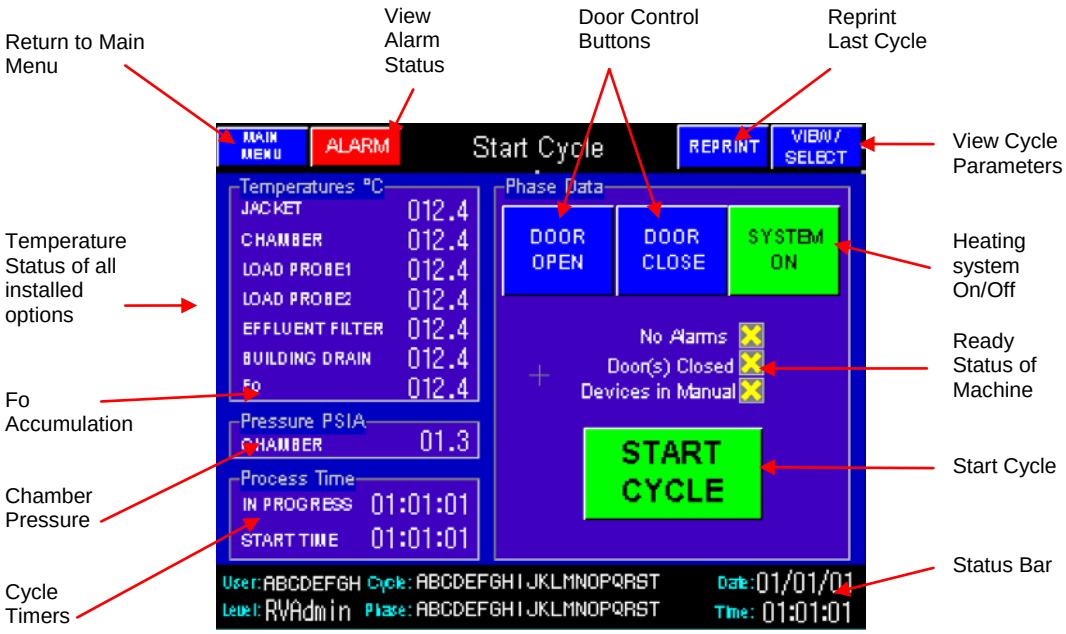
This screen allows you to verify that the cycle you have chosen is correct. Press SELECT ANOTHER CYCLE to change your selection or press CONTINUE to proceed to the Cycle Start screen.

If your security level is Supervisor or above, you can go to the Cycle Setup screen by pressing the EDIT CYCLE button. This will allow you to edit the cycle parameters.

**If the machine is in cycle, the select another cycle and edit cycle are disabled.

Starting a Cycle

Now that a cycle has been selected, you can run the cycle from the Start Cycle screen. This screen displays a variety of status information.



To start a cycle, the system must be in the ready state. This means there can be no active alarms, the door(s) are closed, and the system is in automatic mode. The Ready Status is displayed above by the 3 green ☑, if the system was not ready, one or more of the check marks would be a yellow ☒.

If the Alarms check box contains a yellow ☒, see alarms section of the manual for information on clearing alarms.

If the Door(s) Closed check box contains a yellow ☒, press and hold the DOOR CLOSE button until a green ☑ appears. If a green ☑ does not appear refer to troubleshooting section in manual.

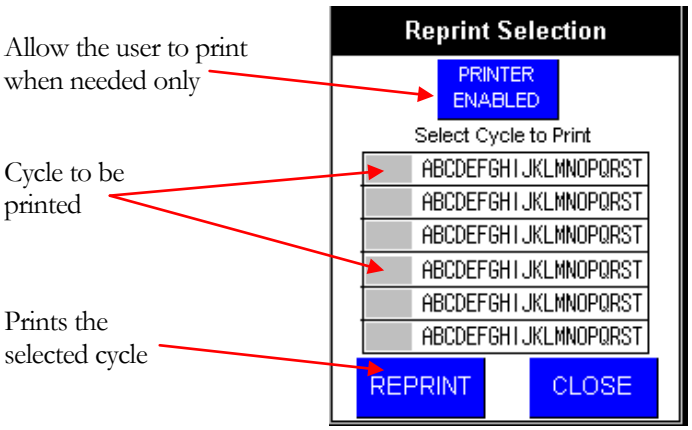
If the third check box contains a yellow☒, the text to the left of it will state "Devices In Manual". This indicates the system is not in automatic mode, refer to troubleshooting section in manual.

If the SYSTEM OFF button is grey, this indicates that the jacket heating system is off. You can turn the jacket heating system on anytime prior to starting a cycle by pressing this button. The button will toggle to SYSTEM ON, and begin to pre-heat the sterilizer.

The SYSTEM OFF button must be toggled to SYSTEM ON before starting a cycle.

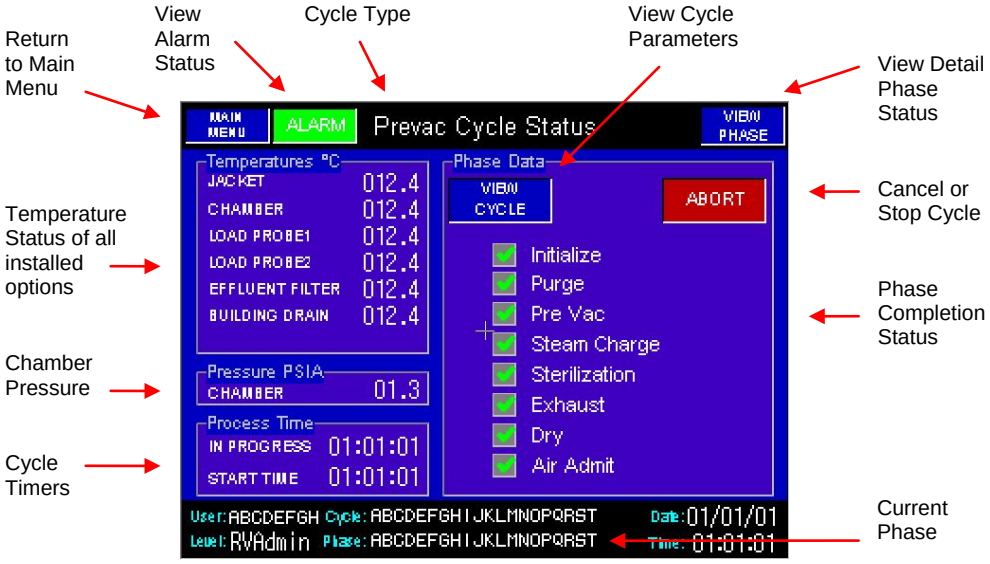
With your cycle loaded and 3 green ☑, your are ready to start the cycle. By pressing the CYCLE START button the cycle will initialize and the Cycle Status screen will appear.

The reprint button is displayed in standby phase only. This option allows the user to reprint the last 6 cycles. When pressed, the following screen is displayed.



Cycle Status

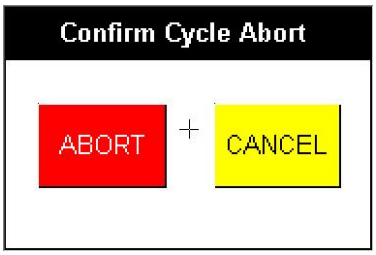
The cycle status screen provides a quick visual status of which phase of the cycle the sterilizer is currently in. You will notice the left side of the screen remains unchanged from the Start Cycle screen, showing you the dynamic status of pressure, temperature, and time. The right side of the screen has been modified to give an overview of which phase of the cycle the sterilizer is in.



The Phase Data box provides a list of the phases required for the type of cycle you are running. A green ☑ indicates the phase has been completed, a yellow ☒ in check box indicates the phase is not completed. The phase currently running is displayed in the center bottom of the status bar.

You can view the parameters of the cycle while it is running by pressing the VIEW CYCLE button. This will bring up the cycle parameters screen. It will not stop or effect the cycle running in any way. You cannot edit cycle parameters of a cycle running regardless of your security level.

If there is a need to stop or cancel the cycle, you can press the ABORT button. This will pop up a Confirm Cycle Abort screen.

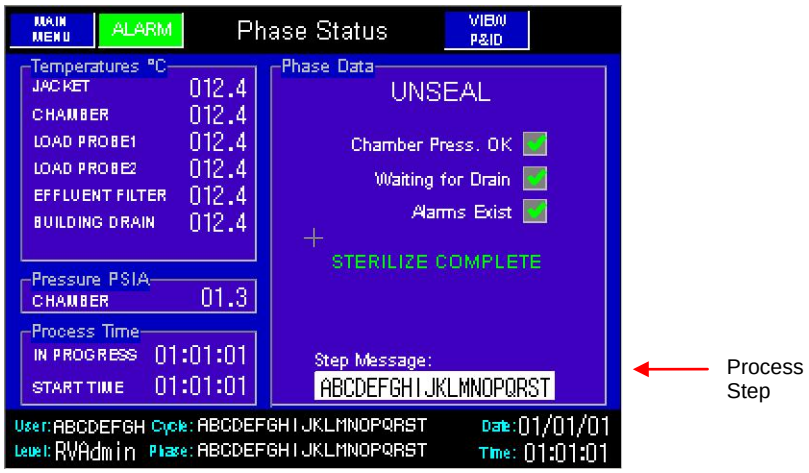


To confirm, press the ABORT button, to cancel the abort press the CANCEL button. Confirming the abort will advance the cycle immediately to the Exhaust Phase.

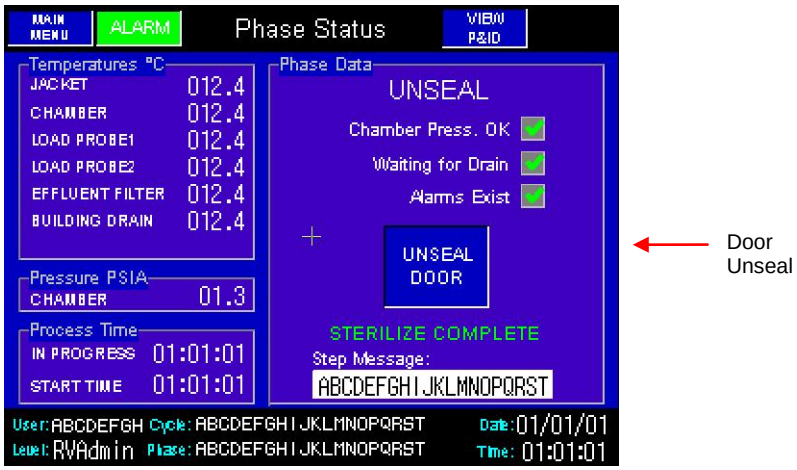
When all phases of the cycle have completed, the Unseal screen will appear.

Door Unseal

The Unseal Screen displays the status of the unseal process. It first verifies the chamber is safe to unseal, it looks to verify the chamber pressure is at ambient (Chamber Press. OK ☑), it looks to verify there is no standing water in the chamber (Waiting for Drain ☑), and it looks to verify that the cycle completed without alarms (Alarms Exist ☑). If any of these conditions are not verified, a red ☒ will appear where you see the green ☑ below. Once these conditions are satisfied on a single door unit or an interlocked double door unit, the unload door will automatically unseal. It will show you the unseal progress in the Step Message box.



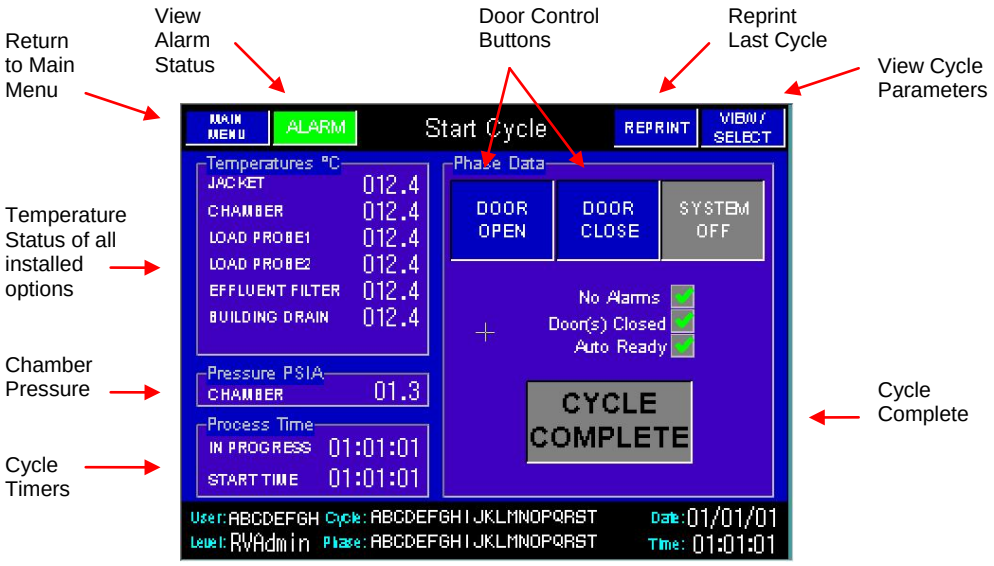
On a non-interlocked or multi-flow double door unit, the screen will look like the one below. This screen will show up on the HMI at both doors allowing the operator to unseal either end. To unseal the door the operator must press the UNSEAL DOOR button on the HMI at the door they wish to unseal.



The door will then automatically unseal just as it did above. After the door is unsealed, the Start Cycle screen will appear displaying a CYCLE COMPLETE button and an audible tone will sound.

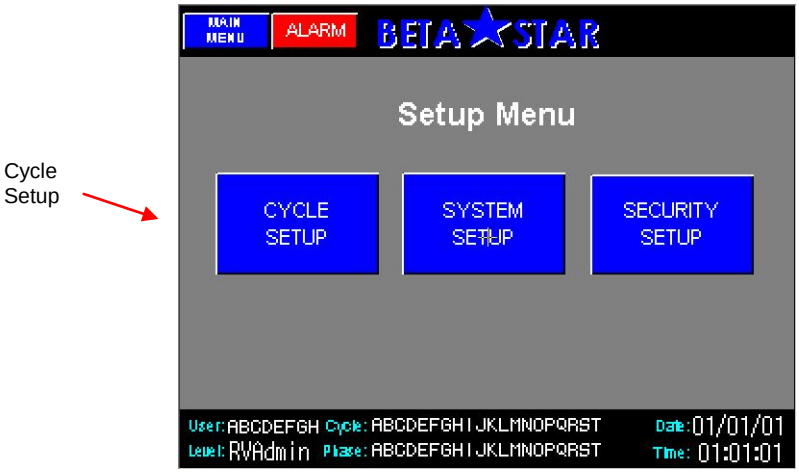
Cycle Complete

At the end of cycle an audible tone will sound and the Start Cycle screen will appear with the START CYCLE button disabled. If the cycle completed without alarm, the screen will look like this. The START CYCLE button will reinstate once the door has been opened to unload the sterilizer.

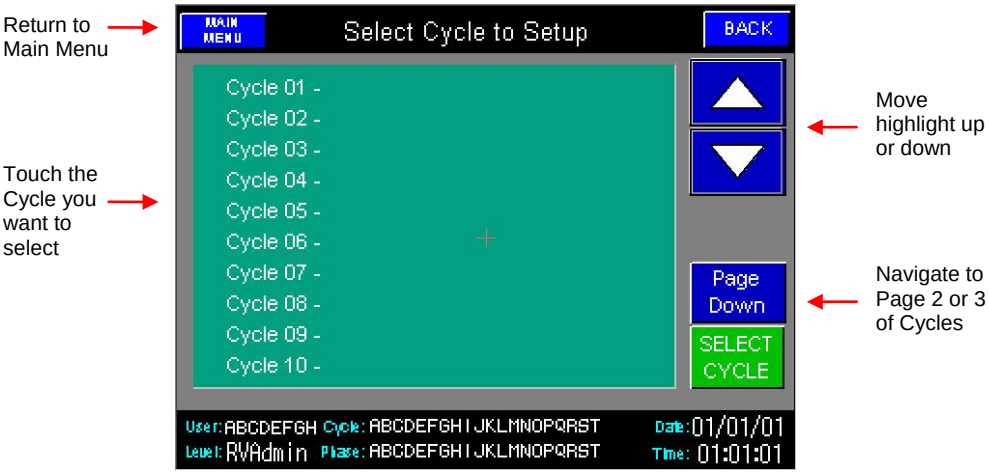


Cycle Setup

To setup a cycle, you must be logged in with a security level of Supervisor or above. From the Main Menu screen, push the SETUP MENU button; this will bring up the Setup Menu screen shown below.

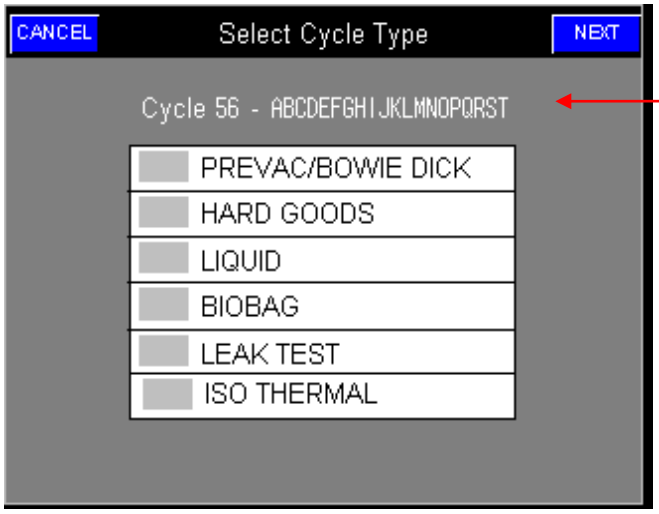


From the Setup Menu screen push the CYCLE SETUP button, this will bring up the Select Cycle to Setup screen shown below.

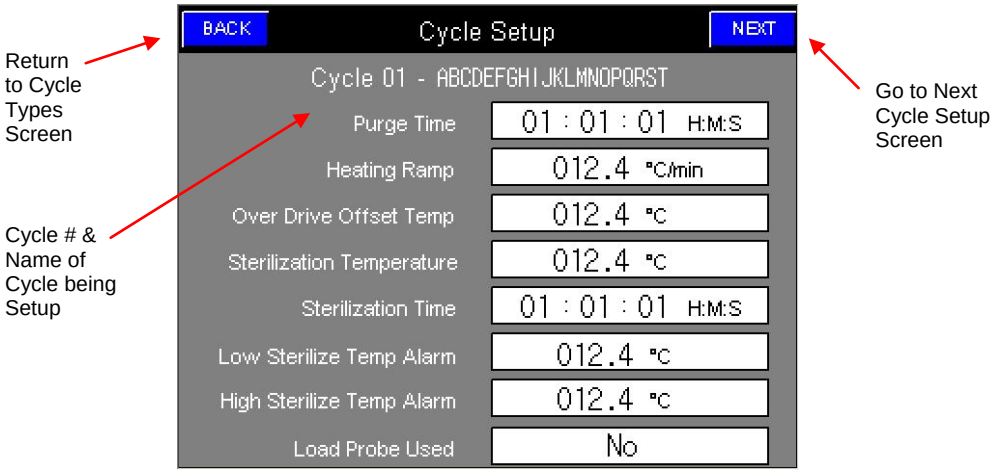


To select a cycle to setup, touch the cycle you want to select, or use the arrow buttons to move the screen highlight to the cycle you would like to select. You can Page Down for more options, the system holds a total of 30 cycles. When you have select the cycle you would like to setup, press the SELECT CYCLE button.

This will bring up the Select Cycle Type Screen shown below. This screen allows you to select what type of cycle you want to setup.



Press one of the five cycle types to select the type of cycle you want to setup. (See the Cycle Definitions section of the manual for detailed descriptions of each cycle type.) The Cycle Type you selected will now be highlighted; you can change your selection by pressing one of the other types. When you have completed your selection press the NEXT button, this will bring up the Cycle Setup screen below.

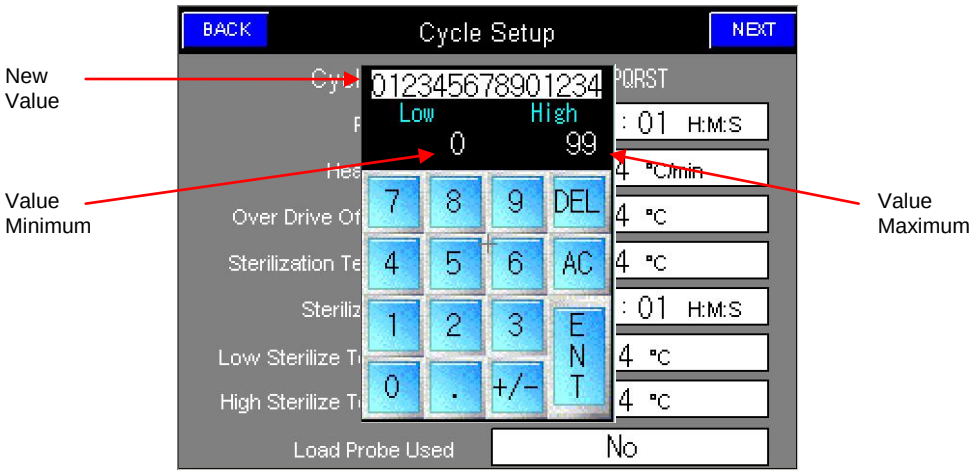


From the Cycle Setup screen you can return to the Select Cycle Type screen using the back button or go forward to the next Cycle Setup screen. Each white box represents a configurable cycle parameter, to edit a parameter, press on the white box of the parameter you would like to change. If the value you want to change is a yes/no value, pressing the box will toggle the values.

Take note each parameter is displayed with its unit of measure.

****On parameters with the H:M:S unit of measure, you can change each section of the box independently. You can change just hours or just minutes or just seconds. Press on the area of the box that contains the unit you want to change.**

If the value you want to change numeric, a numeric keyboard will appear as shown below.



On the keyboard you will see a Low value and a High value; these are the upper and lower limits of the parameter you selected. You must enter a value between the Minimum and Maximum. To enter the new value, simply press the numeric keys on the keyboard, when complete press the ENT key to enter the new value into the parameter you selected.

Repeat these steps through each Cycle Setup screen. On the last screen, you will enter a name for your cycle using the alphanumeric keyboard. When you are finished with the setup press the SAVE button on the last screen. After you press save, you will go back to the Select Cycle to Setup screen. From there you can return to the Main Menu or select another cycle to setup.

Cycle Definitions

This section will review the structure, variables, and definitions of each type of cycle.

Structure

Each cycle type is made up of a series of phases. A phase is a predefined set of instructions that control the sterilizer to perform a specific function. Each phase can be altered by changing the phase parameters or variables. These parameters are defined by a user with a security level of Supervisor or above in the Cycle Setup screens.

Phase Definitions

PHASE DEFINITIONS		CYCLE TYPE					
Phase	Definition	Pre-Vac & Bowie Dick	Liquid	Bio-Bag	Hard Goods	Isothermal	Leak Test
Standby	The Standby phase controls the machine when it is not running a cycle. The Start Screen is showing when this phase is active. If the System on/off button is on, this phase keeps the jacket temperature at 100-105° C. If the system off, this phase in not active. This phase ends when the user presses the START button.	X	X	X	X	X	X
Initialize	The Initialize phase can only be started from Start Cycle screen by pushing the START button. It will only begin if the doors are fully closed, there are no active alarms, and all outputs are in automatic mode. This phase will seal the door(s) and heat the jacket up to the cycle's sterilize set point, stabilize for a preset time, and then advance to the Purge phase. This phase is controlled by jacket temperature, time, and safety interlocks	X	X	X	X	X	X
Purge	The Purge phase is used to pre-condition the chamber and load. It use steam pressure and gravity to remove air from the chamber and pre-heat the load. This phase always follows the Initialize phase. This phase adds steam to the chamber while removing air and steam from the chamber with the vacuum system. The fast exhaust valve remains closed until the chamber reaches the purge pressure set point. Once that set point is reached, the purge timer will start. With the timer running, the fast exhaust valve will then open and close to maintain the chamber pressure within a preset range around the purge pressure set point. This continues until the purge timer has reached the purge time set point. Once the purge time set point has been reached this phase will advance to the next phase. This phase is controlled by chamber pressure and time.	X	X	X	X		X

PHASE DEFINITIONS		CYCLE TYPE					
Phase	Definition	Pre-Vac & Bowie Dick	Liquid	Bio-Bag	Hard Goods	Isothermal	Leak Test
Pre-Vacuum	The Pre-Vacuum phase is also used to pre-condition the chamber and load. It is uses a combination of vacuum pulses and steam charges to remove air and pre-heat the load. This phase always follows the purge phase. The phase begins by drawing a vacuum on the chamber, bringing the pressure down from the purge pressure set point to a percentage of the pre-vacuum set point. The percentage is based on the pre-vacuum pulses set point (the number of times this phase will draw a vacuum). Once it reaches that percentage of the pre-vacuum set point, the phase will begin to charge the chamber with steam. It will charge until it hits the pre-vacuum charge set point at which point it will begin to draw the another vacuum pulse. This will repeat until it reaches the full pre-vacuum set point on the final vacuum pulse. The final pulse will be held for a duration based on the Pulse Hold Time parameter. The phase will then charge the chamber with steam until it reaches ambient pressure at which point the phase will end and advance to the Steam Charge phase. This phase is controlled by chamber pressure.	X					X
Leak Test	The Leak Test phase is used to determine the vacuum leak rate of the system. This phase has two steps, vacuum stabilize and vacuum hold. This phase always follows the Pre-Vacuum phase and is only used in a Leak Test Cycle. The stabilize step is used to allow the vacuum level in the chamber to stabilize prior to beginning the hold step. Once the stabilize time has elapsed, a sample pressure is logged and the phase advances to the hold step. The hold step seals the system for a duration of time based on the leak test time parameter. Once this time has elapsed the pressure is logged and compared to the sample pressure logged at the end of the stabilize step. It compares the difference between the two values against the acceptable leak rate set by the leak test loss limit parameter. If the difference is less than the leak loss limit the test passes, if not it will fail. It then outputs the pass or fail to the printer and advances to the cycle end phase. This phase is controlled by time.						X

PHASE DEFINITIONS		CYCLE TYPE					
Phase	Definition	Pre-Vac & Bowie Dick	Liquid	Bio-Bag	Hard Goods	Isothermal	Leak Test
Charge	The Charge phase is used to bring the chamber and load temperature up to the sterilization set point. This phase can follow either the Purge phase or Pre-Vacuum phase. The phase begins by adding steam to the chamber to increase temperature. The temperature is controlled by the chamber drain RTD giving input to the PID algorithm. This phase has an optional heat ramp parameter that can be used to control the speed at which the chamber temperature will rise. Once the temperature reaches the sterilization set point, the temperature will stabilize for a preset time and then advance to the Sterilization phase. This phase is controlled by temperature and time.	X	X	X	X	X	
Sterilize	The sterilize phase is used to determine the length of time the load is exposed to the sterilization set point temperature. This phase always follows the Charge Phase. The phase starts the sterilization timer. With the timer started the phase maintains the chamber temperature at the sterilization set point using the chamber drain RTD input to the PID algorithm. When the timer reaches the sterilization time set point the phase ends advancing to either fast or slow exhaust. This phase is controlled by temperature and time.	X	X	X	X		
Exposure	The exposure phase is used to determine the length of time the load is exposed to the exposure set point temperature. This phase always follows the Charge Phase. The phase starts the exposure timer. With the timer started the phase maintains the chamber temperature at the sterilization set point using the chamber drain RTD input to the PID algorithm. When the timer reaches the exposure time set point the phase ends advancing to slow exhaust. This phase is controlled by temperature and time.					X	
Fast Exhaust	The fast exhaust phase is used to rapidly evacuate the chamber of pressure and condensate after the sterilization phase. The phase opens the fast exhaust valve allowing pressure in the chamber to exit. The valve remains open until the chamber pressure comes to within 1.5 PSI of ambient at which time the phase advances to the dry phase. This phase is controlled by pressure.	X			X		

PHASE DEFINITIONS		CYCLE TYPE					
Phase	Definition	Pre-Vac & Bowie Dick	Liquid	Bio-Bag	Hard Goods	Isothermal	Leak Test
Slow Exhaust	The slow exhaust phase is used to control the speed at which the chamber pressure is relieved after the sterilization phase. The phase turns the jacket steam off to allow the chamber to begin to cool. It then opens and closes the slow exhaust valve allowing pressure to bleed out of the chamber at a rate set by the exhaust rate parameter. This continues until the chamber pressure comes to within 1.5 PSI of ambient at which time the phase advances to the cool phase. This phase is controlled by pressure and time.		X	X		X	
Cool	The cool phase is used to allow the load time to reduce temperature and always follows the slow exhaust phase. The jacket steam remains off allowing the chamber to continue to cool. The air inlet valve and drain are both opened to keep the chamber at ambient pressure. The phase continues for based on the cool time parameter. Once the cool time has elapsed, the phase advances to cycle end. This phase is controlled by time.		X	X		X	
Drying	The dry phase is used to remove moisture from the load using the vacuum system. The phase pulls a vacuum on the chamber for a length of time set by the dry time parameter. Once the time has elapsed, the vacuum turns off and the phase advances to the air admit phase. This phase is controlled by time.	X			X		
Air Admit	The air admit phase is used to allow the chamber to come to ambient pressure from a vacuum state. The phase opens the air admit valve which allows filtered air to enter the chamber raising the pressure to ambient. Once ambient pressure is achieved the phase will advance to the cycle end phase. This phase is controlled by pressure.	X			X	X	X
Unseal	The unseal phase verifies the system is safe to unseal and unseals the unload door. The unload door is determined by interlock setup on double door units. The phase verifies that, chamber pressure is within one PSI of ambient, there is no standing water in the chamber, and then allows the operator to unseal the appropriate unload door. Once the door has unsealed the phase advances back to standby where the door can be opened. This phase is controlled by safety interlocks.	X	X	X	X	X	X

Parameter Definitions

PARAMETER DEFINITIONS		VALUE				CYCLE TYPE					
Parameter	Definition	UOM	Min	Max	Default	Pre-Vac & Bowie Dick	Liquid	Bio-Bag	Hard Goods	Isothermal	Leak Test
Purge Time	Duration to hold Purge Pressure during purge phase	Min	00	59	**02**	X	X	X	X		X
Number of Pulses	Number of vacuum pulses in pre-vacuum phase	#	0	9	**4**	X		X			X
Pre-Vacuum Level	Level of vacuum to reach on last pre-vacuum pulse	PSIA	1.5	14.0	**3.5**	X		X			X
Pre-Vacuum Ramp	Speed at which the chamber is allowed to change pressure	PSI/ Min	0 (Off)	10	**0**	X		X			
Heating Ramp	Speed at which the chamber is allowed to build heat	°C/ Min	0 (Off)	10	**0**	X	X	X	X	X	
Sterilize Time	Duration to hold Sterilize temperature during sterilize phase	HH:MM	00:00	99:59	**00:20**	X	X	X	X		
Sterilize Temperature	Level of temperature to maintain in chamber during sterilize phase	°C	100	138	**121**	X	X	X	X		
Exposure Time	Duration to hold Exposure temperature during exposure phase	HH:MM	00:00	99:59	**01:00**					X	
Exposure Temperature	Level of temperature to maintain in chamber during exposure phase. 78, 88, 100 or 104 Deg C	°C	78	104	**100**					X	
Exhaust Ramp	Speed at which the chamber is allowed to reduce pressure during slow exhaust phase	PSI/ Min	0 (Off)	3	**0**		X	X			
Drying Time	Duration to maintain vacuum during dry phase	Min	00 (Off)	59	**10**	X			X		
Pre-Vacuum Hold	Duration to hold final pre-vacuum pulse	Min	00	10	**5**	X		X			X
Cool Time	Duration to allow the load to cool.	Min	00 (Off)	59	**10**		X	X		X	

PARAMETER DEFINITIONS		VALUE				CYCLE TYPE					
Parameter	Definition	UOM	Min	Max	Default	Pre-Vac & Bowie Dick	Liquid	Bio-Bag	Hard Goods	Isothermal	Leak Test
Leak Test Time	Duration between start and stop pressure measurements of Leak Test	Min	05	59	**10**						X
Leak Test Loss Limit	Number of PSI pressure loss allowed to pass Leak Test	PSI	0.5	10	**2**						X
Printer Log Time	Duration between print capture of sterilizer status	Sec	30	9999	**60**	X	X	X	X	X	X
High Temp Alarm	Number of degrees above sterilization set point allowed before alarm condition	°C	0.5	5	**3**	X	X	X	X	X	
Low Temp Alarm	Number of degrees below sterilization set point allowed before alarm condition	°C	0.5	5	**1**	X	X	X	X	X	
Load Probe	Is load probe on in cycle or not	On/off	On	Off	**Off**	X	X	X	X		
Temperature Overdrive	Number of degrees the chamber RTD can go over the sterilization set point when the load probe option is on	°C	0 (Off)	9	**0**		X				
Cycle Name	Enter up to 20 character cycle name	TEXT	0	20		X	X	X	X	X	X

Pre-Vacuum Cycle

Theory:

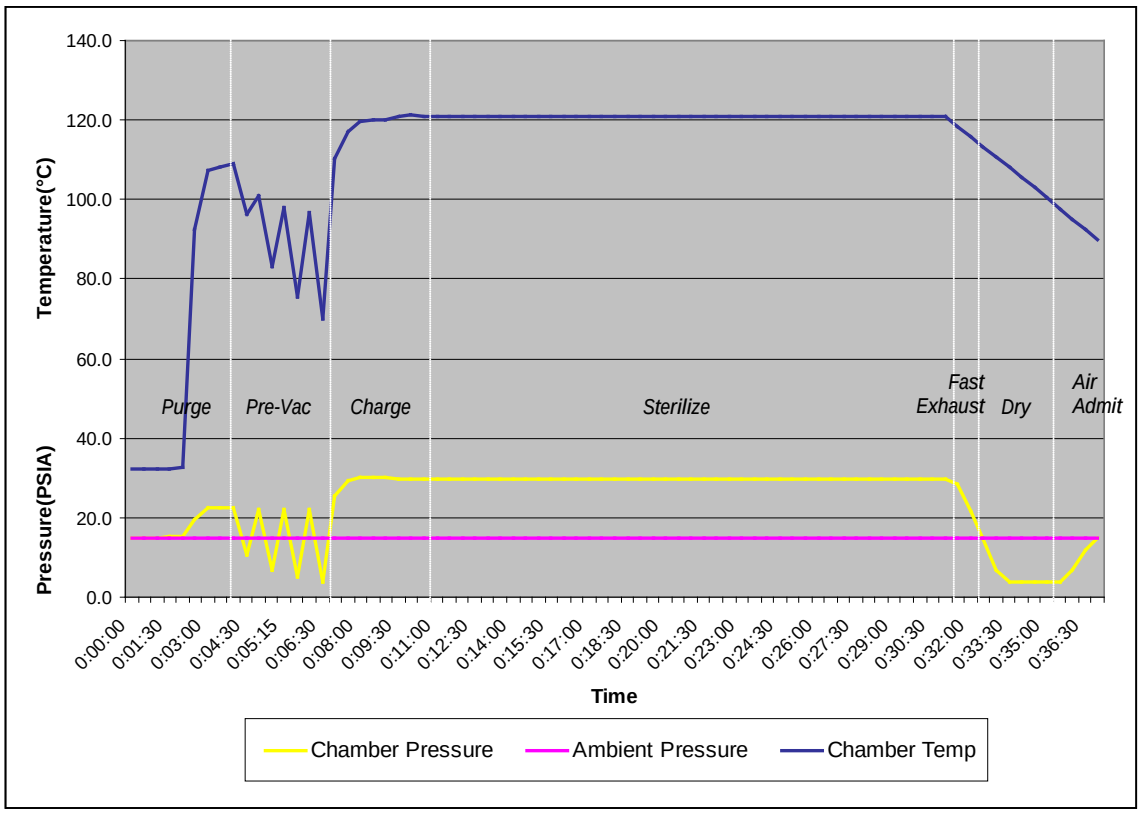
Entrapped air is mechanically removed from inside Filters, Porous materials, and Laboratory apparatuses with hoses and hard to reach areas prior to sterilization. Steam will then penetrate the porous areas and as a result will heat up the loads quicker and more uniformly.

Uses:

Surface sterilization of Instruments and Glassware with rapid drying capability. Pulls deep vacuum prior to sterilization for Porous materials, Fermentors, Hoses, Filters, and most Laboratory apparatuses.

Non-Uses:

Not recommended for liquids or media, Bio-Waste Bags.



Bio-Bag Cycle

Theory:

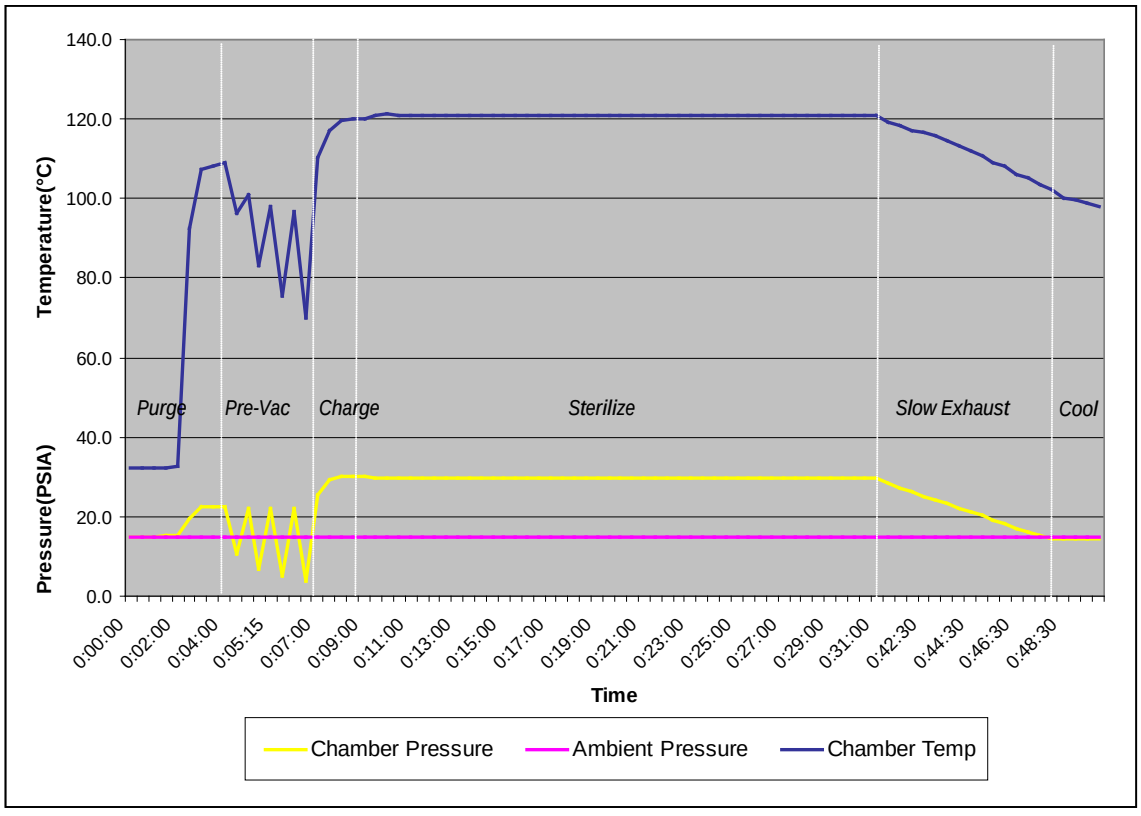
Entrapped air is removed from inside Bio-Waste Bags prior to sterilization. Steam will then penetrate and as a result will heat up the load quicker and more uniformly. A controlled slow exhaust is used to eliminate waste liquids from boiling over and exploding inside the Bags. Bio-Waste Bags reach temperature inside in about 15 minutes versus 3 hours and 15 minutes using a liquids cycle.

Uses:

Filled Bio-Waste Bags and Sharp Containers.

Non-Uses:

Not recommended for liquids or media outside of a container or bag unless placed in a autoclavable tray.



Liquid Cycle

Theory:

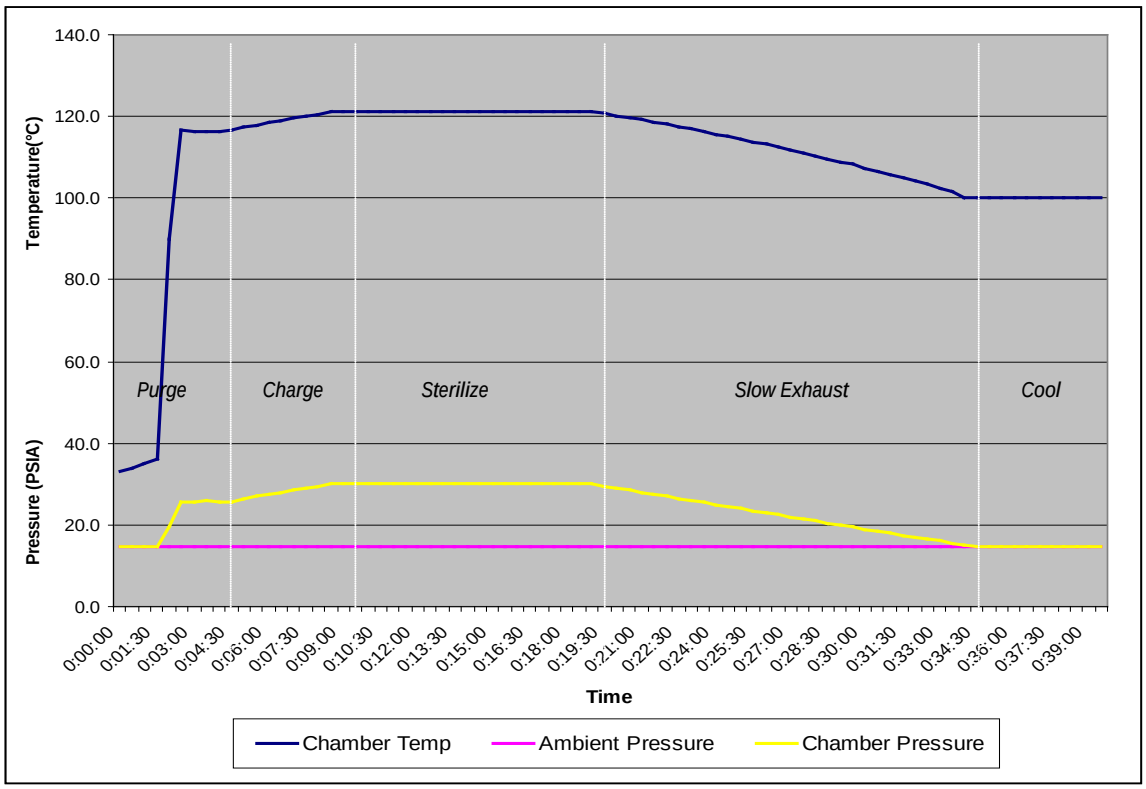
Steam is used as a sterilant under pressure. Steam is lighter than air and rises. As steam enters the chamber it mixes with air under positive pressure. By modulating the drain valves turbulence is created thus mixing the air and steam. As time goes on the air/steam ratio changes. The denser air will gravitate out the drain. In reality different loads may change the internal patterns and may create inconsistent results. After sterilization steam is exhausted at a slow controlled rate to prevent boil over.

Uses:

Surface sterilization only. Instruments, Empty glassware upside down, Liquids or Media.

Non-Uses:

Not recommended for drying applications, porous material, filters or bio-waste bags.



Hard Goods Cycle

Theory:

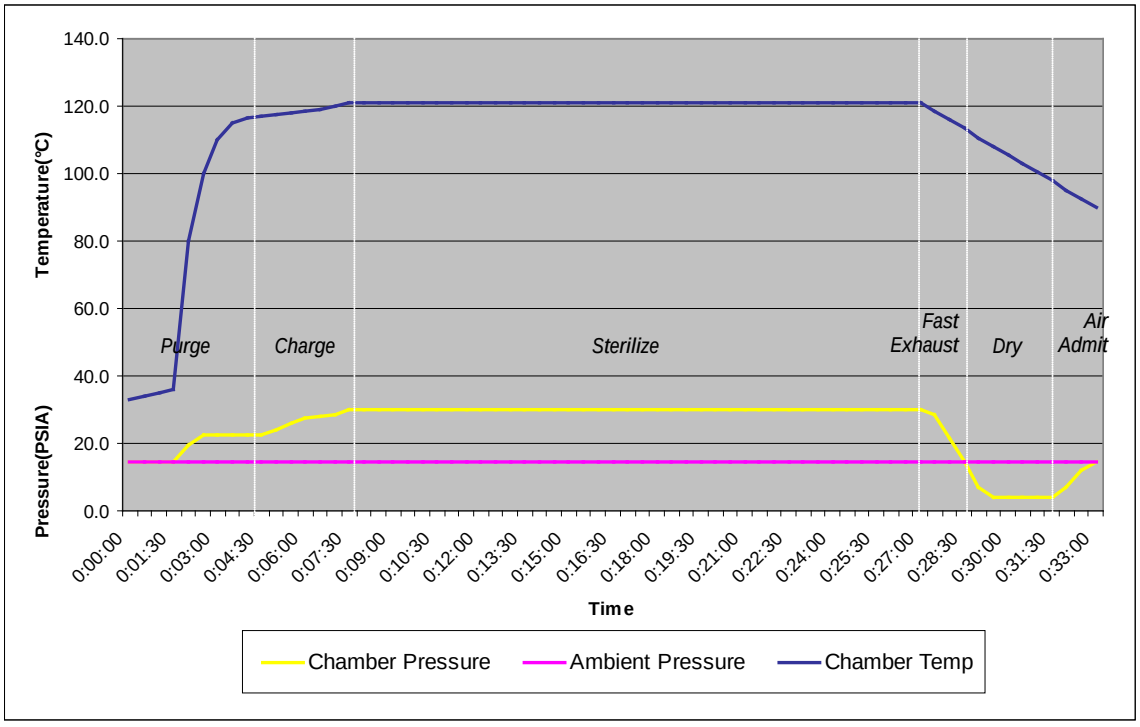
Steam is used as a sterilant under pressure. Steam is lighter than air and rises. As steam enters the chamber it mixes with air under positive pressure. By modulating the drain valves turbulence is created thus mixing the air and steam. As time goes on the air/steam ratio changes. The denser air will gravitate out the drain. In reality different loads may change the internal patterns and may create inconsistent results. After sterilization steam is exhausted at a rapid controlled rate and a vacuum is pulled to expedite the drying process.

Uses:

Surface sterilization only. Instruments, Empty Glassware upside down, Empty carboys, Metal devices from laboratory apparatuses.

Non-Uses:

Not recommended for liquids or media, porous material, filters or bio-waste bags.



Isothermal Cycle (Option)

Theory:

The Isothermal Cycle is designed for low temperature sterilization of heat sensitive and heat congealable materials. There are (4) pre-defined chamber temperatures to select from 78C, 88C, 100C and 104C. The chamber temperature will be controlled at the selected value (variable) +/- 3 deg C. If 78C or 88C are selected as the chamber temperature setpoint then chamber pressure will also be control at a pre-defined (PSIA) value tied to the selected temperature. Chamber pressure will be controlled at +/- 1 PSIA as a target. The following PSIA parameters are from the saturated steam tables.

78 Deg C = Chamber pressure control target 6.1 PSIA

88 Deg C = Chamber pressure control target 9.4 PSIA

If 100C or 104C are selected as the chamber temperature control setpoint then the pressure in the chamber will not be used as to assist in the chamber temperature control.

The jacket setpoint will be set by chamber temperature process variable (TE2) minus 1 Deg C. When jacket temperature is higher then chamber temperature at the start of the cycle, jacket temperature control will wait until jacket temperature and the chamber temperature are the same before controlling the jacket temperature and closing Dump Valve, SPV9.

The following additional conditions exist if 78C or 88C are selected as the chamber temperature setpoint.

- Booster Pump, MS1 is ON, and remains on for the duration of the Steam Charge and Exposure Phases.

- Water Ejector, SPV5 is ON, and remains on for the duration of the Steam Charge and Exposure Phases.

- Fast Exhaust Valve, SPV4, is pulsed ON and OFF as required to maintain the chamber vacuum pressure setpoint for the duration of the Steam Charge and Exposure Phases.

- At end of Exposure phase and before stepping into Slow Exhaust Phase, MS1 is OFF, SPV5 is OFF, SPV4 is OFF and Air to Chamber valve, SPV3 is ON for 30 seconds.

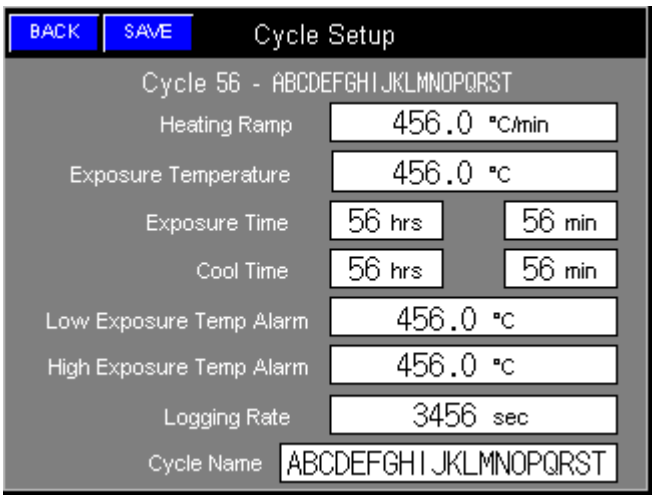
Cool Phase:

- If the cycle parameter for "Cool Time" is set to zero (0), the cycle will advance to the "Cycle End" phase.

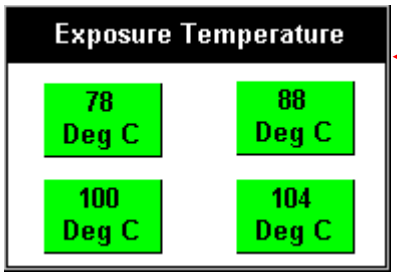
- If the cycle parameter for "Cool Time" is set greater than zero (0), the cycle will advance to the "Cool" phase.

Standby Phase after a completed Isothermal cycle (with Isothermal Cycle Loaded):

- The Jacket Temperature is controlled at Exposure Temperature.
- Jacket Dump valve, SPV9, is ON.



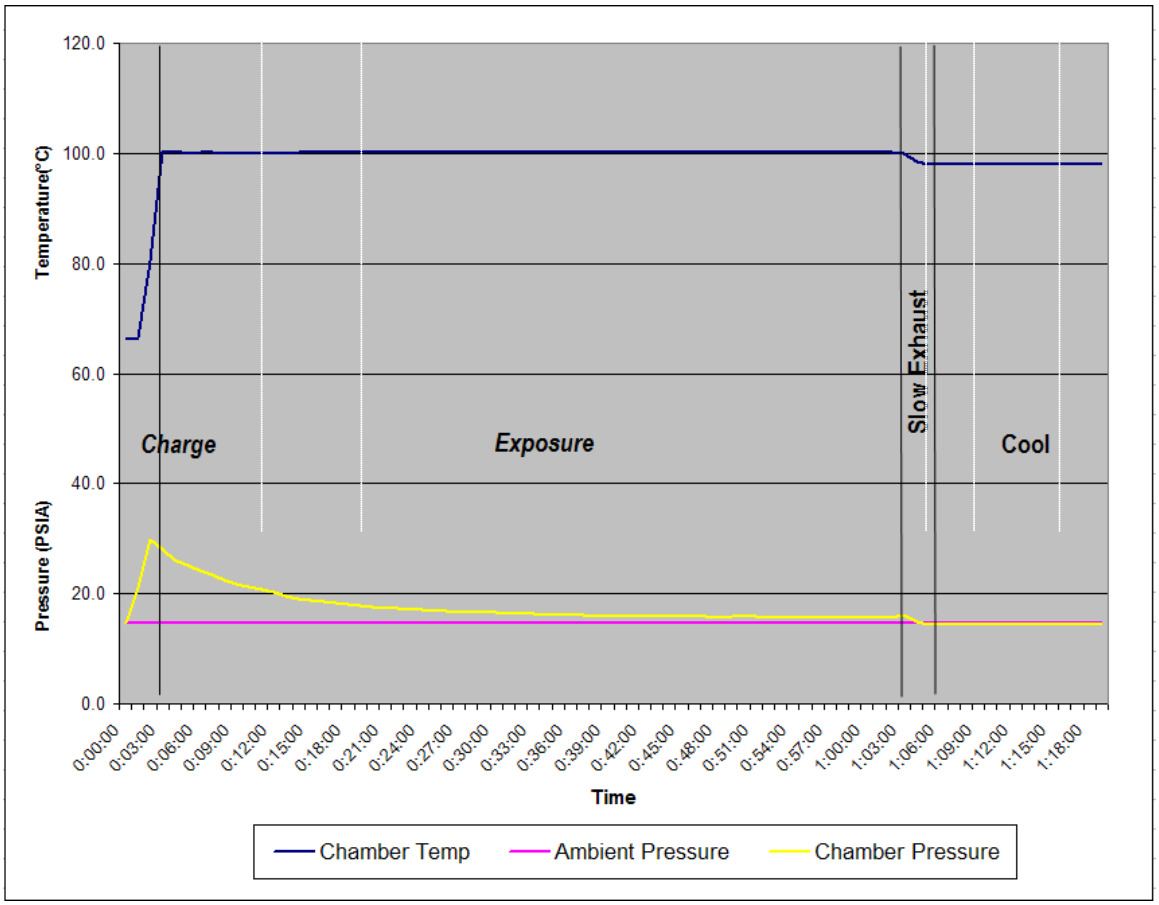
When "Exposure Temperature" is selected in this screen, the screen below will display for exposure temperature selection.



Isothermal Cycle Exposure Temperature Selection

Uses:

Low temperature cycles for heat sensitive materials.



Leak Test Cycle

Theory:

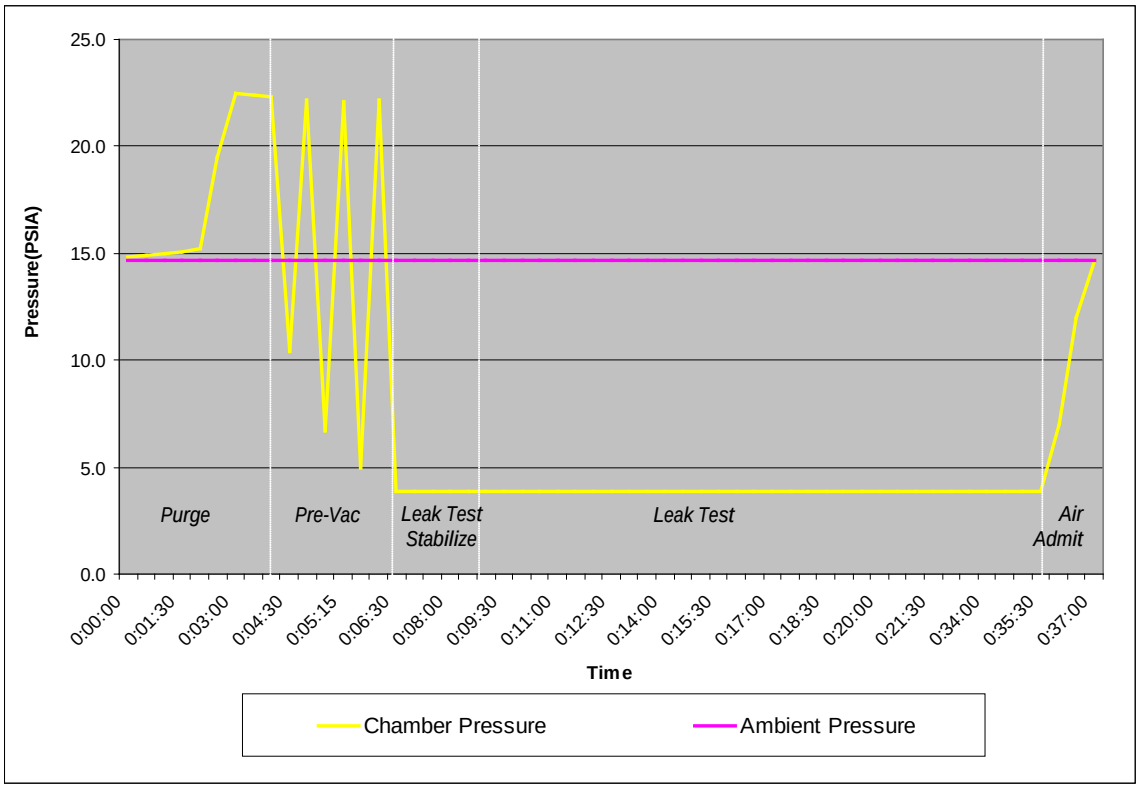
Air is removed from inside the chamber to a programmed level of vacuum. The system allows for a 5 minute stabilization period followed by a 10 minute dwell time. The vacuum level is sampled at the beginning and end of this dwell period. If the leak rate is greater then the programmed leak differential then the unit states "Fail". Otherwise it states "Pass".

Uses:

To test the chamber piping and door gasket(s) integrity.

Non-Uses:

Not recommended for any use other then the Leak Test.



Data Logging

This section will define how the sterilizer captures and records the status of the cycle, based on cycle events and time based intervals.

Cycle data is logged within the PLC based on the logging frequency set by the Printer Log Time parameter and the timing of log events. A log event is one of the following: the start of cycle, a change of phase, an alarm, the end of cycle, and some step changes within a phase.

Print Format

Each cycle printout is made up of the Cycle Header, Cycle Data, and the Cycle Summary. When the CYCLE START button is pressed, the control sends the Cycle Header information to the printer. The Cycle Header consists of these data elements:

- Customer Name
- Machine Serial Number
- Cycle #
- Cycle Counter count
- Current Date
- Start Time
- Machine Name
- User Name
- Cycle Parameters

The Cycle Header is followed by the Cycle Data. The Cycle Data is sent to the printer on a frequency set by the Printer Log Time parameter. If the parameter is set to 60, the printer will print, the time in cycle, the chamber pressure, and the chamber temperature, every 60 seconds. In addition to this frequency based logging, the printer will also print a message for each change of phase, each process change in a phase, and all alarms.

At the end of cycle the control sends the Cycle Summary information to the printer. This information can vary by type of cycle. The Cycle Summary contains basic statistics about the cycle. These may include:

- Time in Sterilize
- Minimum Chamber Temperature in Sterilize
- Maximum Chamber Temperature in Sterilize
- Minimum Chamber Pressure in Sterilize
- Maximum Chamber Pressure in Sterilize

The data sent to the printer remains stored in the control until the next cycle begins. This allows a cycle to be reprinted using the REPRINT button on the Start Cycle screen. The user can reprint last 6 cycles.

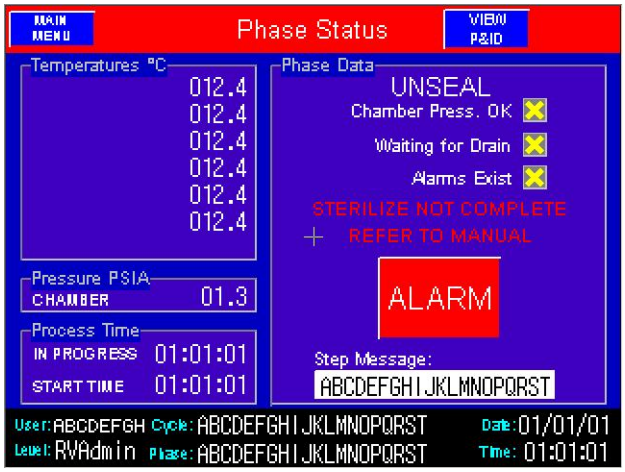
Alarms

This section will define the sterilizer's alarms conditions, the PNID tag number of the instrument related to that condition, and the system response to the condition.

Alarm	PNID Tag #	Alarm Condition
E-Stop	ES1 ES2	Emergency Stop button is pressed, during any phase with the exception of Standby.
Sensor Error	PT-1 TE-2 TE-1 TE-5 TE-9 TE-10	During any phase when pressure or temperature register at the upper or lower limit of the measuring device.
Door # Not Sealed	PSW-1 PSW-2	During all phases except Standby, pressure is lost in the Door # seal. Also if Door # seal pressure switch has become defective.
Door # Not Closed	ZS-1 ZS-2	During all phases except standby, electrical signal from Door # closed limit switch is lost.
Power Failure	N/A	Power to the sterilizer was lost for more than five minutes while a cycle was in progress. Not applicable to Standby.
High Chamber Pressure	PT-1	The Chamber Pressure Transducer is sensing pressure greater that set as a max in Global Parameters.
Time-Out (phase)	PT-1	The Pre-Vacuum cycle parameter for "Pre-Vacuum Depth" has not been achieved within the time set by the pre-vacuum timeout Global Parameter.
	PT-1	During the Purge phase and Pre-Vacuum Charge step, the steam pressure to the chamber does not reach the set point within the time set by their respective Global timeout Parameters.
	TE-2	During the Charge phases, the chamber temperature does not reach the set point within the time set by the Charge Global timeout Parameters.
Low Temperature	TE-2	During any Sterilization phase, the sterilization temperature drops below the alarm set point for "Sterilization Temperature" for more than two minutes or three consecutive drops of less than two minutes.
High Temperature	TE-2	During any Sterilization phase, the sterilization temperature rises above the alarm set point for "Sterilization Temperature" for more than 2 minutes.
High Condensate Level in Drain	LS-1	The High Condensate Level in Chamber Drain Alarm indicates that the Drain level condensate float switch, detects condensate in the chamber drain line during the Door unseal phase for more than 2 minutes.
Leak Test Failure	PT-1	During the Leak Test phase of the Leak Test cycle, the chamber pressure rise exceeds the cycle recipe parameters for Leak Test Amount in the time specified in the cycle recipe for "Leak Test Time".
High Jacket temp	TE-1	During all the phase if the jacket temperature exceeds 140°C for two minutes.
Effluent jacket low temp	TE-9	If the effluent filter temperature drops bellow 105°C for more then 1min.
Water booster-pump overload	MS/OL-1	If the overload trips on the motor starter this alarm is active.
Rupture disc	PSW-4	If PSW-4 sense pressure and closes

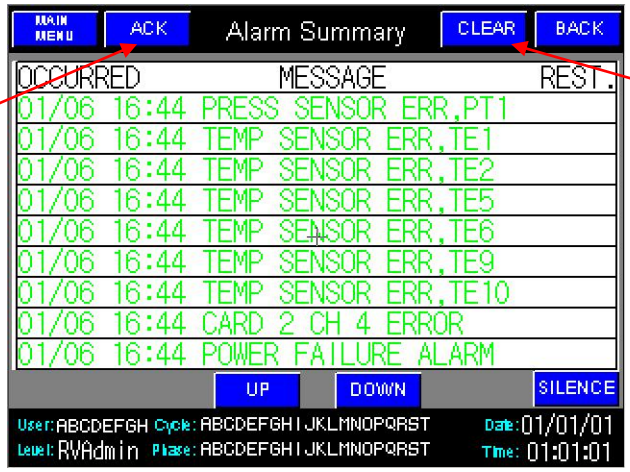
Handling Alarms

When an alarm occurs, the system will present visual and audible alerts, it will then automatically abort the cycle and attempt to get the sterilizer to a safe unseal state. A tone will sound, the alarm button will turn Red, and the screen title bar will turn Red as shown below, and the machine will automatically advance to the exhaust phase of the cycle where it will progress through to the unseal process.



View Alarm Condition

Pressing the ALARM button will bring up the Alarm Summary screen below. This screen shows all alarms that have occurred, the red alarms are active, the green alarms have been acknowledged. You can silence the audible alert by pressing the SILENCE button.



Acknowledge Selected Alarm

Clear All Alarms

Silence Alarm

You can acknowledge an alarm by pressing the alarm description you want to acknowledge and then pressing the ACK button.

The alarm log can be cleared by pressing the CLEAR button. Clear requires a security level of Technician or above.

Troubleshooting

This section outlines potential problems and the probable cause. For technical information to correct a problem you will need to reference the Service Manual, contact local your Service Provider, or call our Factory Tech Support Team.

TROUBLESHOOTING GUIDE		
#	Problem	Probable Cause
1	Control Screen Not Active	No Electrical Power to Unit Circuit Breaker in PLC Cabinet tripped or turned off Power Supply Failure Touch Screen Failure Touch Screen in Hibernate or Power Save Mode
2	Power on, Control Active, but Cycle will not start	System may not be in full Auto mode Door may not be closed Door limit switch is not activated System may have an Active Alarm
3	Jacket Temperature will not reach set point	System may not be in full Auto mode Air supply failure Steam supply failure Steam regulator set to low Faulty steam regulator Clogged steam supply strainer Jacket Steam valve failure Jacket Steam trap failure Jacket RTD transmitter out of calibration No Output signal from PLC Solenoid Valve Failure
4	Chamber Temperature not reaching set point	Air supply failure Steam supply failure Steam regulator set to low Faulty steam regulator Clogged steam supply strainer Chamber Steam valve failure Slow Exhaust orifice may be blocked Chamber RTD transmitter out of calibration No Output Signal from PLC Solenoid Valve Failure
5	High Temperature Alarm occurs	Chamber Steam valve failure Chamber Steam valve stroke limiter requires adjustment Steam regulator set to high PID algorithm requires adjustment Solenoid Valve Failure
6	Not reaching vacuum set point	No output signal from PLC to ejector water valve or pump sytsem Wrong rotation of pump Loss of three phase power to pump system Loss of adequate water supply pressure Fast Exhaust Valve not opening Gross containment leak in system Pump or Ejector Failure Input water to warm to maintain vacuum efficiency
7	Door Unlocked Alarm occurs	Loss of air supply and check valve failure Leak in door seal assembly Pressure Switch Failure Door Gasket damaged
8	Door Opened Alarm occurs	Door close limit switch not engaged Door close limit switch failure
9	Phase Limit Alarm occurs	Phase advance condition not met in preset time frame

Cleaning & Operator Maintenance

This section will outline recommended preventative maintenance and cleaning procedures to keep your sterilizer running well.

WARNING

Maintenance activities should be performed when the sterilizer is cool. Attempting any cleaning or maintenance activity when the unit is running or still hot after running can result is "SEVERE BURNS". The sterilizer should be turned off an allowed to cool before performing cleaning and maintenance activity.

Cleaning the Chamber

The following procedure is recommended to maintain the interior surface of the sterilizer chamber. Cleaning frequency is determined by operator visual inspection with scheduling of the cleaning to meet the requirements of the individual facility.

- Ensure that the autoclave is cool to the touch. This can be done by turning the autoclave to off by use of the On/Off button on the Control System Start Cycle screen.
- Utilize a soft bristle brush to sweep the autoclave chamber of any loose material.
- A "wet-vac" industrial vacuum sweeper may be used to help remove material. Care should be taken to limit loose materials from entering the chamber sediment screen.
- If large amounts of water are used to help remove the debris cover the drain opening.
- For harder to remove material a plastic scraper may be utilized. This is especially true for "Milk" based material that adheres to the walls as a black soft flaky material and the chamber floor as a semi hardened paste like substance. The scraper may be attached to a handle to allow the operator to reach into the chamber.
- Remove the sediment screen from the chamber drain and clean thoroughly by turning the screen upside down over a waste container and shaking to dislodge any material. Use a small screwdriver to gently loosen any material that does not easily fall out of the screen. Replace screen into chamber drain opening.
- After removing all material from load deposits check for mineral buildup on internal surfaces. If present continue to clean the interior of the autoclave by wiping all surfaces with a soft water dampened lint free cloth.* If water is not sufficient to remove the mineral buildup which is probably carryover from the steam utilize white vinegar in place of water for cleaning. Rinse all surfaces thoroughly with clean water after applying vinegar. Clean lint free cloths should be placed on the autoclave chamber floor to absorb all moisture. Care should be taken to ensure that cleaning material and any material loosened during the cleaning process does not enter into the autoclave drain system.
- If deposit are too hard or resistant to physical cleaning as described above please contact or Factory Technical Support Team to discuss other cleaning options.

** A plain (non detergent impregnated) cleaning pad such as "3M Scotch Brite" may be used in place of the cloth. Never use abrasive materials, cleaning agents or detergents. These items may

damage the item to be cleaned or deposit chemicals or abrasives that may be transferred to the load being autoclaved. This will cause contamination of the materials being processed.

Cleaning the Door Seal

The following procedure is recommended for cleaning of the autoclave door gasket, door gasket groove and door gasket sealing surface. Cleaning frequency is determined by operator visual inspection to meet the requirements of the individual facility.

Door Gasket and Door Gasket Groove

- Carefully remove any foreign material by gently pulling the item from the affected area or by wiping with a soft lint free cloth.
- Clean the door gasket completely by removing the gasket from the gasket groove. *(See Changing Door Seal Gasket Section of Service Manual for Instruction)* Do not use a sharp instrument or knife blade to free the gasket from the groove. Care should be taken when removing the gasket to ensure that no damage occurs to the gasket.
- Use a soft water dampened lint free cloth* to completely wipe the gasket until clean. Dry and re-insert into the gasket grove.
- Use a soft water dampened lint free cloth* to completely wipe the door gasket groove until clean.

Sealing surface

- Clean the autoclave door gasket sealing surface by gently rubbing the exposed surface with a water dampened soft lint free cloth.* This is the front vertical surface of the autoclave chamber or the interior door surface that the door gasket presses against to create a chamber seal.

** A plain (non detergent impregnated) cleaning pad such as "3M Scotch Brite" may be used in place of the cloth. Never use abrasive materials, cleaning agents or detergents. These items may damage the item to be cleaned or deposit chemicals or abrasives that may be transferred to the load being autoclaved. This will cause contamination of the materials being processed.

Operator Maintenance

DAILY OPERATOR MAINTENANCE CHECKLIST		
#	*Description*	*Frequency*
1	Inspect chamber daily, clean as required. Ensure that the chamber is cool to the touch. Use a soft bristle brush or "wet-vac" to remove any loose material. For hardened material a plastic scraper or non-detergent impregnated scratch pad may be used.* Clean the chamber drain screen of any material. Ensure that loose material does not enter the drain and If material is flushed down the drain the inline drain strainer will need to be removed for cleaning.	Inspect prior to each cycle and clean as required.
2	Prior to each cycle inspect and clean the chamber drain screen by removing the chamber screen and visually inspecting the screen and the surface area around the screen penetration for debris. Remove any material and replace the drain screen by pushing the drain screen into the drain penetration and ensuring that the screen is flush to the chamber floor.	Inspect prior to each cycle and clean as required.
3	Inspect door gasket and sealing surface. Clean as required. Inspect these items prior to each cycle by visually checking the exposed visible section of the gasket, gasket groove and sealing surface for material such as tape, glass or solidified product. Carefully remove any foreign material by gently pulling the item from the affected area or by wiping with a soft lint free cloth. If the gasket is damaged it should be replaced immediately. Care should be taken to ensure that contact is not made with hot areas of the sterilizer. If the door gasket must be removed please follow door gasket removal instructions in the service manual.	Inspect prior to each cycle and clean as required.
4	Inspect interior rack and shelving (if applicable) for damage and proper slide operation. If shelving is damaged or does not slide correctly please contact your service provider for assistance. Care must be taken to ensure that the product is able to remain securely on the shelving during loading, processing and unloading. Processed item will be extremely hot after cycle completion.	Inspect prior to each cycle and clean as required.
6	Inspect the transfer carriage (if applicable) for damage and for proper operation. Check that the wheels are not damaged and roll easily. Depress the wheel locking mechanism to ensure that the wheel lock engages. Align carriage to the autoclave and ensure latching fingers engage onto the autoclave securely. Pull down on carriage locking handle to release latching fingers from the autoclave.	Check Daily
5	Inspect the loading cart (if applicable) for damage and for proper operation. Check that the wheels are not damaged and roll easily. Pull loading cart onto the transfer carriage until the back axle engages the cart locking mechanism. Push on carriage to ensure that it remains securely locked in place and does not roll forward. Check shelves for damage.	Check Daily
7	Check printer for printer paper and replace as required. See operator's manual for paper replacement instructions.	Check Daily
8	Check printouts for print quality and readability. If printed information is illegible please contact your service provider for printer maintenance. If the printed information is too light to read please refer to the operator's manual for printer ribbon replacement instructions.	Check Daily

** A plain (non detergent impregnated) cleaning pad such as "3M Scotch Brite" may be used in place of the cloth. Never use abrasive materials, cleaning agents or detergents. These items may damage the item to be cleaned or deposit chemicals or abrasives that may be transferred to the product being processed. This will cause contamination of the materials being processed.