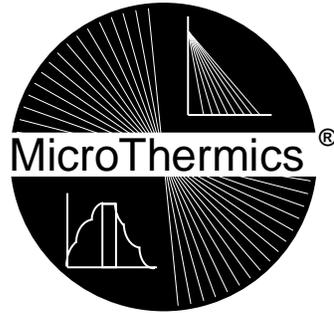


Operational Manual

For



UHT/HTST Lab25 DIPW

**Impossible Foods, Inc.
Redwood City, CA
3216-886**

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1. General Warnings & Symbols Definitions: Before you begin read this manual thoroughly!

A. General Warnings and Warranty:

Follow all manufacturers' instructions when working with this equipment in any way (installing, operating, cleaning maintaining and servicing etc.). Failure to follow the manufacturer's instructions will void all warranties and guarantees, and may result in personal injury.

Proper safety procedures should be followed while working with this equipment in any way (installing, operating, cleaning maintaining and servicing etc.).

Consult the service manual for warnings and procedures before servicing the equipment.

Do not modify or move wiring that is internal to this equipment. Modification or movement of internal wiring will alter the EMC compatibility and void all manufacturer's warranties and guarantees.

Statement of warranty conditions: This equipment is warranted against defects in materials and workmanship for a period of 12 months from the time of installation. It is not warranted against failure due to food product failure, operation outside design limits, or failure of wearing parts.

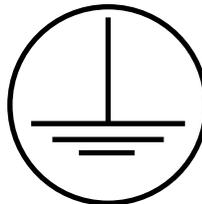
B. Symbol Definitions



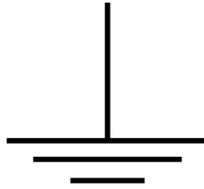
This CAUTION symbol on the equipment refers the user to the Manual for additional information. This symbol is located beside hazard symbols in the hazard area, and on doors protecting the operator from the hazard. This symbol also appears next to the required information in the Manual.



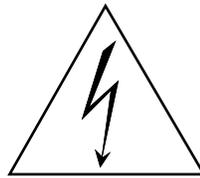
WARNING, HOT SURFACE. This symbol warns the user of a potential BURN hazard where HAZARDOUS HOT SURFACES AND COMPONENTS may be accessible.



This PROTECTIVE EARTH GROUND symbol indicates the protective earth terminal inside the equipment. The protective earth ground is provided for connection of the protective earth (green with yellow stripes) supply conductor.



This FUNCTIONAL EARTH GROUND symbol indicates the functional earth terminals inside the equipment. The functional earth ground is provided for connection of the ground conductor from individual components to the protective earth (green with yellow stripes) supply conductor.



WARNING, RISK OF ELECTRICAL SHOCK. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltage may be accessible.

Observe Warnings and Operational Instructions. Be sure to operate this equipment as specified and observe all warnings. Failure to do so will reduce the protection provided by the equipment, and could result in personal injury and damage to the equipment.

2. Warnings-Before You Begin, Read This Manual!!

- A. Do not operate this system until the initial start-up and training has been conducted by MicroThermics personnel. Doing so can cause damage to the system.
- B. Follow all manufacturers' instructions when working with this equipment in any way (installing, operating, cleaning maintaining and servicing etc.). Failure to follow the manufacturer's instructions will void all warranties and guarantees, and may result in personal injury. Proper safety procedures should be followed while working with this equipment in any way (installing, operating, cleaning maintaining and servicing etc.).
- C. MicroThermics systems are designed and built to be durable over a wide range of operating conditions. It is unavoidable that eventually, some components will fail and require repair or replacement. A system in disrepair will not operate properly and will prevent efforts to understand or troubleshoot product performance. Operating a system in disrepair can damage other components and endanger bystanders. MicroThermics provides technical support, service calls, preventative maintenance contracts, and stocks spare parts, for overnight shipping, to keep your laboratory operating properly.
- D. Ensure that the 1Ø electricity is connected to a Ground Fault Circuit Interrupter (GFCI).
- E. This system uses 3-phase high voltage. Only qualified electrical service personnel should perform maintenance or service to 1Ø or 3Ø components. Before servicing any electrical components, be sure that all power to the system is turned off at the main 3Ø and 1Ø disconnects feeding the system.
- F. DO NOT SUPPLY THE SYSTEM WITH MORE THAN 80 PSI (5.6Kg/cm²) STEAM. The system is equipped with a relief valve on the steam supply that will release at 100 psi (7 Kg/cm²). This is within the tolerances of the system and above operational requirements. It is designed to prevent over-

pressuring of the system resulting in hazardous failures. DO NOT SUPPLY THE SYSTEM WITH MORE THAN 80 PSI (5.6 Kg/cm²) STEAM.

- G. TURN OFF ALL STEAM SUPPLIED TO THE SYSTEM AND ALLOW THE SYSTEM TO COOL UNTIL ALL PIPES ARE COOL TO THE TOUCH BEFORE SERVICING INTERNAL COMPONENTS.
- H. When your system is configured in indirect mode using both the preheater and final heater, do not operate the final heater unless the circulator pump is turned on. Failure to turn the circulator pump on will prevent the product from heating, causing the controller to overheat. This may open the water relief valve, briefly releasing hot water and steam inside the equipment and into the area. It will not cause injury to operators.
- I. During normal use, the pipes, control valves, and tube sections located inside the system cabinet will get very hot. Use gloves when adjusting steam pressure. Do not reach into the system cabinet, beyond the panels provided, during operation or while the system is hot after use. Keep people away from the exposed tube sections located to the inside of the doors.
- J. Do not operate the system without operating the product coolers to cool exiting product. If the coolant is not used, the product exiting the system will be hot, and may flash causing spraying onto bystanders.
- K. Coolant and coolant lines exiting the system may contain hot or boiling coolant, and should be handled accordingly. The product cooler in this system has been designed to allow trim cooling. This type of cooling operation can produce hot or boiling coolant exiting the system. Coolant and coolant lines should be handled accordingly.
- L. During equipment operation, sterilization or sanitization, only control coolant using the valves and solenoids on the MicroThermics system. Do not use the utility valves of the installation site to turn off the coolant return during equipment use. Doing so may severely damage the equipment.
- M. Once steam has been admitted to the hot water generator for the preheater, DO NOT PUT THE FILL/DRAIN VALVE INTO THE FILLING POSITION. THIS WILL RELEASE SUPERHEATED WATER FROM THE HEATER, WHICH WOULD VENT BENEATH THE SYSTEM OR INTO DRAIN LINES. IT MAY ALSO DAMAGE THE CIRCULATOR PUMP SEALS.
- N. Do not operate the system with a homogenizer unless a relief bypass valve has been installed at the pump feeding the homogenizer. Failure to do so will result in failure of the pump.
- O. Do not pressurize product lines above 1500psi (105Kg/cm²). Use of a homogenizer provides the capability to operate the system at pressures higher than it may have been designed for. System pressure meters for the product are equipped with outputs for alarms and can be set to trigger alarms at specific set points. These may be used to alert the operator if system pressure becomes excessively high.
- P. Do not operate the product pump or extraction pump dry or with distilled or deionized water. This will cause rapid pump failure.
- Q. Pressure against the product pump or extraction pump should not exceed 180psi (12.6 Kg/cm²) to avoid pump failure.
- R. Do not allow steam pressure to vent directly into the vacuum pump. To do so will damage the vacuum pump. Be sure a mixture of air and steam are entering the vacuum pump by leaving the vacuum control valves partially open during steam venting.
- S. Do not feed excess water pressure to the vacuum pump. To do so may impair the pumps operation or damage the pump. Excess water may exit the pump's vapor vent and flood the area.
- T. Do not exceed the maximum vacuum of 22-23"Hg. To do so may damage the vacuum pump.

- U. Do not allow the product pump or extraction pump to run dry. Dry operation will damage the stator and cause pump failure.
- V. Do not allow the vacuum chamber to completely fill. This could cause liquid to flow directly into the vacuum pump and may cause damage.
- W. Do not add city water to the vacuum chamber when the chamber is hot. This could cause the sight glasses to shatter from thermal shock.
- X. Do not supply city water to the system above 105°F (40.5°C). To do so may damage the vacuum pump under high vacuum.
- Y. Do not allow pressure in the vacuum chamber to exceed 42psi (2.94Kg/cm²). Excessive pressure will cause the relief valve to open and vent gases/steam into the area.
- Z. Ensure all clamps on the vacuum chamber and the hose feeding the chamber are secure prior to operation. Failure to do so could cause serious injury to persons in the vicinity of the equipment.
- AA. When servicing the product back pressure valve and steam injector be sure to shut off all product and steam supplies and relieve steam pressure from the steam filter.
- BB. Do not add water to preheat or final heat hot water loops/generators once they are hot. To do so may heat-shock the circulator pump seal, causing it to fail and leak.
- CC. Do not store this equipment in areas where it may become frozen without contacting MicroThermics®. Freezing can cause system components to burst and leak during operating. Freezing is not covered under the product warranty/guarantee.
- DD. Do not leave the system unattended while operating.
- EE. Wear safety glasses while operating this system.
- FF. Do not clean the external surfaces with a water hose gun or any other pressurized water source. Doing so can cause damage to internal electrical components of the system.

3. This system is from MicroThermics Inc.

3216-B Wellington Court, Raleigh, N.C. 27615. Phone: (919) 878-8076/8045, Fax: (919) 878-8032.

4. Description

This is a processor designed to simulate thermal process using direct steam injection and indirect tubular heating all contained in one cabinet. The specific capabilities that it adds are as follows:

- a. Direct product heating using steam injection. Note: The system provides a debris filter to remove solid contamination. Steam fed to the system should be of potable water, and free of boiler additives.
- b. Indirect product heating using steam heated water in a tubular product heater.
- c. Preheat and metering portion using steam heated water.
- d. Automatic temperature control in either direct or indirect heating mode. Temperature of product exiting the product heater is regulated by automatic temperature controls. The thermocouple for the controller should be located in the product stream that immediately exits the product heater. The controller compares the temperature of the product with the target or setpoint (called SP) temperature. If the product temperature is too low, the controller opens the steam control valve to add more heat to the process. If the product temperature is too high, the controller closes the valve to reduce the steam and amount of heat fed to the product.

The controller can be operated on either manual or automatic mode. The operating mode is changed by pressing the buttons labeled "Manual" and "Auto". The word "Manual" is shown in the color red when the controller is in manual mode and the word "Auto" is green when it is in automatic mode.

- e. Vacuum cooling. Note: The vacuum chamber, vacuum pump, and product pump may also be used as a deaerator/de-foamer. Vacuum cooling and deaeration/de-foaming cannot be performed separately in the same process.
- f. Indirect (tubular) product cooling. Restricting the coolant supply controls product temperature or the amount of cooling. The cooler in this system has been designed to allow trim cooling. This is a cooling step where hot-fill style products are processed above their filling temperature and pressure to inactivate microorganisms, and then cooled slightly (i.e. trim-cooled) to their hot-fill temperature before exiting the system to atmospheric pressure.

This type of cooling operation can produce hot or boiling coolant exiting the system. Coolant and coolant lines should be handled accordingly

- g. Sterilization of down line components, piping and sterile product outlet.
- h. Central connection/jumper panel allowing various processes to be assembled by moving jumper connections. This also provides easy access to incorporate additional operations like in-line homogenization, and for instrumentation service and repair. Warning: When incorporating a homogenizer, a relief bypass valve must be installed in the product line at the system pump to prevent the system pump from overfeeding the homogenizer. The system pump must also be operated so that the pressure at the pump exceeds 50psi (3.5Kg/cm²). This will ensure that an adequate supply of product is provided to the homogenizer.
- i. Two hold tubes that can be used individually or in series. Hold times can be varied using the tubes provided, and the pump speed control. These hold tubes have been well insulated; however some temperature loss is unavoidable with long hold times. Details of the hold tube configuration for your system and for determining hold time from flow rate are provided in the section labeled "Flow Rates & Hold Times".
- j. Variable-speed product pump drawing product from the vacuum chamber. This allows pump speed to be adjusted to control the level of product in the vacuum chamber, and correct for pump performance changes due to temperature changes.
- k. Product & utility temperatures displayed on a digital readout on the touchscreen. Thermocouple channels and their location in the system are shown in Figure 1.
- l. Product pressure displayed on a digital readout on the touchscreen.
- m. Process data available for data acquisition with terminal blocks ready for connection to a data acquisition unit.

5. Operational Comments

A. General:

This system was designed to be flexible and provide a wide range of processing conditions for a variety of products. It was not designed to process heat sensitive products for excessive periods of time. Operational conditions and performance of the system should be monitored constantly during operation. This will prevent excessive fouling of product heaters, simplify cleaning, and avoid blocking product heaters. Blockage of heat exchangers and system piping due to product fouling or buildup is not covered under warranty.

B. Product Pump Care and Operation:

The system is equipped with two variable speed positive displacement (or metering) pumps. Product pump #1 is designed to feed the preheat portion of the system, it can pump products ranging from room temperature to 135°F. Product pump #2 is designed to pump hot products ranging from approximately

160°F-270°F (71-132°C). Operation outside these temperature ranges will accelerate pump wear and cause increased service. We recommend keeping a spare stator for these pumps at your location and have included one for each pump.

C. Steam Injection Heating:

(Mark 95 Valve Back Pressure Control)

Steam injection heating involves adding steam to heat product to a desired temperature. For UHT processing temperatures, the product must be maintained under pressure to prevent boiling. As a result, these processes are a balance between the pressure of the product and that of the steam. If the steam pressure is lower than that of the product, it will not inject into the product and no heating will occur. If it is too high, too much steam will be added to the product and the product will boil.

Product pressure before the vacuum chamber is maintained with the DIP's Mark 95 valve. It provides continuous adjustment over a wide range of products and target temperatures/pressures. The Mark 95 backpressure valve is located at the end of the hold tube or the entrance of the vacuum chamber.

The backpressure valve will require periodic servicing. It should be disassembled for inspection, manual cleaning and service.

The product pressure appropriate for specific process temperatures can be found in the table entitled "DIP Steam Table". The right column of this table provides the minimum pressures needed at process temperature to prevent the product from boiling and still allow the steam to flow into the product.

In general, the flow rate and temperature of the incoming product are set and the product pressure is set next. The steam pressure is then increased gradually until it exceeds the product pressure, at which time the temperature increases rapidly. If the steam pipes supplying the injector contain condensate, it will flow into the product before the steam and cause a delay between the times that the pressures are right for injection and a delay in the temperature rises. The condensate will also often cause noticeable cooling of the product because it is cold. It is advisable to blow condensate out through the injector feed pipes before processing is begun.

Note: It is possible to inject steam into the product and observe apparent temperatures at the injector exit that are well above those determined by the backpressure valve. This can be due to local overheating and incomplete steam/product mixing. Under these conditions, the temperature of product at the end of the hold tube will be drastically lower, indicating that the product has been boiling-down in the hold tube. Normal temperature drops along the hold tube range from 2-10°F (1.1-5.6°C) depending on the product. Temperature drops of 12-20°F (6.7-11.1°C) often indicates boiling-down. Temperature drops of this size and as large as 30°F (16.7°C) may also be due to endothermic reactions occurring in the hold tube. A common example is starch hydration.

D. Vacuum Cooling:

Direct steam heating adds water to the product as the steam condenses. This dilutes the product. A rough guide is that 5% more water is added to the product for every 20°F (11.1°C) rise in temperature due to steam incorporation. This water must either be adjusted for in the formulation or it must be removed by vacuum cooling. In this process, the hot pressurized product is released into a vacuum chamber where the excess water boils off as steam and the product temperature reaches equilibrium with the pressure/vacuum in the chamber. The steam is removed continuously by a vacuum pump.

The level of vacuum regulates the temperature of product exiting the chamber. More vacuum removes more water. Most products are preheated before entering the injector. In general, vacuum cooling the product to approximately 5°F (2.8°C) below the preheat temperature will remove the necessary amount of water. In a perfect world, vacuum cooling to the preheat temperature would remove all water from steam injection. The additional 5°F (2.8°C) is to account for heat loss between injection and vacuum cooling. A more precise guide is the temperature drop along the hold tube. If the drop is 8°F (4.4°C), then vacuum cool to approximately 8°F (4.4°C) below the preheat temperature.

E. Vacuum Chamber Care:

Your vacuum chamber is equipped with sight glasses to permit viewing the product and allow light into the chamber. The sight glasses are sealed to the chamber flanges using standard sanitary flanges and gaskets. Be sure the gaskets are seated properly and clamped to seal well before using the chamber.

Your vacuum chamber provides space for the product to boil-off steam, and accumulate before it is drawn out by the product pump. This also allows the product to slow and may allow material to settle out and remain in the chamber. The chamber is only partially cleaned by CIP. It must be more thoroughly cleaned by hand, wiped dry and allowed to air dry.

F. Vacuum Pump:

The DIP uses a type of vacuum pump called a "liquid ring pump" to provide the vacuum for the chamber. It uses city water flowing through the pump to provide the seal to help generate a vacuum. It is very durable and does not suffer from the rust and sealing problems associated with piston style oil-sealed pumps. It does not require a condenser to eliminate moisture and will also tolerate small amounts of product that may be drawn as foam or mists when the product level in the chamber rises too high. It will not tolerate a direct stream of product.

The vacuum pump requires a constant supply of water and is equipped with a flow switch preventing operation without water. If the pump is started with insufficient water, it will operate for several seconds and then shut off before it can be damaged. Do not continue to turn the pump on until the water supply has been corrected.

6. Utility Connections

Utility connections to the system consist of coolant (supply and return), city water, steam and electricity. Drainage is onto the floor beneath the system through 1-1/4" PVC pipe. All utility connections are 1/2" compression fittings on 1/2" tubing.

7. Flow Schematic-see Figure 1.

8. Instrumentation Location-see Figure 1.

- a. Product Pressure
- b. Product Temperature
- c. Heat Exchange Medium Temperature

9. Product Control

a. Product Routing (Process Layout):

The system is equipped with a central connection panel, also called a jumper panel, to which all unit operations have been connected. This panel provides access for service and repair to instrumentation located in the product stream. It also provides access to the process stream so additional operations, like a homogenizer or deaerator, can be added at nearly any location in the process. It also allows the process to be changed and unneeded operations to be bypassed. Various processes can be conducted by changing the positions of the instrumentation and jumpers. Please see the section of this manual entitled "Flow and Jumper Diagrams" for examples of alternate processes and the jumper configuration for each.

The first step in laying-out your process is to select a flow diagram from those provided in the next section. The next step is to select the flow-jumper diagram that shows the layout of the jumpers for your process, and positioning the jumpers and instrumentation as directed.

b. Flow Rate Control:

Changing the flow rate setpoint of the product pump in Automatic mode controls flow rate of product in the system. Flow rate is measured with an inline mass flow meter. The speed of the pump can also be controlled in Manual mode by adjusting the percent output.

Please note that the product pump is a positive displacement pump and should not be "dead-ended". This will prevent failure of the pump stator.

Monitoring and controlling the flow rate of product in the system is critical to conducting a successful process.

Steam Injection Heating & Deaeration:

For Steam injection and deaeration, product flow rate is determined by two pumps, that from product pump #1 and the pump drawing product from the vacuum chamber (product pump #2). The hold time is determined by the flow rate of product pump #1, the quantity of steam injected into the product and the hold tubes used in the system. This product enters the vacuum chamber and is removed by product pump #2.

Product pump #2 is designed for hot products, and will not perform well at temperatures below 160°F (71°C). Changes in product temperature will cause changes in the pump's flow rate because it will seal better in certain temperature ranges. Consequently, the flow rate display is not always accurate. The most useful method to determine the product flow rate is to measure it at the product outlet and to monitor changes in the level of product in the vacuum chamber. The level of product in the chamber should be monitored constantly to prevent the pump from running dry.

Speed of the extraction pump is controlled using the HMI touchscreen. Flow rate is measured by measuring the volume or weight of product exiting the system in a known period of time. It is most useful to use a 1 liter graduated cylinder, and measure the volume of product processed in 30 seconds. Please note that both product pumps are positive displacement pumps and should not be "dead-ended". This will prevent failure of the pump stator.

Indirect Heating:

Indirect heating uses only product pump #1 to determine the flow rate of the product.

c. Hold Tube & Hold Time Control:

Hold tubes have been provided with the system. The internal hold tubes can be used individually or in series. Panel hold tubes and an extended hold cabinet may also be included; See Figure 1 for details on all included hold tubes. Hold times will vary according to the flow rates and tubes used and are given in the section labeled "Flow Rate & Hold Times".

d. Back Pressure Control:

It is necessary to maintain backpressure on the product when product temperatures approach their boiling point in the system. This provides control over product temperature and residence time.

e. Homogenizer Integration

A homogenizer can be placed in the product stream. To connect a homogenizer, the supply line from the desired process location, is connected to the homogenizer inlet. The homogenizer outlet is connected to the return line, which is then connected at the desired position in the jumper panel. Warning: A relief bypass valve must be installed in the product line from the pump supplying product to the homogenizer to prevent the system pump from overfeeding the homogenizer. The product pump must also be operated so that the pressure at the pump exceeds 50psi. This will ensure that an adequate supply of product is provided to the homogenizer.

There are locations in the system's process layout where it is undesirable to place a homogenizer. In general these are the high temperature portions of the process between the final heater and the first cooling step. Locating a homogenizer here extends the time that product is at the maximum temperature and can cause undesirable product deterioration.

Homogenizers are often located immediately following a preheat step. The DIP uses a Seepex positive displacement pump to feed the preheat portion of the system. The homogenizer can be placed between the preheat portion and the final heating step. For steam injection heating at this scale, it is often advisable to remove the homogenizer's outlet pulsation dampener to reduce temperature control problems related to pressure fluctuation.

Homogenizers are also placed immediately following initial or partial cooling steps. For steam injection processes, they can be placed between product pump #2 and cooler #2. The product is

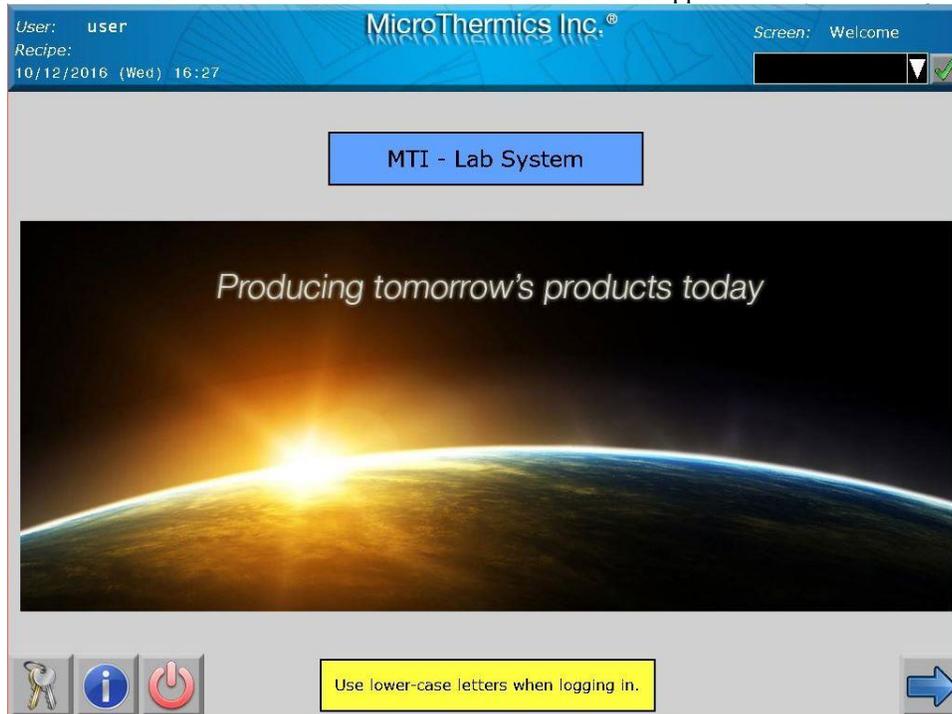
partially cooled in the vacuum chamber and drawn out by the product pump. (A homogenizer cannot draw product directly from the vacuum chamber.)

10. PLC Touchscreen Control

This MicroThermics system uses a PLC Touchscreen for its instrumentation. This allows for computerized controls for the flow rate, both product heaters, and automatic cooling control. This also displays all thermocouple temperatures (product and utility) and product pressures.

START-UP PROCEDURE

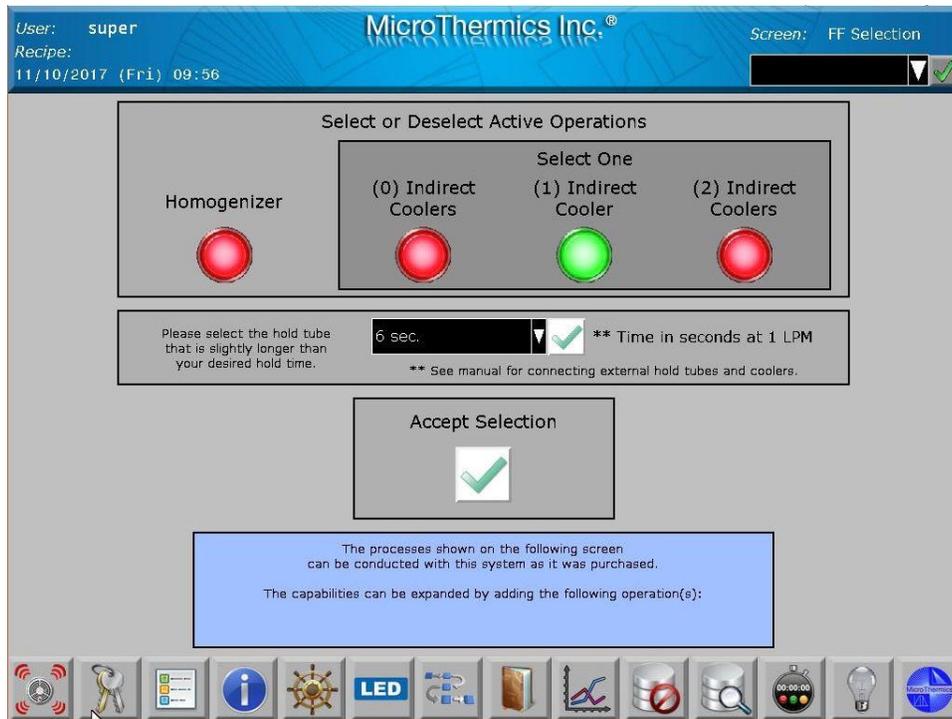
1. Turn the MAIN POWER on. This will automatically turn on the PLC Touchscreen, boot the computer's operating system, and load the PLC control software.
2. Press the Login Manager icon (the button that looks like keys) on the lower-left corner of the screen.
3. Press the black box to the right of "User ID", enter your user name with the keyboard that appears, then press "ENT" to continue. **NOTE:** On start-up, the keyboard will default to ALL CAPS. Press the "CAPS" button for lower-case letters (the "CAPS" button will appear darker when typing lower-case).
4. Press the black box to the right of "Password", enter your password with the keyboard that appears, then press "ENT" to continue.
5. Press "OK", then press the forward arrow (→) on the lower-right corner of the screen to continue.
6. A notice will appear. Read the notice, then press "AGREE" to continue.
7. The first Flow Process Selection screen for Indirect mode will appear.



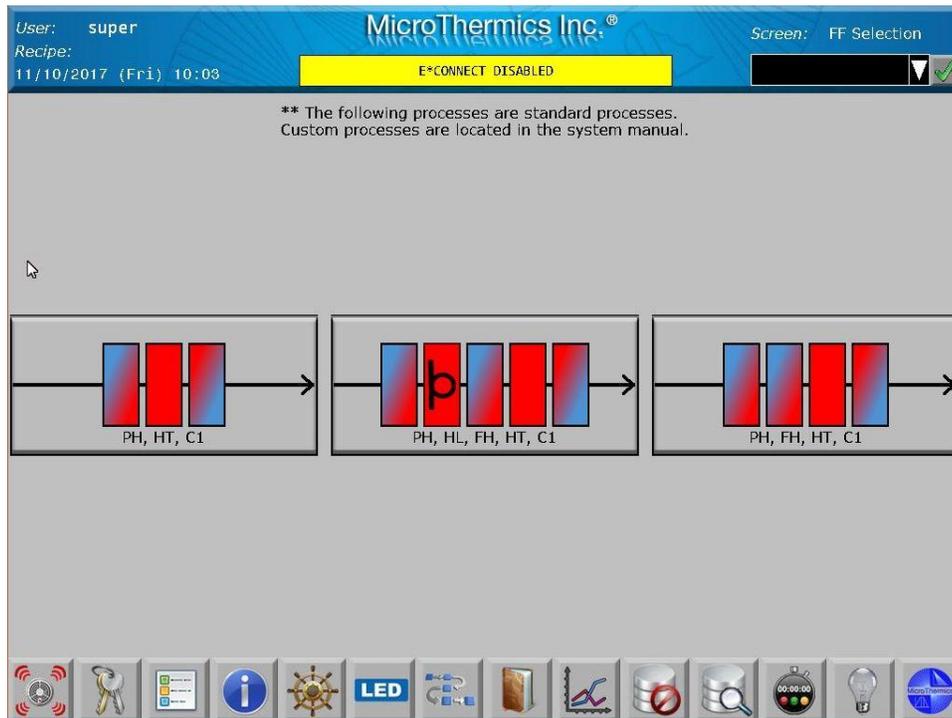
Welcome Screen after Logging In

FLOW PROCESS SELECTION

Upon login, several menus will appear. This will allow you to select the specific process being performed, which in turn will customize the process flow diagram on the touchscreen, and will select the on-screen jumper diagrams specific to your process.

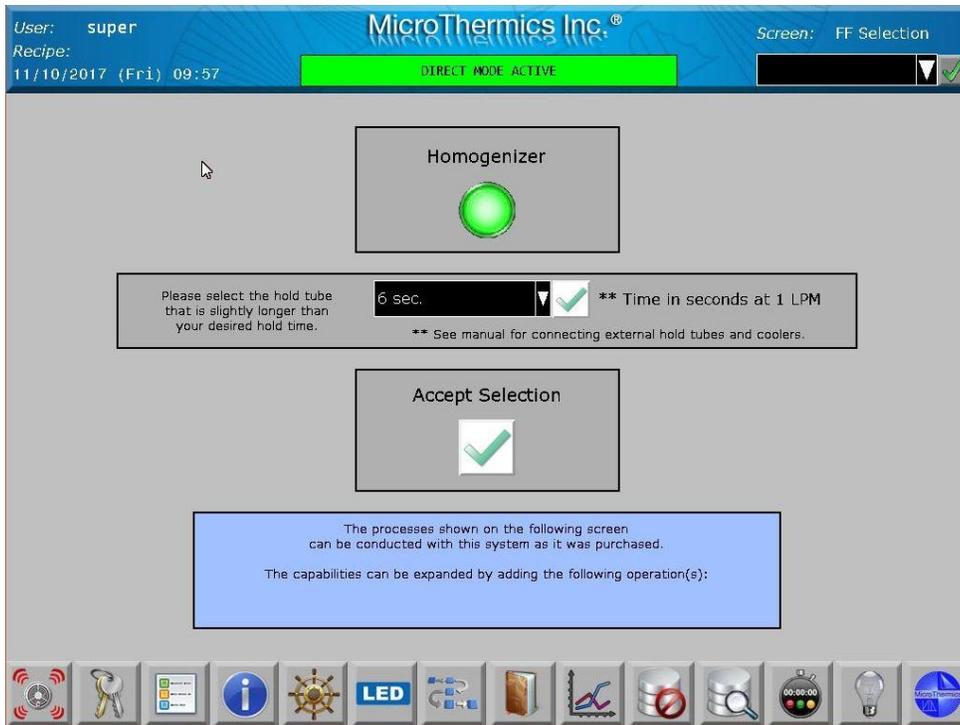


Indirect Process Flow Selection Screen (Coolers, Homogenizer, and Hold Tube)

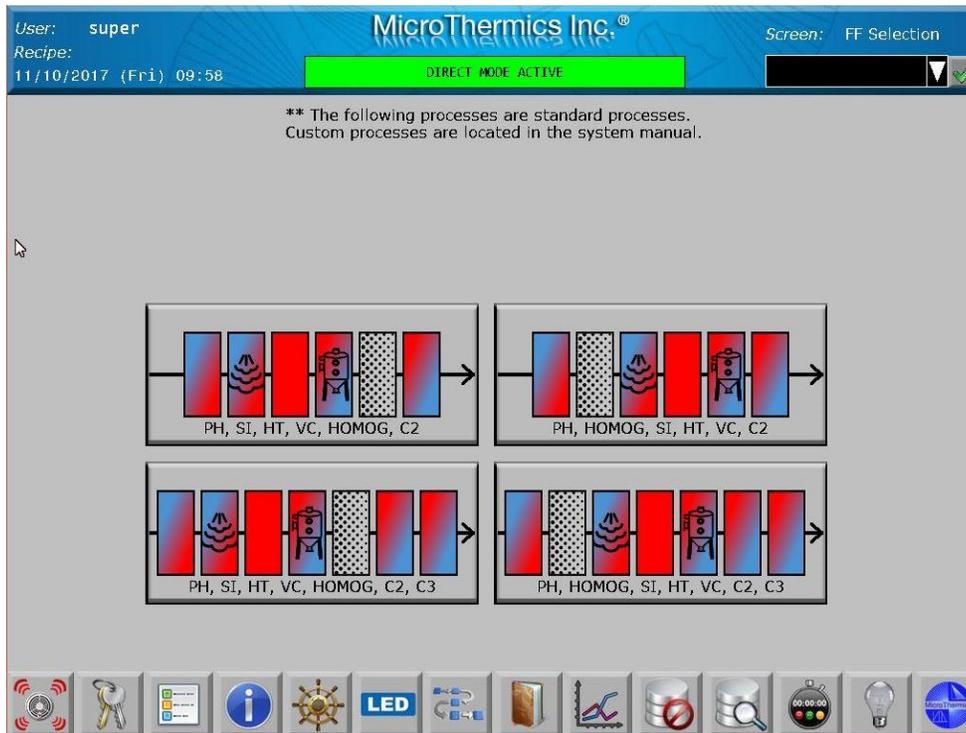


Indirect Process Flow Selection Screen (Component Configuration)

NOTE: The Flow Process Selection will automatically default to indirect processing. To select a direct steam injection process at start-up, press the Control Screen icon at the bottom of the screen (the one that looks like the steering wheel of a boat), press the Mode Select field, and press the “Direct” button.



Direct Process Flow Selection Screen (Homogenizer, and Hold Tube)



Direct Process Flow Selection Screen (Component Configuration)

LEGEND

This system uses buttons on the bottom of each screen to navigate to different sections of the operational program. Each button has an icon, indicating the screen that each button navigates to. A listing of these icons is below. This can also be accessed on the Legend screen.

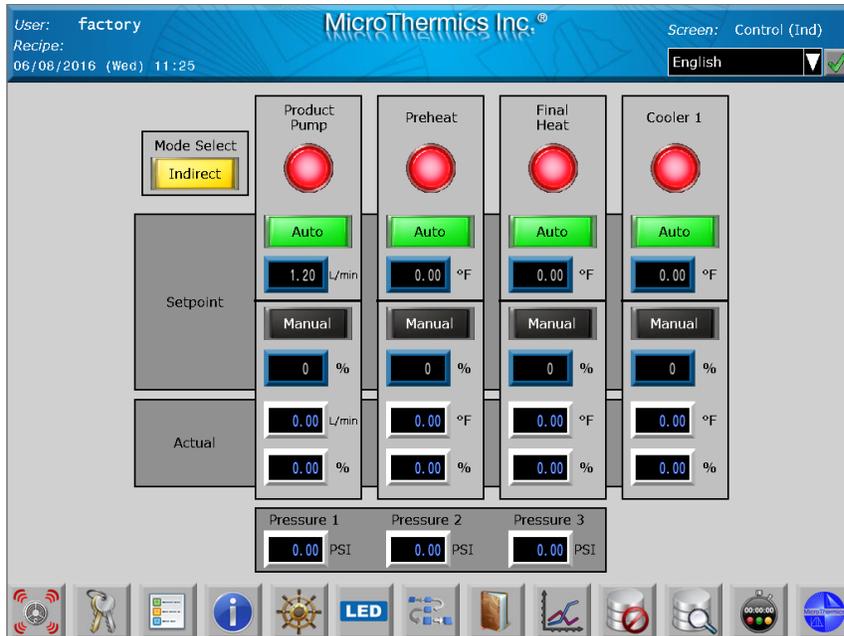
	Go to Alarm Summary Screen		Go to Strip Chart Index Screen
	Go to Login Manager		Data Logging is Enabled
	Go to Legend Screen		Data Logging is Disabled
	Go to General Information Screen		Go to Data Viewer Screen
	Go to Control Screen		Pop-Up Process Timer
	Go to LED Screen		Go to Main Navigation Screen
	Go to Final Flow Screen		Go to Previous Screen
	Go to Recipe Screen		Page/Scroll Up
	Scroll Down		Copy Current Selection
	Acknowledge/Accept		Edit Current Selection
	Cancel/Clear		Delete Current Selection
	Silence Alarm		Zoom In
	Save		Zoom Out
	Refresh Data/Recipe List		Scroll Left in Data/Recipe List
	Transfer from Display to PLC		Scroll Right in Data/Recipe List
	Transfer from PLC to Display		Show Translation Key

	Show Historical Data Display		Green Status/Enable Buttons Indicate an Active State or Running Action
	Show Additional Information Key		Blue Backgrounds Indicate a Number that can be Changed.
	Import from USB/CF Card		White Backgrounds Indicate a Number that cannot be Changed
	Export to USB/CF Card		
	Close Pop-Up Screen		
	Reset Current Alarm		
	Red Status/Enable Buttons Indicate a Stopped State or Stopping Action		
	Yellow Status/Enable Buttons Indicate a Bypass or Reset State/Action		

CONTROLS

Press the Control Screen icon to get to this screen. This screen controls the product pump, both heaters, the automatic cooling control (if applicable). They can be turned on or off and can be placed in automatic or manual mode by pressing the corresponding buttons. To change automatic set points or manual output levels, press the corresponding value, and enter the new value on the keypad that appears.

NOTE: The following pictures may include, or may not include, components not on your specific processor. Please refer to Figure 1 to see all components included on your processor.



Control Screen for Indirect Mode



Control Screen for Direct Mode

LARGE EQUIPMENT DISPLAY

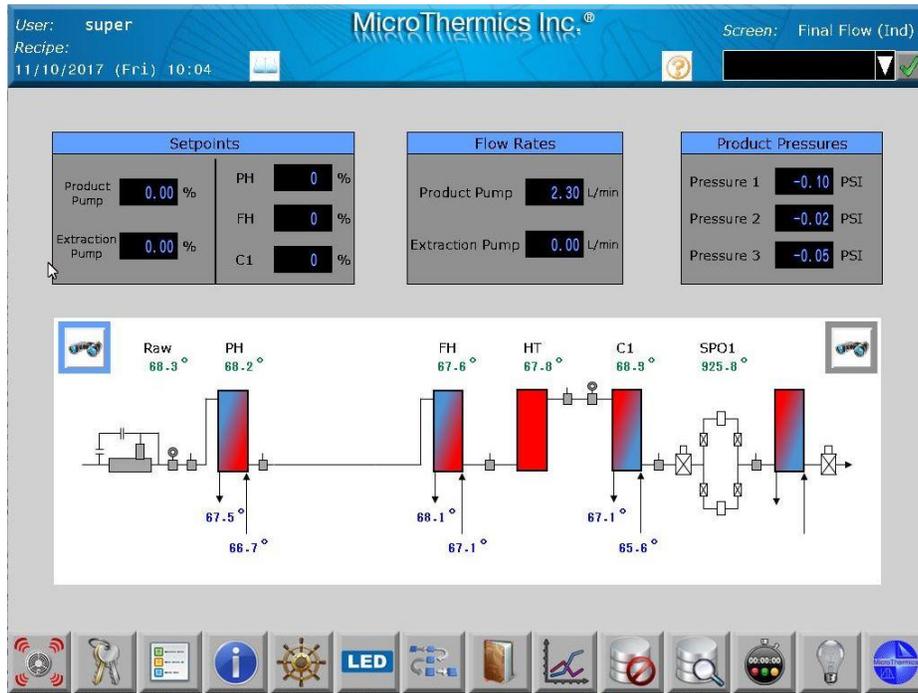
Press the LED Screen icon to get to this screen. This screen displays the current readings for thermocouples and the product pressure sensors.



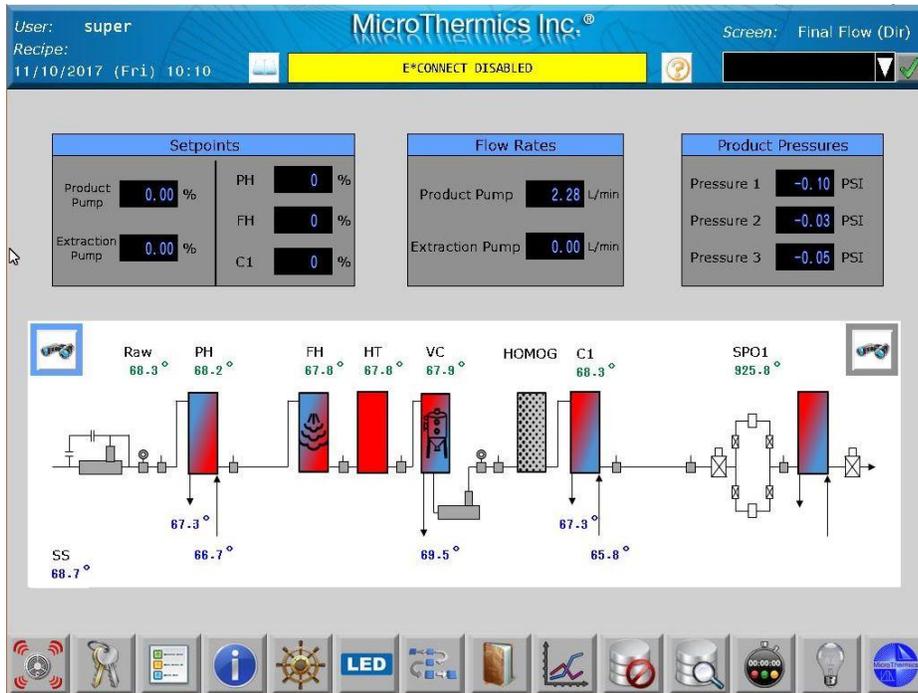
Large Equipment Display Screen

FINAL FLOW

Press the Final Flow Screen icon to get to this screen. This screen displays the flow diagram for the system, as well as thermocouple readings, product pressure sensor readings, and control setpoints.



Final Flow Screen for Indirect Mode



Final Flow Screen for Direct Mode

ON-SCREEN JUMPER DIAGRAMS

By pressing the “binocular” icon buttons on the lower corners of the Final Flow Screen, jumper diagrams for your selected process will appear. The lower left button will show the Product Flow jumper diagram; the lower right button will show the Hold Tube jumper diagram.

The screenshot shows the 'Process Jumper Diagram' window. The legend table is as follows:

Port Name (Translation ID #)
(1) Pump Outlet
(2) Pre-Heater Inlet
(3) Steam To Injector
(4) To Jumper Panel
(5) Product To Injector
(6) Cooler Outlet
(7) Product Outlet
(8) Pre-Heater Outlet
(9) Tubular Heat Inlet
(13) To Hold Tube
(15) From Hold Tube
(16) Cooler Inlet
(17) Tubular Heat Outlet

Final Flow Screen with Product Flow Jumper Diagram (Indirect Mode)

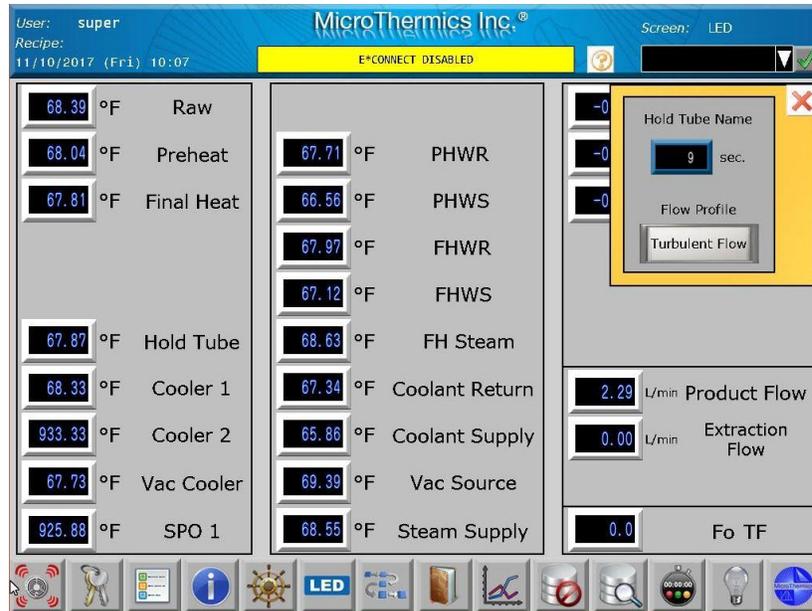
The screenshot shows the 'Hold Tube Jumper Diagram' window. The legend table is as follows:

Port Name (Translation ID #)
(3) Steam To Injector
(4) To Jumper Panel
(5) Product To Injector
(30) Product Supply
(31) EH-1 Inlet
(32) EH-1 Outlet
(35) Product Return

Final Flow Screen with Hold Tube Jumper Diagram

F₀ HOLD TUBE CALCULATION

The touchscreen automatically calculates the F₀ for the hold tube. It does so using set conditions given by the operator, such as the hold tube in use, and the flow characteristics of the product (turbulent or laminar). To change these inputs, press the F₀ field on the Large Equipment Display Screen, and a popup window will appear, allowing the operator to make these changes.



Large Equipment Display Screen with F₀ Popup Window

STRIP CHARTS

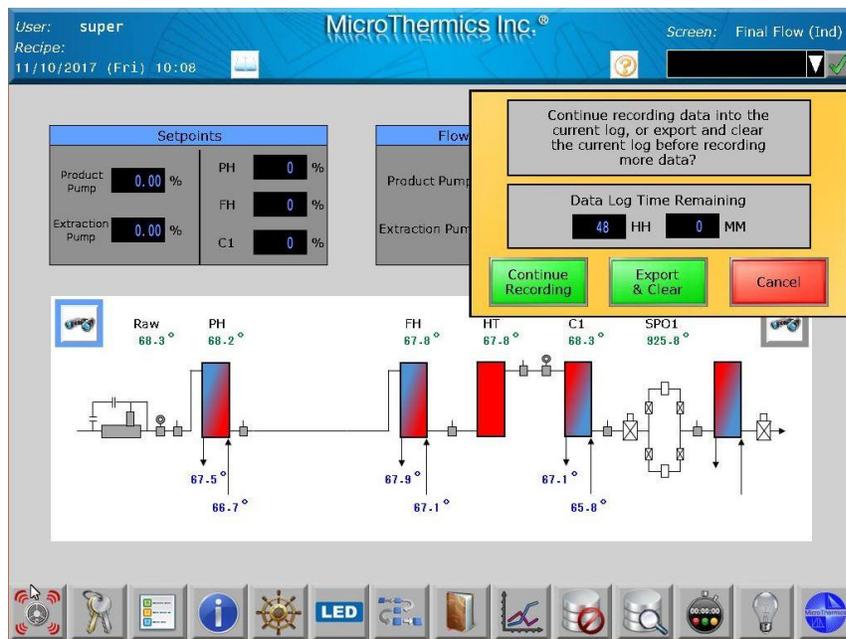
Press the Strip Chart Index Screen icon to get to access these. These are real-time charts showing temperatures, pressures, and flow rates for the processor. Once at the index screen, press the button that corresponds to the chart you want (Product, Preheat, Final Heat, and Hold Tube).



Product Strip Chart Screen

DATA LOGGING

1. When the system is not data logging, the “Data Logging is Disabled” icon will appear at the bottom of the screen.
2. To start recording data, press Data Logging Enabled/Disabled button (the “Data Logging is Disabled” icon).
3. A message will appear, indicating the remaining amount of time on the active data log. There will be three options available:
 - a. **Continue Recording** – Begins recording at the end of the active data log, and returns to the previous screen
 - b. **Export & Clear** – Opens the Data Viewer Screen, where the active data log can be exported and cleared
 - c. **Cancel** – Returns to the previous screen (data logger remains inactive)
4. Press “Continue Recording”. The Data Logging Enabled/Disabled button will display the “Data Logging is Enabled” icon while recording data to the active log.
5. To end recording data, press Data Logging Enabled/Disabled button (the “Data Logging is Enabled” icon).
6. A message will appear, indicating the remaining amount of time on the active data log. There will be three options available:
 - a. **Stop Recording** – Ends recording onto the active data log, and returns to the previous screen
 - b. **Stop, Export & Clear** – Ends recording onto the active data log and opens the Data Viewer Screen, where the active data log can be exported and cleared
 - c. **Cancel** – Returns to the previous screen (data logger remains active)
7. The current data log can be accessed by pressing the Data Viewer Screen icon. Please refer to Section 27 “Reviewing and Exporting Recorded Data” for details.



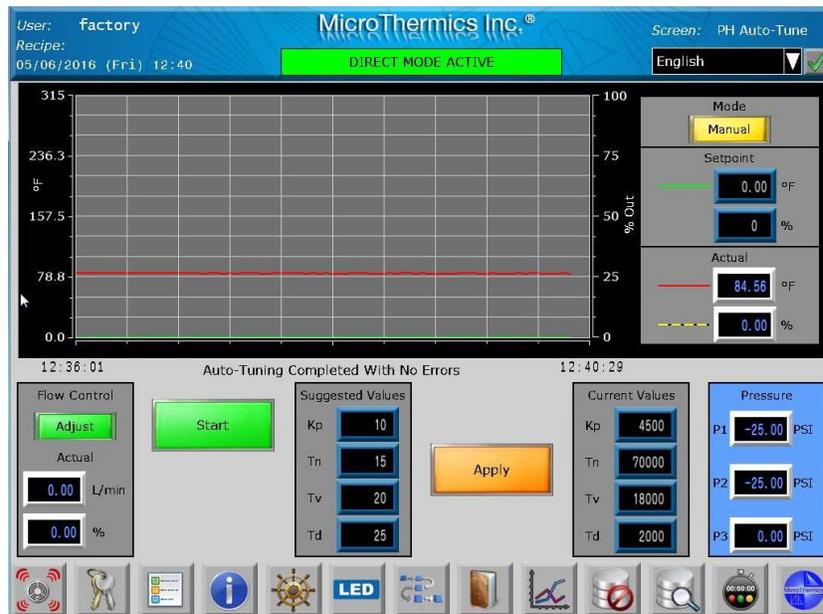
Control Screen with Continue Data Recording Message

SUPERVISOR LEVEL OPERATIONS

The following procedures require supervisor level access. This requires the user to enter the supervisor username and password during login. To access these functions, press the Main Navigation Screen icon (the MicroThermics logo).

AUTOTUNE CONTROL LOOPS (Supervisor Level)

1. If not logged in as a supervisor, press the Login Manager icon, and sign in with supervisor credentials.
2. Press the “Auto-Tune” button.
3. Press the button corresponding with the controller to be tuned (Product Flow, Preheat, Final Heat, and Cooler 1).
4. When the current value is close to the desired set point, press “Start”.
5. When the Auto-Tune is complete, Suggested Values will appear at the bottom-center portion of the screen. Press “Apply” to accept.
6. Tuning values can also be entered in manual in the “Current Values” section of the Auto-Tune screen.



Preheat Autotune Screen

CALIBRATING SENSORS (Administrator Level)

NOTE: Calibrating sensors on the PLC Touchscreen requires calculating the slope and intercept between the input and output of the sensor to be calibrated. These can be calculated on a spreadsheet titled “Calibration Worksheet” on the USB drive accompanying this manual. This calculation requires the observed and actual readings from two data points for the sensor to be calibrated.

1. If not logged in as a supervisor, press the Login Manager icon, and sign in with supervisor credentials.
2. Press the “Calibration” button. The Calibration Index screen will appear.
3. Press the button corresponding with the sensor to be calibrated (Product Temperature, Utility Temperature, and Pressure, and Flow Rates).
4. Press the data field under “Slope” for the sensor you wish to calibrate.
5. Enter the value calculated on the calibration spreadsheet for the selected sensor and press “ENT”.
6. Press the data field under “Offset” for the sensor you wish to calibrate.
7. Enter the value calculated on the calibration spreadsheet for the selected sensor and press “ENT”.
8. Continue for all sensors you wish to calibrate.

When finished, press the back arrow (←) on the lower-right corner of the screen to return to the Calibration Index screen.



Product Thermocouple Calibration Screen

SHUT DOWN PROCEDURE

NOTE: Do not turn off the MAIN POWER before shutting down the data logger.

1. In the Main Navigation screen, press the “Shutdown” button.
2. A message will appear, listing two options:
 - a. **Shutdown Touchscreen** – Closes the HMI application for operating the processor, as well as the touchscreen’s overall operating software
 - b. **Shutdown Application** – Only closes the HMI application
3. Press “Shutdown Touchscreen”. A message will appear indicating that the PC will shut down.
4. When the touchscreen display is completely dark, turn the MAIN POWER disconnect off.

11. Operation of Preheater

Note: The system should be pumping water or product with a back pressure set around 75psi (5kg/cm) at this point. Steam should be off. The coolant and city water should be on. The control air supply should be set to 16-18 psi. The preheat temperature controller should be set to manual operation with 0 output (fully closed).

- A. Set the Preheater Fill/Drain Valves in the filling position (Figure 2). Listen to hear that water is exiting the system to be sure that water has passed through. If no water is heard, check all valve positions and supply status. Turn the Preheater circulator pump on.
- B. After 20 seconds, turn the Preheater circulator pump off.
- C. Set Preheater Fill/Drain Valves in the running position (Figure 2).
- D. Adjust the Preheater Fill/Drain Valves until the Preheat Water Pressure is between 15 and 20 psi. To raise the pressure, partially open the valve on the left; to lower the pressure, partially open the valve on the left. Once 15-20 psi is achieved, set both valves back to the running position.
- E. Turn the steam supply to the system on.
- F. Set the Preheater controller set point to the desired value, and put the controller into automatic mode.
- G. The water pressure in the preheater will increase while heating due to the expansion of water. Do not release the pressure in the preheater utility water loop. This will cause the utility water to boil, which will cause damage to the circulator pump mechanical seal.

NOTE: DO NOT ALLOW HEATING WATER TO EXCEED 265°F (130°C). THIS WILL PREVENT DAMAGE TO SEALS IN THE CIRCULATING PUMP.

12. Operation of the Steam Injection Heater:

Starting Status:

- System should be properly piped and all fittings snugged to prevent leakage.
 - City water, the vacuum pump and cooling should be on.
 - Vacuum control plug valves should be open.
 - The systems cold flow control valve should be open allowing coolant to pass freely through the cooler.
 - Control air supply should be set to 16-18 psi.
 - The main steam valve on the system's valve panel should be closed (horizontal).
 - The "Heater Selection Valve" should be turned to Direct Heating position.
 - The controller should be in manual mode with OT=0.
 - The temperature reading at the controller should be approximately the same as that from the feed system's heater, less heat lost in transit.
-
- A. Set the product flow rate on product pump #1.
 - B. Open the main steam valve on the system.
 - C. Set the feed temperature and place the controller in the Auto Mode.
 - D. Allow the level of product in the system's vacuum chamber to reach the desired level and turn on product pump #2.
 - E. Adjust the speed of product pump #2 to maintain the product level in the chamber as needed. Be sure to monitor the level of the product to prevent running the pump dry or accumulating excessive product.
 - F. Set the feed pressure using the needle valve to the pressure value corresponding to the target temperature in the DIP Steam Table.
 - G. Set the final heat controller OT to 50.
 - H. Open the steam Pressure Reducing Valve (PRV), located behind the left side lower cabinet door, and allow condensate to vent into the chamber.
 - I. Allow the condensate to blow into the vacuum chamber until steam begins to blow into the chamber.
 - J. Turn on the vacuum pump.
 - K. Close the first vacuum control Nupro plug valve. Gradually close the second vacuum control Nupro plug valve until the vacuum is approximately 7"Hg.
 - L. Monitor the steam injected product temperature.
 - M. Adjust the PRV until the product temperature is 5°F (2.8°C) below the target temperature. (The steam pressure will be 1-5 psi (0.07-0.35Kg/cm²) above that of the heated water's pressure read on the feed.)
 - N. Allow the product temperature to stabilize.
 - O. Set the final heat controller's Set Point (SP) to the target temperature.
 - P. Press the Auto/Manual button.

Adjusting Product Temperature Using Steam Injection Heating:

1. Determine the product pressure needed from the Steam Table.
2. To increase temperature, increase the controller's SP and gradually increase the product pressure by adjusting the product backpressure valve at the feed of the vacuum chamber. You may need to open the PRV to supply more steam for improved control if the OT variable exceeds 60-70.

Note: If product temperature drops more than 10°F (5.6°C) across the hold tube, the product pressure may not be sufficient. If this occurs, gradually increase the pressure of the product by closing the backpressure valve slowly. If product pressure exceeds the steam pressure, temperature will drop rapidly and sterility may be lost.

13. Operation of the Vacuum Chamber for vacuum cooling.

Starting status:

- System should be properly piped and all fittings snugged to prevent leakage.
- Put the vacuum chamber's 3-way valve into the running position (handle extending up above the valve).
- Both Nupro vacuum suction valves should be open.
- City water, the vacuum pump and coolant should be on.
- The systems cold flow control valve should be open allowing coolant to pass freely through the cooler.
- Product should be supplied to the steam injector at the desired flow rate and temperature.

- The speed of the system's product pump #2 should be adjusted so that the level of product is maintained at the bottom of the sight glass.
- The main steam valve on the system's valve panel should be closed (horizontal).
- A. Be sure that the clamps on the chamber's flanges are tight and properly sealed.
- B. Turn the vacuum pump on.
- C. Close one Nupro suction valve partially to regulate vacuum from 0-3" Hg.
- D. For more* vacuum and lower product temperature gradually close the second valve until the desired vacuum is reached. The product in the chamber may boil** and its temperature will drop gradually.
- E. Adjust the system's product pump #2 so that the product level remains constant at the bottom of the sight glass.

Note:

*It may be necessary to adjust the valve position for the desired vacuum with hot steam-injected product.

**When increasing the level of vacuum the product in the chamber will boil. Adjust the vacuum slowly enough to allow the product to boil evenly across the surface. If boiling erupts at the center of the chamber, the vacuum is too high and must be immediately reduced (lower number of "Hg). Failure to reduce the vacuum will cause cavitation in the product pump and prevent from pumping.

Operational Concept:

The temperature and concentration of solids in product exiting the chamber is regulated by the level of vacuum in the chamber. More vacuum cools product further by removing more water. Most products are preheated before entering the injector. In general, vacuum cooling the product to approximately 5°F (2.8°C) below the preheat temperature will remove the necessary amount of water. A more precise guide is the temperature drop along the hold tube. If the drop is 8°F (4.4°C), then vacuum cool to approximately 8°F (4.4°C) below the preheat temperature.

14. Operation of the Indirect Heater.

-Starting Status:

- Steam supplied to the system should be turned off at the source.
 - System should be properly piped and all fittings snugged to prevent leakage.
 - City water and the coolant should be on.
 - Control air supply should be set to 16-18 psi.
 - The system's cold flow control valve should be open allowing coolant to pass freely through the cooler.
 - Product should be supplied at the desired flow rate and temperature.
 - The main steam valve on the system's valve panel should be closed (horizontal).
 - Product pump #2 should be off.
 - The vacuum pump should be off.
 - The system's main steam control valve feeding the PRV should be FULLY OPEN (counterclockwise from the top).
 - The heater selection valve should be in the "Indirect Heat" position.
 - The controller should be in manual mode with OT=0.
 - The temperature at the controller should be approximately the same as that from the feed system's heater, less heat lost in transit.
- A. Set the Final Heater Fill/Drain Valves in the filling position (Figure 2). Listen to hear that water is exiting the system to be sure that water has passed through. If no water is heard, check all valve positions and supply status. Turn the Final heater circulator pump on.
 - B. After 20 seconds, turn the Final heater circulator pump off.
 - C. Set Final Heater Fill/Drain Valves in the running position (Figure 2).
 - D. Adjust the Final Heater Fill/Drain Valves until the Final heat Water Pressure is between 15 and 20 psi. To raise the pressure, partially open the valve on the left; to lower the pressure, partially open the valve on the right. Once 15-20 psi is achieved, set both valves back to the running position.
 - E. Turn the steam supply to the system on.
 - F. Set the Final Heater controller set point to the desired value, and put the controller into automatic mode.
 - G. The water pressure in the final heater will increase while heating due to the expansion of water. Do not release the pressure in the final heater utility water loop. This will cause the utility water to boil, which will cause damage to the circulator pump mechanical seal.

15. Product Heater Temperature Control

Temperature of product exiting the product heaters is regulated by automatic temperature control. The thermocouple for the controller should be located in the product stream exiting the heater outlet.

The controller can be operated in either manual or automatic mode. The operating mode of the controller is changed by pressing the button labeled "Manual" or "Auto". The "Manual" will be colored red and "Auto" button will be colored green when in each respective mode.

Under manual mode, the percent heating time can be set manually by adjusting the percent output. This is displayed as the parameter labeled "Manual Output". This value is displayed as a percentage, from 0% (no heating) to 100% (maximum heating).

Under automatic mode, the controller compares the temperature of the product with the target or setpoint temperature. If the product temperature is too low, the controller increases the amount that the steam control valve is open, adding more heat to the product. If the product temperature is too high, the controller decreases the amount that the steam control valve is open, decreasing the amount of heat added to the product. The "Output" variable is directly defined as the percentage that the control valve is open.

The controller maintains constant product temperature using a series of parameters that it determines during a tuning phase. The controller will work well over a fairly wide range of conditions, unless the product flow rate is changed dramatically. Under good control, the product temperature will fluctuate within approximately +/- 0.3°F (0.15°C). If the temperature fluctuates over a wider range, or if the controller cannot reach the setpoint temperature, the controller should be tuned. Be sure the product is flowing constantly and properly pressurized. Adjust the product temperature to approximately 20-30°F (10-15°C) below the desired setpoint, and allow it to stabilize. It is not necessary for it to be extremely stable, only that it is not increasing or decreasing rapidly. The controller is finished tuning when an OT other than 0 or 100 is shown on the lower display.

- a. In manual mode, set OT=50
- b. Adjust the steam pressure reducing valve (PRV) until the product temperature is 5°F (2.8°C) below the target. The steam PRV is the main valve located behind the left side lower cabinet door.
- c. Set the SP to the target temperature value.
- d. Enter the Auto Tune screen for the desired control point
- e. When the current value is close to the desired set point, press "Start Autotune".
- f. When the Autotune is complete, Suggested Values will appear at the lower-left corner of the screen. Press "Apply Suggested Values" to accept.

16. Operation of the Tubular Product Cooler

The system's manual tubular coolers utilize cold flow control valves found on the valve panel. Adjust the coolant flow control valve to vary the amount of coolant flowing through the cooler, and control product cooling. If only slight cooling is needed (trim cooling), adjustments should be very gradual until the desired temperature has been reached. It is often helpful to use city water in place of coolant for trim cooling.

The system's automatic tubular cooler utilizes an automatic control valve, which is controlled using the HMI touchscreen. For more information, please refer to Section 15 of this manual.

17. Start-Up Sequence-ALL HEAT OFF TO START-SEE WARNINGS

Direct Heating In The System

- a. Make sure the system has been thoroughly cleaned (see section 19).
- b. Assemble for operation
 - Select your process & set up jumpers, see "Flow & Jumper Diagrams".
 - Homogenizer Integration-see section 9e.
 - Select Hold Tube-see Section 9c, "Flow & Hold Times" and "Hold Tube Jumper Guide".
- c. Introduce water or the product to the system feeding the final heat portion
- d. Set the product flow rate on product pump #1.
- e. Introduce coolant into the system's product cooler (see Section 16.).
- f. Set up the system's preheating conditions.

- g. Open the main steam valve and allow preheat portion to reach the desired temperature.
- h. Start extraction pump (see section 13).
- i. Start the steam injection heater (see section 12).
- j. If the system's tubular cooler is to be used for trim cooling to temperatures above 212°F (100°C), adjust the product backpressure valve at the product outlet to keep the product from boiling.
- k. If the system's cooler is to be used for trim cooling to temperatures below 212°F (100°C), adjust the main system's cooler to cool the product as needed.
- l. Sanitize or sterilize the system and down-line equipment.
- m. Adjust operating conditions as required for product.
- n. Introduce product into the system.
- o. Speed up product pump #2 to lower the level in the vacuum chamber as low as can be seen and reset the pump speed to the original setting. Monitor product level in the chamber to avoid accumulating product or running dry.
- p. Allow product to rinse water out of the vacuum chamber while adjusting the vacuum level to set the vacuum cooling temperature (see section 13).
- q. Adjust the steam supplied through the PRV gradually if the system is having difficulty controlling temperature. The module will control temperature most effectively with the output below 50%. Tune the controller if needed (see section 15).
- r. Follow product with water as described in steps n-q to rinse product out.
- s. Clean the system before complete shut-down (see section 19)

Indirect Heating In The System

- a. Make sure the system has been thoroughly cleaned (see section 19).
- b. Assemble for operation
 - Select your process & set up jumpers, see "Flow & Jumper Diagrams.
 - Homogenizer Integration-see section 9e.
 - Select Hold Tube-see Section 9c, "Flow & Hold Times", and "Hold & Jumper" diagrams.
- c. Introduce water or the product to the system.
- d. Set the product flow rate on the feed system.
- e. Introduce the coolant into the system's product coolers (see Section 16).
- f. Set up the system's preheating conditions.
- g. Start the system's indirect heater (see section 14).
- h. If the system's cooler is to be used for trim cooling to temperatures above 212°F, adjust the product back pressure valve at the product outlet
- i. If the system's cooler is to be used for trim cooling to temperatures below 212°F, adjust the main system's cooler to cool the product as needed.
- j. Sanitize or sterilize the system and down-line equipment (see section 18).
- k. Adjust operating conditions as required for product.
- l. Introduce product into the system and time it through as it exits the product outlet.
- m. Adjust the steam supplied through the PRV gradually if the system is having difficulty controlling temperature. The module will control temperature most effectively with the output below 50%. Tune the controller if needed (see section 15).
- o. Follow product with water to rinse product out.
- p. Clean the system before complete shut-down (see section 19)

18. System Sterilization*:

*Requires Sterile Product Outlet option (This System is equipped for Sterilization)

Indirect Heating:

- a. Connect the system and pipe for indirect heating with hold tube, coolers as needed.
- b. Setup the Sterile Product Outlet (SPO) according to its instructions.
- c. Place the system faucet above the reservoir allowing the water to run over into the drain.
- d. Execute system start-up, adjusting product flow rate to between 1.5L-2.0L per minute, and preheat product temperature to approximately 210°F at the last thermocouple in the system.
- e. Allow product temperature to stabilize with backpressure set at 50-75 psi with the SPO's needle style backpressure valve (NBPV) located at the SPO outlet. Be sure that the Diaphragm style BPV (DBPV) located between the last cooler and the SPO is open.
- f. Execute start-up for indirect heating, adjusting final heat product temperature from the heater to approximately 275°F.

- g. Turn off the coolant supply with the cold flow control valve on the system.
- h. Monitor temperature of the product at the thermocouple located at the cooler outlet. It should increase to between 250 and 270°F. Do not allow the temperature to exceed 275°F at the last cooler outlet.
- i. Maintain the SPO outlet temperature between 250 and 270°F for approximately 40 minutes for hot water sterilization.
- j. Cool the SPO and the cooler in the system by turning the coolant on at each location. Monitor the cooler outlet temperature until it is below approximately 110°F.
- k. Transfer backpressure control from the SPO's needle valve to the diaphragm-style backpressure valve located between the last cooler and the SPO as follows:
 - Be sure the diaphragm style BPV is completely cool to the touch.
 - Gradually open the needle BPV and close the DBPV, to maintain product pressure between 75 and 100 psi, until all pressure control is with the DBPV. Do not allow the pressure to drop below 50 psi.

Steam Injection Heating:

Operating Concept:

Sterilization of the DIP under steam injection conditions requires sterilization of all components after the hold tube. Sterilizing process piping is relatively simple; however the vacuum chamber requires special attention.

Steam injection system using a needle style backpressure valve can use steam injection to heat the chamber and product pipes sufficiently for sterilization. The chamber must be closed to the vacuum source and out the outside atmosphere so it will fill with steam from the product and heat sufficiently for sterilization. During this procedure, air will be replaced with steam for proper heating.

Sterilization Procedure:

- a. Connect the system and pipe for direct heating with hold tube, coolers as needed.
- b. Setup the Sterile Product Outlet (SPO) according to its instructions.
- c. Place the system faucet above the reservoir allowing the water to run over into the drain.
- d. Turn on the condenser.
- e. Turn off any inline coolers.
- f. Execute system start-up, adjusting product flow rate on product pump #1 to 2 liters per minute, and product temperature to approximately 250°F (121°C) at the last thermocouple in the system.

Heat-Up

- g. Start up the system as described previously, and set product pump #1 to 2 L/min and preheat temperature to 200°F (93°C), and allow the temperature to stabilize.
- h. Set the steam injected product temperature and pressure between 40-50 psi feed steam (see DIP Steam Table) for 260°F (127°C), The controller should be in manual mode at 100% OT. Note: You may need to adjust the PRV down to control temperature properly at this temperature. The steam pressure will 1-5 psi (0.07-0.35KG/cm²) above the required product pressure.
- i. Turn the vacuum pump off, and immediately turn the system's sterilization valve until it is in the sterilize position.
- j. Monitor the level of product in the chamber. Keep the product as low in the chamber as possible. Adjust product pump #2 speed as needed.
- k. Monitor the temperature of product in the chamber. It will increase and stabilize when the target temperature is reached.
- l. Monitor the chamber pressure and temperature. Remember that the product exiting the chamber goes to the product pump. It will cool slightly before it reaches the pump; however do not allow it to exceed 270°F (132°C) as it exits the chamber.
- m. Turn off the system's product cooler.
- n. The temperature of product exiting the cooler will increase and stabilize above 250°F (121°C). The temperature of product at the product outlet (SPO) should also exceed 250°F (121°C). If it does not stabilize above this temperature, gradually increase the product flow of product pump #1 and product pump #2 to carry the heat to the outlet more rapidly.
- o. Allow the system to stabilize and remain above 250°F (121°C) for 40 minutes for sterilization.

Cool-Down

- p. Turn on any inline coolers.
- q. Begin applying backpressure using the Mark 95 backpressure regulator above the vacuum chamber. Turn the valve to the 2/3 closed position. Monitor the inlet hose feeding the vacuum chamber. If it begins shaking excessively, slowly close the Mark 95. This will increase the back pressure, reducing the flashing in the hose that is causing the shaking. Be careful not to add too much back pressure, as this will cut off the steam injection, and the Final Heat temperature will drop
- r. Turn off condenser.
- s. Set the product flow rate to the target flow rate on product pump #1 and adjust the speed of product pump #2 to maintain an adequate level.
- t. Open both vacuum control plug valves.
- u. Slowly, turn the vacuum chamber's sterilization valve to the vacuum position. Do not open this valve quickly. To do so will pressurize the vacuum pump with steam and cause severe damage
- v. Turn the vacuum pump on.
- w. Monitor the product in the chamber. It should boil slightly. If it boils violently into the chamber from the center, close the plug valve slightly to slow the venting process.
- x. Once the valve is completely in the vacuum venting position, adjust the product temperature and pressure for further processing. Note: You may need to adjust the PRV to provide sufficient steam for your process.
- y. Allow the product temperature to stabilize.
- z. Adjust the vacuum to cool the product as needed.
- aa. Adjust product pump #2 speed as needed to maintain the desired level.
Note: If the temperatures after the vacuum chamber are above 212°F (100°C) then apply backpressure with the diaphragm style backpressure valve on the feed system.

19. System Cleaning:

This system was designed primarily for Clean In Place (CIP) using conventional CIP solutions used in the dairy and UHT processing industries. The exception to this is that the chamber must be cleaned manually after CIP and allowed to air dry to be sure it is thoroughly clean. In general, the entire system is cleaned at the same time. Product pump #1 is set near the maximum, product temperature is set to 140-150°F (60°C-66°C). The final heater is turned off and allowed to cool.

Cleaning Following Steam Injection

Rinsing Procedure:

Whenever switching between different products or solutions in the system, it is necessary to speed up and slow down product pump #2 to lower and raise the level of material in the chamber for thorough rinsing. In this procedure, the pump is sped up to lower the level in the chamber as low as possible without running the pump dry, and allows the feed to rinse directly to the bottom of the chamber. Once the feed solution has rinsed from the pipes, the pump is slowed to accumulate the solution and more thoroughly rinse the inside of the chamber. (Note: If the chamber is cool and not under pressure or vacuum, the city water flush can be used to flush excess product to the bottom of the chamber. Pump #2 is used to remove the excess rinse water.) It is then sped up to remove the rinse material, and adjusted to maintain the level near the bottom of the chamber.

Cleaning:

Once the previous product or solution has been thoroughly rinsed out, the level of cleaning solution can be brought up to the middle of the sight glass to help clean the chamber. Be sure to keep the level visible in the sight glass. Maintain the level while recirculating this cleaning solution. After the appropriate cleaning time, rinse the solution out with water using the rinse procedure described above. Then, rinse the water out with the next cleaning solution, reset the level in the chamber as needed for cleaning, and recirculate the second solution as need. Finally, once the CIP procedure has been completed for the system, rinse the solution out with water, shut off pump #1 and drain the water from the chamber with product pump #2. Set the vacuum pump isolation valve to run, so any pressure vents out, and carefully remove the top sight glass and then the front sight glass. Clean the chamber with a plastic abrasive sponge and dish detergent. Use the product pump to drain the chamber and pump rinse water to the supply system's sink. Once the chamber is clean, dry it thoroughly and allow it to air dry. Do not reinstall the sight glasses until they have completely dried.

Cleaning Following Indirect Heating

When used for indirect heating, the system can be cleaned in place.

Dismantling For Inspection

Instrumentation connections for temperature and pressure should be opened and inspected to be sure all materials has been removed.

The steam injector product backpressure valve and steam check valve should be dismantled after cleaning for inspection to ensure that no materials have been retained.

The product pump relief bypass should be dismantled following cleaning to ensure that all material was removed.

Cleaning Solutions

The specific cleaning procedure for any given product must be determined individually. Cleaning following most dairy products can be done with a 25-minute caustic circulation, a 10-minute rinse, and a 20-minute acid circulation, followed by a 15-minute rinse. If, during cleaning, the circulating solution splashes at a product outlet, connect a piece of tubing to the product outlet, placing the other end below the surface of the reservoir. This will prevent splashing of the caustic and acid solutions.

If the product relief bypass valve was in place (homogenizer operation) during operation with product, it should be in place during cleaning. Backpressure should be set high enough (probably 100 psi) during cleaning to ensure that cleaning solutions circulate freely through the valve. It is desirable to disassemble this valve periodically for manual cleaning.

Note: Do not use cleaning solutions using nitric, hydrochloric, sulfuric or other mineral acids. These will damage the product pump.

Note: Do not leave system filled with sanitizers or cleaning solutions overnight or for prolonged periods. This will tend to pit the stainless steel.

20. System Shutdown:

- a. Turn off the system's heaters. Set the Preheat controller to manual mode with the OT to zero and keep the circulator pump operating to allow the system to cool properly.
- b. Close the system's main steam control valve (On the Valve Panel).
- c. Set the Final Heat controller to manual operation and the output to 100, and allows the final heater to cool and steam pressure to drop to zero.
- d. Set the Final Heat controller to manual operation and the output to 0 (zero), after the steam pressure has dropped to zero and the lines have cooled.
- e. For steam injection heating, monitor the level of product in the chamber and adjust the product pump to keep it as low as possible.
- f. Turn the vacuum pump off.
- g. Once the system has cooled, turn off the coolant.
- h. Turn off system's product pump #1 and #2.
- i. Open the product backpressure valve at the product outlet.
- j. Turn off the instrumentation power.

21. Thermocouple Replacement

All thermocouples that are internal to the system are accessed through the removable panel behind the right cabinet door or the access panel on the left end and rear of the system. Thermocouples in product lines are ungrounded type "T" sanitary style. The utility thermocouples are 3mm. They are mounted in 3mm reducers that have been bored through. They are replaced by unscrewing the nut and removing both the nut and thermocouple. The thermocouple is then cut and the nut removed and slid onto the replacement thermocouple. The back-ferule and ferule are then slid into the nut. This entire "assembly" is then slid into the original fitting, and the nut tightened until it is "hand tight". The thermocouple is then adjusted until the tip is in the center of the product stream, and the nut is tightened 3/4 turn using the proper size wrench. Note: It is important to use two wrenches, one to hold the fitting still and one to turn the nut. This will prevent damage to the surrounding piping and fittings.

22. Installation and Removal of the Product Pump Homogenizer Relief Valve

The system's main product pump is a positive displacement metering pump. If it is connected in-line with another positive displacement pump like a homogenizer, either pump could be damaged unless their flow rates are equal or a relief valve is installed between them. The homogenizer relief valve allows the flow rate of the product pump to be more than that of the homogenizer, and allows excess product to be recirculated back to the pump's inlet. This is useful to maintain adequate stuffing pressure for the homogenizer and to maintain pressure to prevent hot product from boiling. The recirculated product is the cold raw product.

Caution:

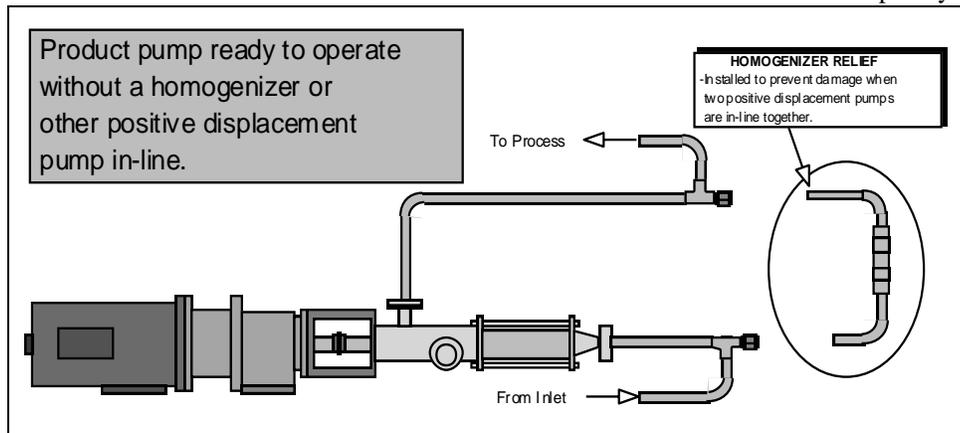
During cleaning, be sure that the product pressure is sufficient to open the product relief valve and permit cleaning. If not, it will hold raw product, which will contaminate other product. It is also desirable to disconnect the side of the valve near the pump inlet to verify that it has opened and flushed clean.

Caution:

Do not stop product flow down line from the main product pump. Stopping flow will cause the relief valve to recirculate product in the pump loop, and product in other system pipes (i.e. heat exchangers etc.) will not flow. This can cause excessive heating, runaway controls (in systems with automatic controls) and plugged heat exchangers.

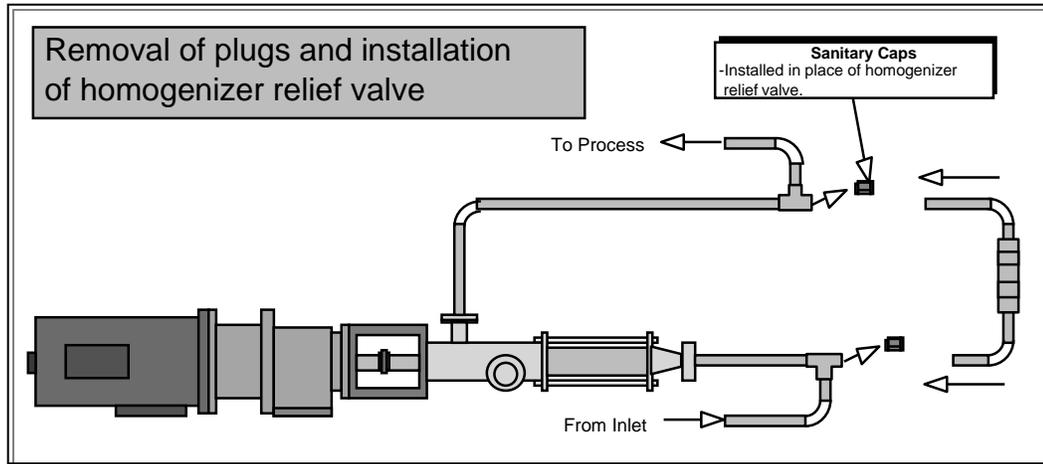
The product pump homogenizer relief valve is installed as follows:

1. Cool all product and utility lines.
2. Relieve all pressure in the product tubes.
3. Turn the system off.
4. Close the product inlet valves.
5. Remove the access panel beneath the sink.
6. Check the orientation of the relief valve to be sure that it installs with the valve completely vertical.

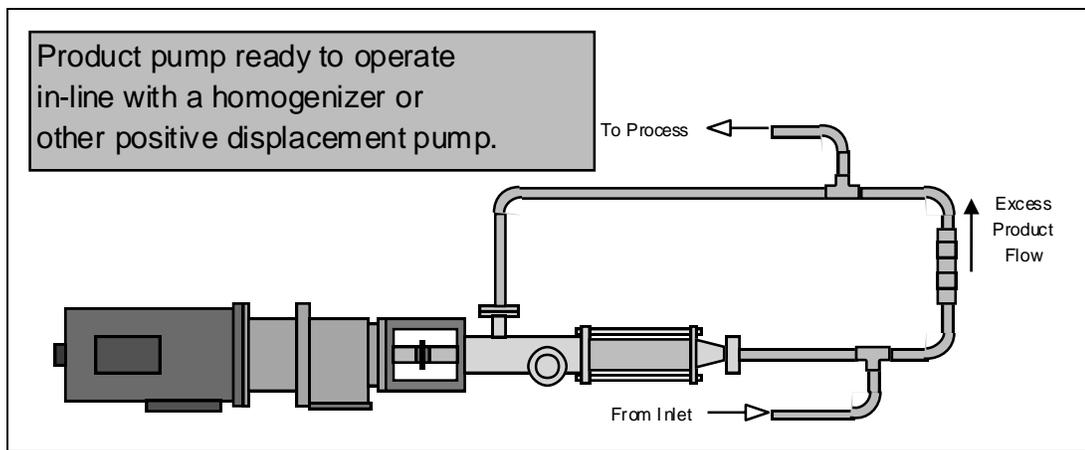


Orient the Relief Valve

7. Remove the plugs from the pump loop "T" connections and install the relief valve.



Remove Plugs & Install Relief Valve



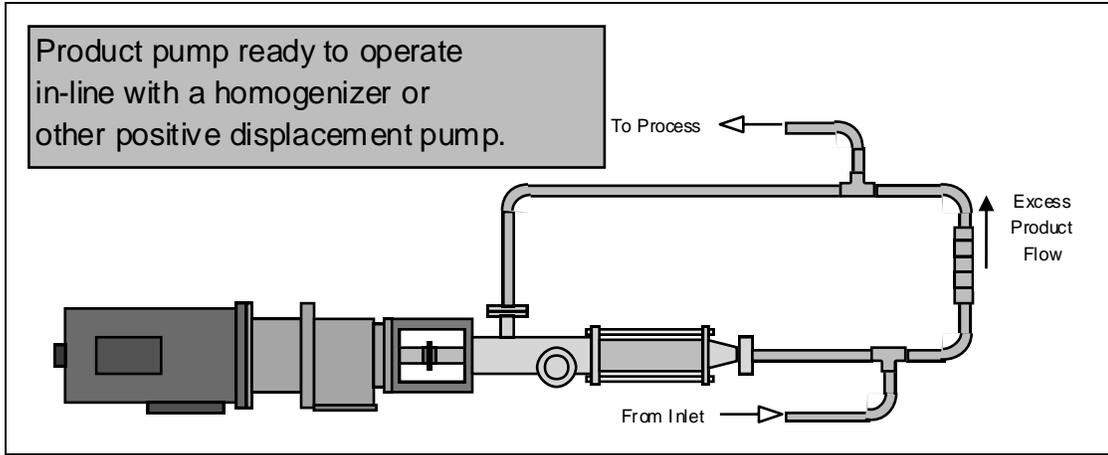
Product Pump Ready for Operation with Homogenizer

8. Be sure to open the product inlet valves before starting the system.
9. Replace the access panel.

Removal of the Product Pump Homogenizer Relief Valve (Operator Procedure)

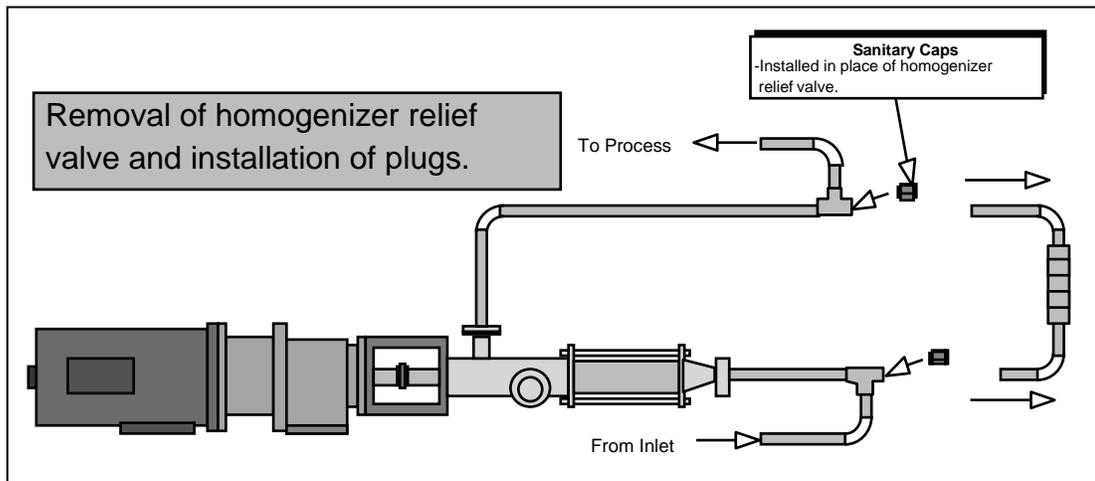
Note: See comments and cautions under "Installation of the Homogenizer Relief Valve"

1. Cool all product and utility lines.
2. Relieve all pressure in the product tubes.
3. Turn the system off and associated equipment off (i.e. homogenizer or any other equipment connected to the main system).
4. Close the product inlet valves.
5. Remove the access panel beneath the sink.

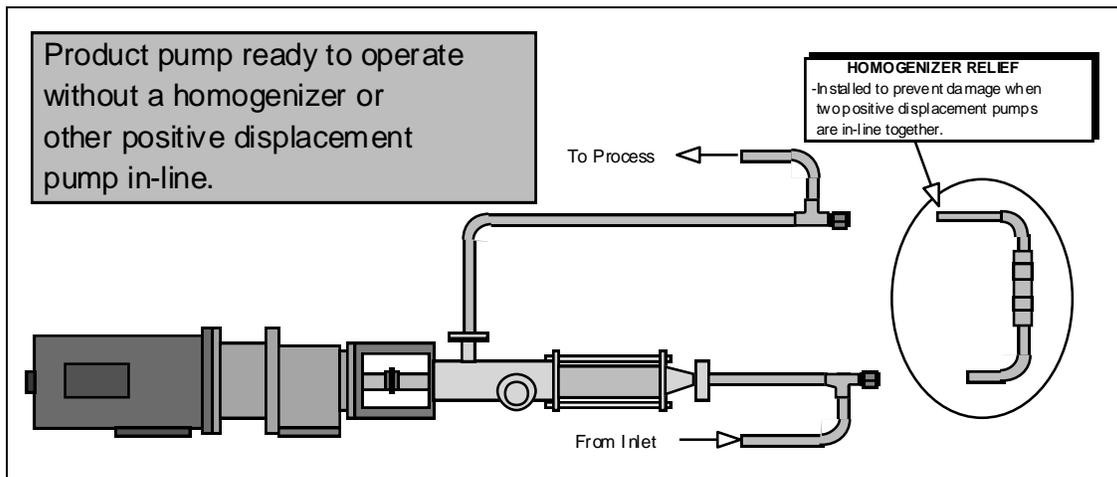


Product Pump Ready for Operation with Homogenizer

6. Remove the homogenizer relief valve and install the plugs in the open "T" connections.



Remove Homogenizer Relief Valve & Install Plugs



Product Pump Ready for Standard Operation

7. Be sure to open the product inlet valves before starting the system.
8. Replace the access panel.

23. Installation and Removal of the Extraction Pump Homogenizer Relief Valve

The system's extraction pump is a positive displacement metering pump. If it is connected in-line with another positive displacement pump like a homogenizer, either pump could be damaged unless their flow rates are equal or a relief valve is installed between them. The homogenizer relief valve allows the flow rate of the product pump to be more than that of the homogenizer, and allows excess product to be recirculated back to the pump's inlet. This is useful to maintain adequate stuffing pressure for the homogenizer and to maintain pressure to prevent hot product from boiling. The recirculated product is the cold raw product. The extraction pump will need a relief valve if it is feeding the homogenizer such as downstream homogenization.

Caution:

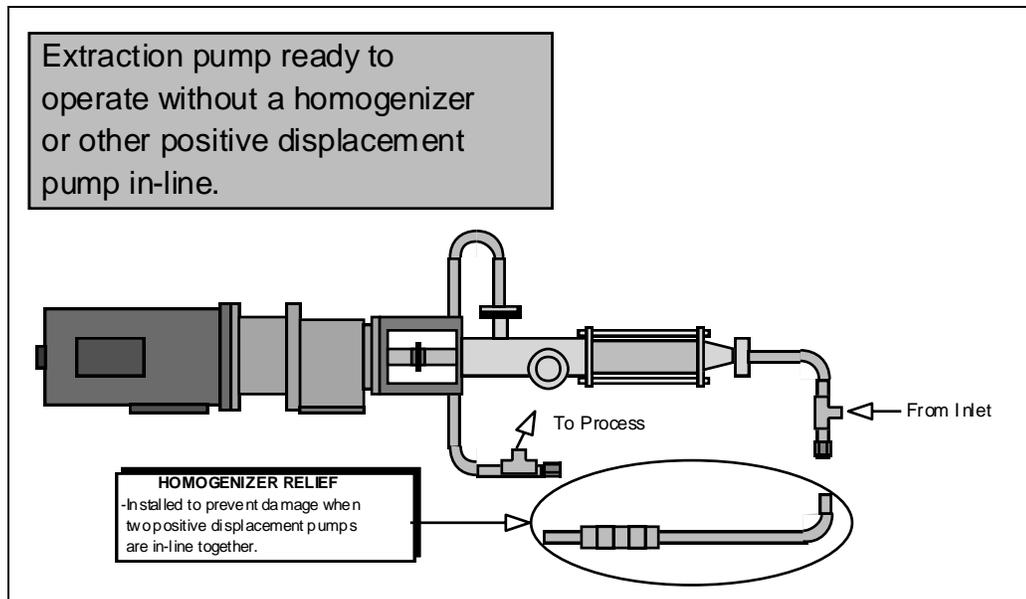
During cleaning, be sure that the product pressure is sufficient to open the product relief valve and permit cleaning. If not, it will hold raw product, which will contaminate other product. It is also desirable to disconnect the side of the valve near the pump inlet to verify that it has opened and flushed clean.

Caution:

Do not stop product flow down line from the extraction pump. Stopping flow will cause the relief valve to recirculate product in the pump loop, and product in other system pipes (i.e. heat exchangers etc.) will not flow. This can cause excessive heating, runaway controls (in systems with automatic controls) and plugged heat exchangers.

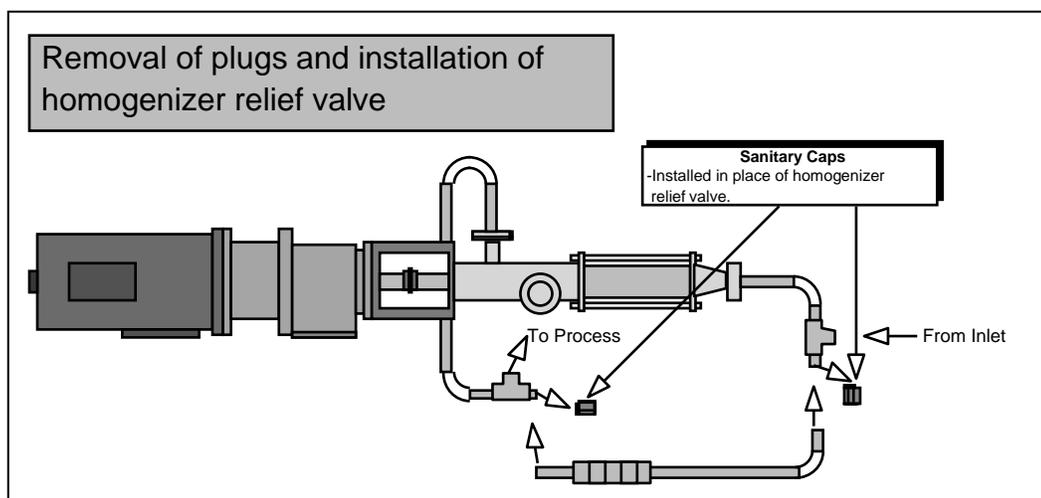
The extraction pump homogenizer relief valve is installed as follows:

1. Cool all product and utility lines.
2. Relieve all pressure in the product tubes.
3. Turn the system off.
4. Close the product inlet valves.
5. Check the orientation of the relief valve to be sure that it installs with the valve in the correct flow path.

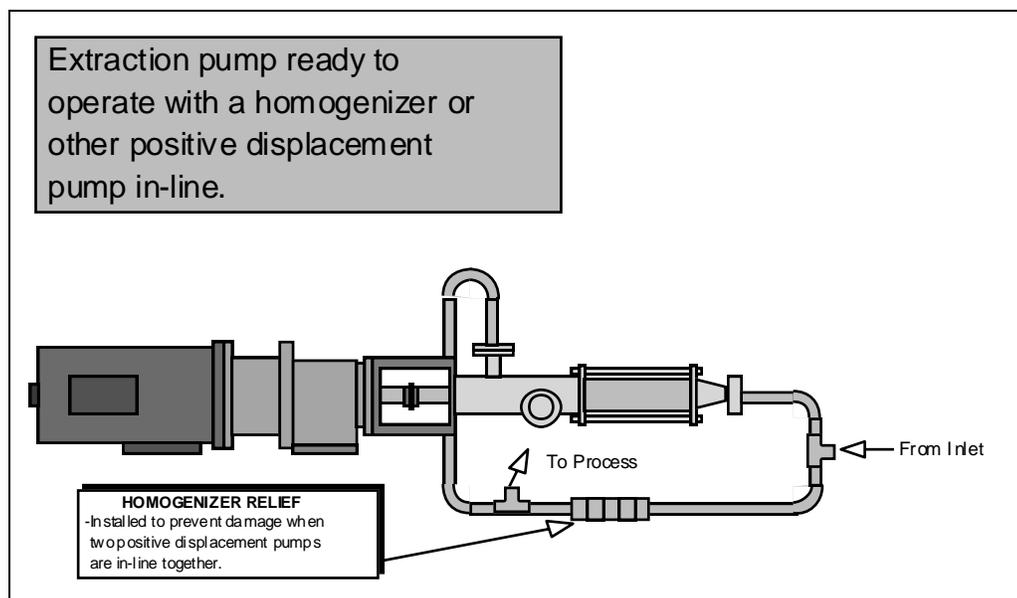


Orient the Relief Valve

6. Remove the plugs from the pump loop "T" connections and install the relief valve.



Remove Plugs & Install Relief Valve



Extraction Pump Ready for Operation with Homogenizer

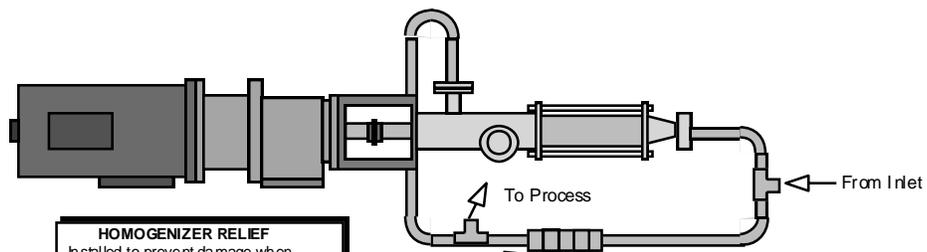
7. Be sure to open the product inlet valves before starting the system.

Removal of the Extraction Pump Homogenizer Relief Valve (Operator Procedure)

Note: See comments and cautions under "Installation of the Homogenizer Relief Valve"

1. Cool all product and utility lines.
2. Relieve all pressure in the product tubes.
3. Turn the system off and associated equipment off (i.e. homogenizer or any other equipment connected to the main system).
4. Close the product inlet valves.

Extraction pump ready to operate with a homogenizer or other positive displacement pump in-line.

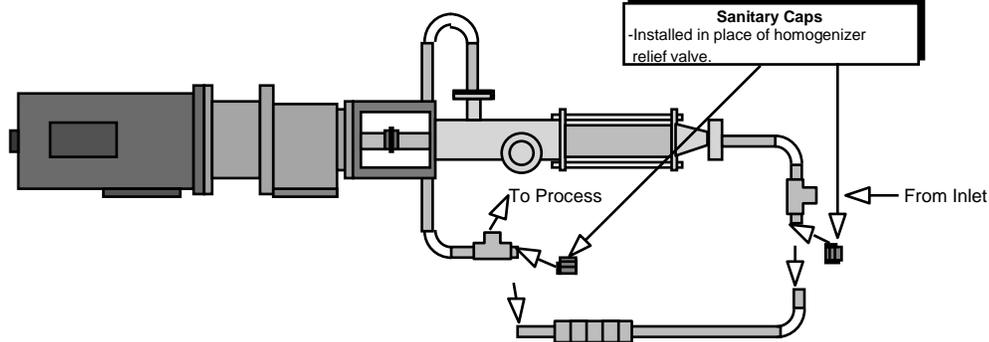


HOMOGENIZER RELIEF
-Installed to prevent damage when two positive displacement pumps are in-line together.

Pump Ready for Operation with Homogenizer

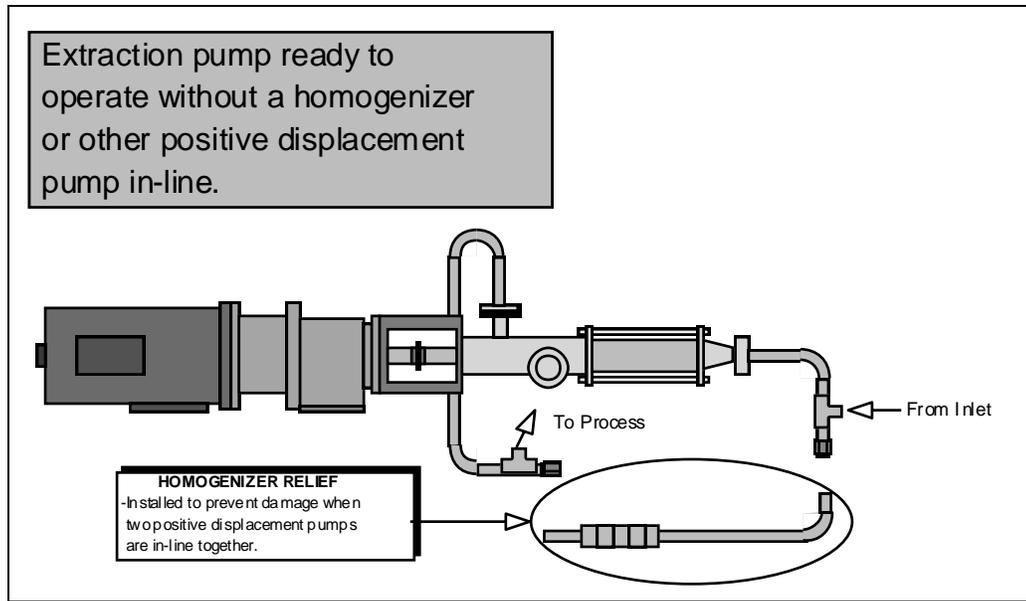
5. Remove the homogenizer relief valve and install the plugs in the open "T" connections.

Removal of homogenizer relief valve and installation of plugs.



Sanitary Caps
-Installed in place of homogenizer relief valve.

Remove Homogenizer Relief Valve & Install Plugs



Extraction Pump Ready for Standard Operation

6. Be sure to open the product inlet valves before starting the system.

24. Pump Stator Replacement (Specifically Designed for Moyno Brand Pumps)

The product pumps used in MicroThermics main processing systems are durable positive displacement pumps. If maintained properly, they are very reliable, and maintain constant flow against changing pressure. The pump consists of the motor, gear reducer, wet end, and speed sensor.

Occasionally, you may wear out the component of the wet end called the stator. This is indicated by a lack of flow or by a significant loss of flow when pressure is applied to the product. The stator can be replaced using the following procedure:

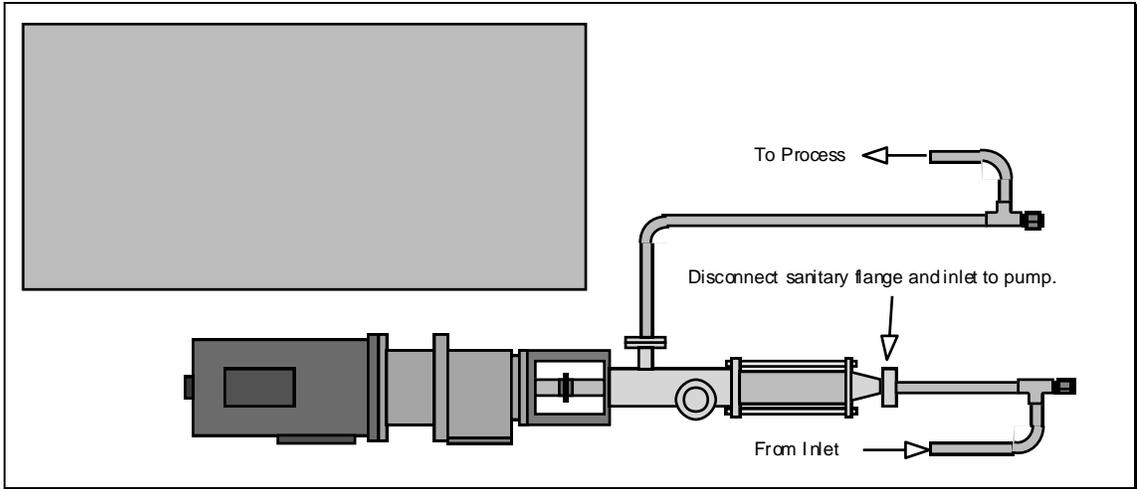
Starting Service Conditions:

- a. All product lines should be at atmospheric pressure.
- b. All product lines should be cool to the touch.

Pump Stator Replacement: (Operator Procedure)

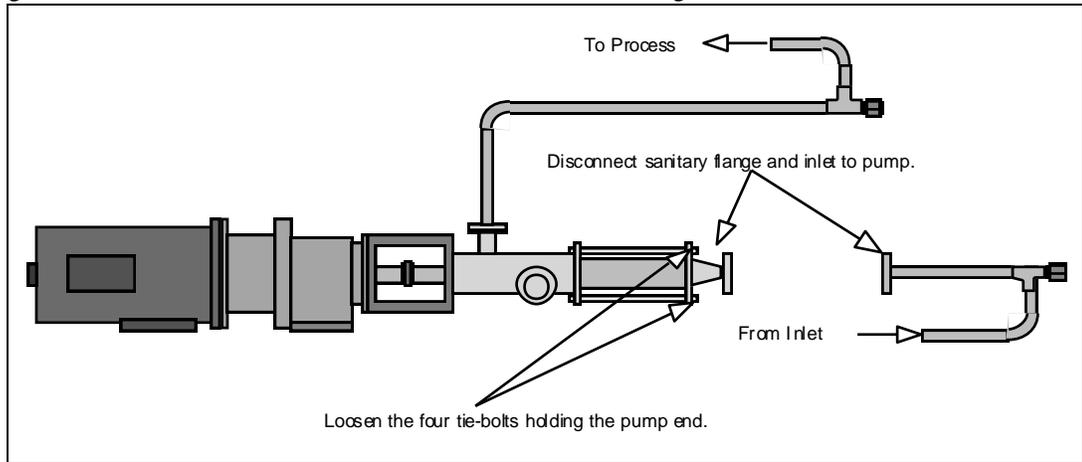
Failure of the pump to maintain constant flow against backpressure, and changing backpressure indicates failure or imminent failure of the pump stator.

- a. Flush all products out of the system with water if possible.
- b. Pump a lubricating solution of dish detergent into the pump.
- c. Turn the product pump and all power off. Be sure there is no pressure in the product lines and all product and utility temperatures are at ambient.
- d. Relieve all pressure in product lines.
- e. Close both inlet valves.
- f. Disconnect the sanitary product line connection at the pump exit.



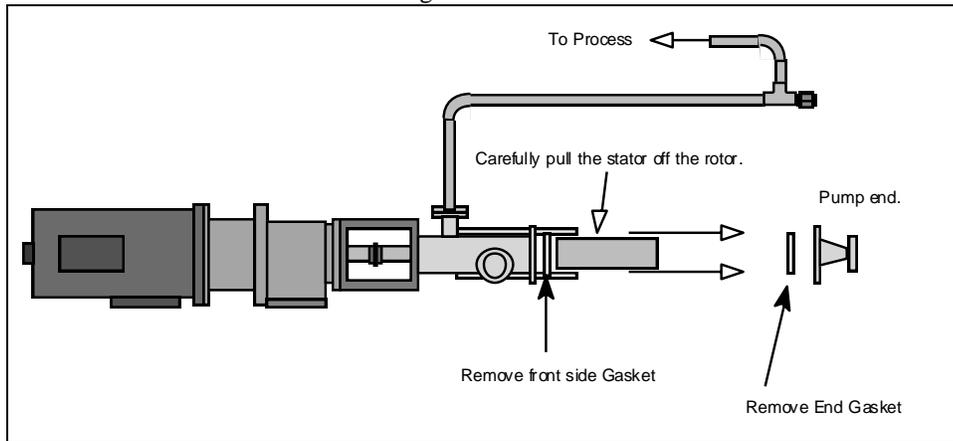
Disconnect the Pump Sanitary Flange

g. Unthread the nuts on the tie rods, and remove the end flange.

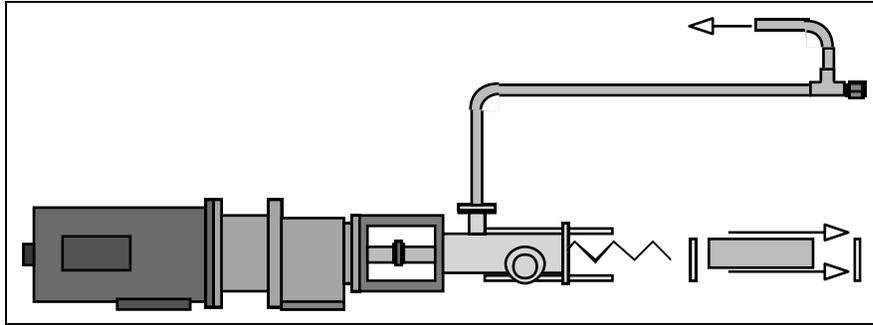


Remove the Sanitary Flange & Loosen the Tie-Rod Nuts

h. Unscrew/pull the stator from the pump body, and pull it off the internal rotor. Also remove the front side and end gaskets of the stator.

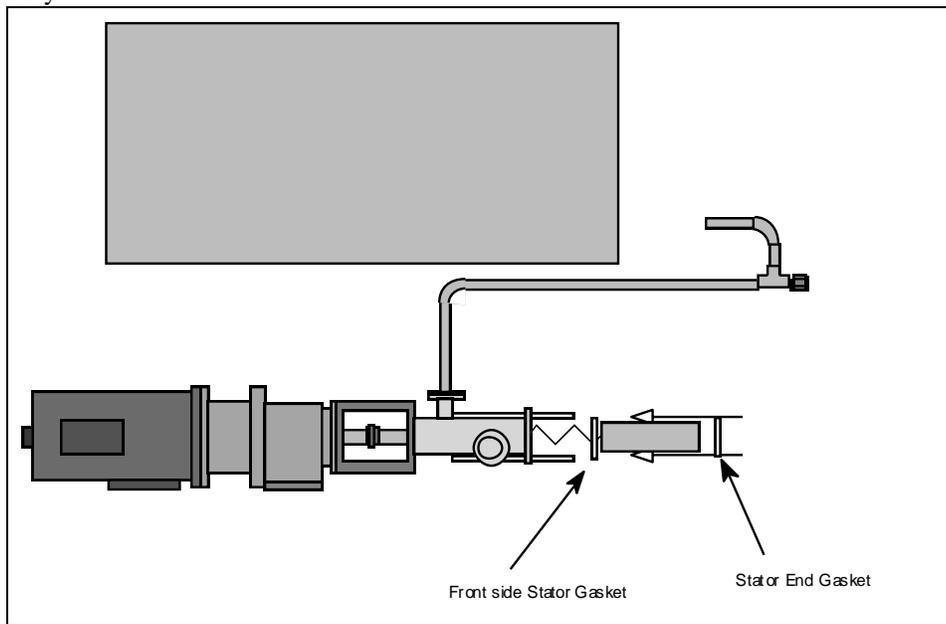


Remove the End Flange



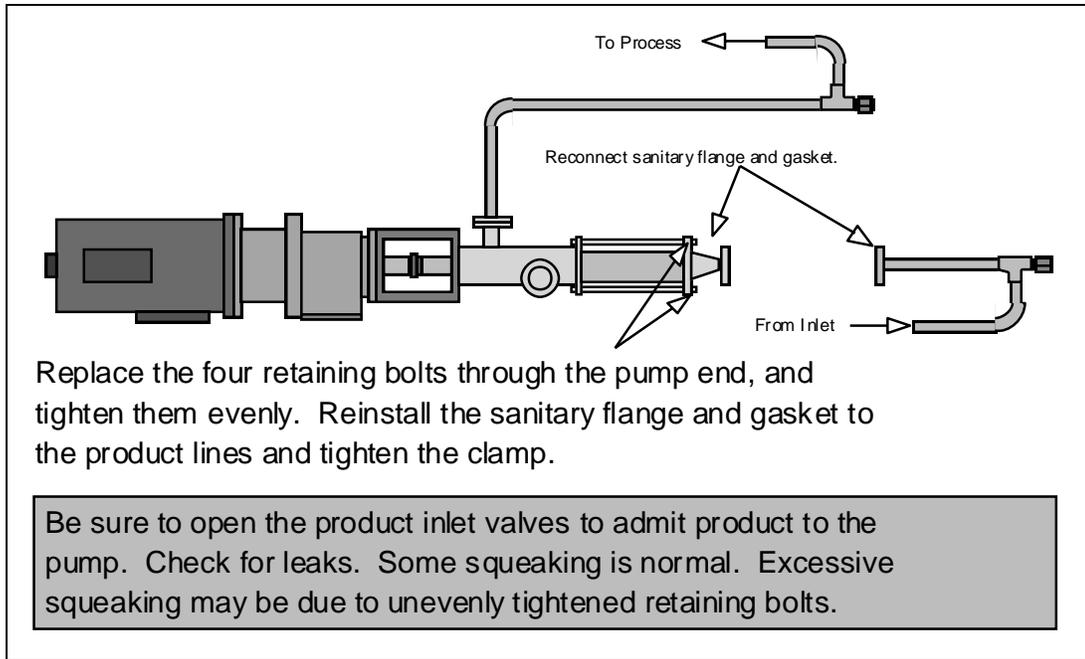
Remove the Old Stator and Replace Stator Gaskets

- i. Lubricate the rotor with liquid dish soap and pushing the new stator on until it contacts the pump body.



Push the New Stator on the Rotor Along with New Front and End Gaskets.

- j. Replace the end flange, and the tie rods.
- k. Tighten the tie rods evenly.
- l. Replace and tighten the sanitary product connection.



Connect the Sanitary Flange to the Process Piping

- m. Open the product inlet valves.
- n. Start the system, and flush the detergent out with water before processing product.
 - New stators tend to squeak, however if it is very loud or persists, there may be too much tension on the tie rods or the tension may be uneven. Adjust the tension to reduce squeaking as needed.

25. Cleaning Solution Compatibility for Product Pump Stators

Following are summary tables and notes that define the use of CIP cleaners with Seepex and Moyno pumps in MicroThermics' equipment. The information in this document is based on MicroThermics' experience, experiments, and pump manufacturer recommendations.

SEPEX PUMP STATORS

Stator Material	Stator Symbol	Temp Limit -Water	Temp Limit -CIP Cleaner	Approved CIP Acids	Damaging Acids -Do not use for CIP
FKM	HC	135° F (53° C)	135° F (53° C)	Phosphoric Sulfamic	Mineral (strong) Acids -Nitric -Sulfuric -Hydrochloric -Hydrofluoric
EPDM	R9	135° F (53° C)	135° F (53° C)	Phosphoric	Mineral (strong) Acids -SEE ABOVE Sulfamic

MOYNO PUMP STATORS

Stator Material	Stator Symbol	Temp Limit -Water	Temp Limit -CIP Cleaner	Approved CIP Acids	Damaging Acids -Do not use for CIP
EPDM	302	180° F (82° C)	155° F (68° C)	Phosphoric Sulfamic	Mineral (strong) Acids -Nitric -Sulfuric -Hydrochloric -Hydrofluoric
FKM	502	270° F (132° C)	155° F (68° C)	Same as Moyno EPDM listed above	

NOTE: Using CIP cleaning chemicals containing acids listed under "Damaging Acids-Do not use for CIP" may cause rapid failure of the pump stator. Exceeding the temperature limit listed above for the pump stators may cause rapid failure of the pump stator.

CAUSTIC (ALKAL) CIP CLEANERS

Caustic (Alkali) cleaners increase the lubricity of water and therefore usually do not cause problems with pump stators. We recommend Ecolab Fastpac 110 as a caustic cleaner.

26. Reviewing and Exporting Recorded Data

Your MicroThermics system has the ability to record data onto a data log within the HMI program. This data log can be viewed on the Data Viewer screen. It can also be exported to a comma-separated values (CSV) file on the hard drive of the touchscreen PC, where it can be transferred to a USB data drive or to another computer via a network connection. The exported CSV file can be opened with most spreadsheet applications for analysis.

1. Press the Data Viewer Screen icon to access the current data log on the HMI program.
2. Press the Save icon to export the current data log to the internal hard drive.
3. A message of “Data export successful!” will appear, indicating that the export is complete.
4. To access the exported data file, access the Main Navigation screen, and press the “Windows Explorer” button to access the Windows OS.
5. The exported data files are automatically saved in the following folder:

a. Documents\Exports\SAMP01\00000

Using Windows, the data can be transferred to a USB data drive. A USB port is on the right side of the electrical console (remove the dust cover to access). If the processor is connected to a network, the exported data files can also be accessed remotely.

The screenshot shows the MicroThermics HMI interface. At the top, it displays 'User: super', 'Recipe: 10/04/2016 (Tue) 15:01', and 'Screen: Data Viewer'. Below this is a data table with columns: Date, Time, PP SP, PP FX, CALC FX, PP OUT, PP RIN, RW, P1, PH SP, PH, PH OUT, and PMS. The table contains multiple rows of data. A large green message box with a red 'X' icon and the text 'Data export successful!' is overlaid on the table. At the bottom of the screen, there is a 'Data Log Time Remaining' section showing '44 HH 9 MM' and a row of navigation icons including a key, a gear, an 'LED' button, and a power button.

Date	Time	PP SP	PP FX	CALC FX	PP OUT	PP RIN	RW	P1	PH SP	PH	PH OUT	PMS
10/04/16	12:19:10	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5110	160.0000	72.1975	0.0000	71.9586
10/04/16	12:19:00	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5110	160.0000	72.1975	0.0000	71.7782
10/04/16	12:18:50	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5000	160.0000	72.3700	0.0000	71.9586
10/04/16	12:18:40	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5110	160.0000	72.1975	0.0000	71.9586
10/04/16	12:18:30	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5110	160.0000	72.1975	0.0000	71.9586
10/04/16	12:18:20	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5110	160.0000	72.3700	0.0000	71.7782
10/04/16	12:18:10	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5000	160.0000	72.1975	0.0000	71.9586
10/04/16	12:18:00	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5110	160.0000	72.3700	0.0000	71.9586
10/04/16	12:17:50	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5110	160.0000	72.1975	0.0000	71.9586
10/04/16	12:17:40	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	72.1383
10/04/16	12:17:30	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:17:20	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:17:10	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:17:00	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.7782
10/04/16	12:16:50	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.7782
10/04/16	12:16:40	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	72.1383
10/04/16	12:16:30	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:16:20	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:16:10	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:16:00	2.0000	-0.0039	0.0000	0.0000	0	0.0000	0.0000	0.0000	72.1975	0.0000	71.9586
10/04/16	12:15:50	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5110	160.0000	72.1975	0.0000	71.9586
10/04/16	12:15:40	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5000	160.0000	72.3700	0.0000	71.9586
10/04/16	12:15:30	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5000	160.0000	72.3700	0.0000	71.9586
10/04/16	12:15:20	2.0000	-0.0039	0.0000	0.0000	0	71.9724	0.5000	160.0000	72.0051	0.0000	71.7782
10/04/16	12:09:55	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5000	160.0000	72.1975	0.0000	71.9586
10/04/16	12:09:48	2.0000	-0.0039	0.0000	0.0000	0	72.1524	0.5000	160.0000	72.1975	0.0000	71.9586
10/04/16	12:09:38	2.0000	-0.0039	0.0000	0.0000	0	72.3315	0.5110	160.0000	72.1975	0.0000	71.9586

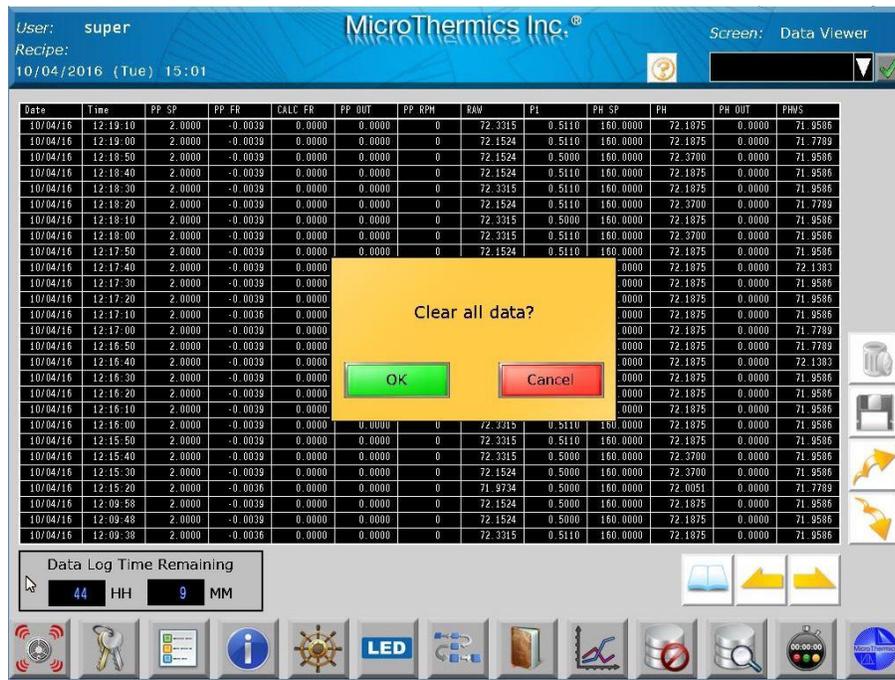
Data Viewer Screen with Data Export Successful Message

27. Purging Recorded Data – SUPERVISOR LEVEL ONLY

The active data log on the HMI program has a data storage capacity of 48 cumulative hours. To ensure full use of the data logging function, the data will need to be periodically exported (see previous section) and purged. Purging data only affects the active data log, and does not erase data files exported onto the touchscreen PCs hard drive. This can only be performed while logged in as a supervisor!

WARNING: PURGING THE DATA LOG PERMANENTLY REMOVES ALL DATA FROM THE ACTIVE DATA LOG. ENSURE THE DATABASE HAS BEEN EXPORTED AND SAVED PRIOR TO PERFORMING THIS OPERATION!

1. Press the Data Viewer Screen icon to access the current data log on the HMI program.
2. Press the Delete Current Selection icon to purge the current data log.
3. A “Clear all data?” message will appear. Press “OK” to proceed.
4. The data entries on the screen will be blank once the purge is complete.



Data Viewer Screen with Clear All Data Message

28. Data Export on the Fly

This system is equipped with a function that automatically exports recorded data and clears the data log once the active data log is full. Data recording resumes immediately following the data log is exported and cleared (the process is nearly instantaneous). To make use of this function, it must be enabled on the touchscreen, and a USB thumb drive must be installed on the equipment.

Caution:

If a USB thumb drive is not inserted into the system, the data logger will perform with normal functionality (i.e. it will stop when the active data log is full).

29. Cleaning of External Surfaces

To clean the stainless steel surfaces of your MicroThermics equipment, use glass cleaner and a cloth or paper towel. To clean touchscreens or other electronic displays, wipe down with a damp cloth or paper towel.

Caution:

Do not clean the external surfaces with a water hose gun or any other pressurized water source. Doing so can cause damage to internal electrical components of the system.

30. Service Reminders

Service reminders will appear on your touchscreen periodically, to alert the operator to replace critical parts (such as pump stators, mechanical seals, and product connection hoses) when they get near the end of their estimated lifespan, or to remind the operator to schedule a preventative maintenance or follow-up training visit from a MicroThermics service technician. If you see one of these reminders and would like to order the recommended part, schedule a visit, or clear the message, please contact MicroThermics (contact information is in Appendix B – Technical Support).

31. Automatic SIP Timer

This system is equipped with an automatic sterilization-in-place (SIP) timer. This is a count-down timer to indicate the time remaining for SIP. This can be accessed on the Control Screen. To change the timer values, login as a supervisor, and access the SIP timer settings on the Main Navigation Screen.



Control Screen with Automatic SIP Timer Popup

32. Operation of Run-Dry Protection

This processor is equipped with run-dry protection for the main product pump. The system will automatically feed city water into the pump upon start-up, and will revert back to water if the flow meter detects an empty sensor pipe, preventing the pump from running dry.

Run-Dry Protection consists of two states of operation:

WATER-MODE: This mode is used during System Setup, Sanitation/Sterilization, and Shut Down, as well as certain failure modes, such as loss of power or compressed air.

1. The system always starts up in water-mode.
2. The utility water shutoff valve is hardwired to always open when the product pump is running, instead of via PLC logic.
3. The divert valve operation is controlled via PLC logic.
4. The operator can switch to water mode at any time via the “Inlet Control” button on the Control Screen,
5. While the product pump is running:
 - a. Run-Dry Protection Active
 - i. Empty Pipe Detection
 1. **RUN-DRY PROTECTION ACTIVE** banner is displayed on all production related HMI screens. (CONTROL, LED & FINAL FIGURE Screens)
 2. PLC logic monitors the “empty pipe” signal from the flow meter.
 3. RDP Watchdog starts timing when an “empty pipe” is indicated, as well as annunciates **LOW WATER SUPPLY DETECTED** via HMI warning banner and intermittent audible alarm.
 4. The “empty pipe” signal must persist, otherwise; the watchdog will restart timing once signal reappears.
 - ii. Low Flow Detection
 1. **RUN-DRY PROTECTION ACTIVE** banner is displayed on all production related HMI screens. (CONTROL, LED & FINAL FIGURE Screens)
 2. PLC logic monitors the analog flow signal from the flow meter.
 3. RDP Watchdog starts timing when flow rate < 0.6 LPM, as well as annunciates **LOW WATER FLOW DETECTED** via HMI warning banner and intermittent audible alarm.
 4. The low flow signal must persist, otherwise; the watchdog will restart timing once signal reappears.

- iii. If the RDP Watchdog times out, PLC logic annunciates **RUN-DRY PROTECTION TRIPPED ... CHECK WATER SUPPLY** via HMI alarm banner and constant audible alarm. The alarm must be reset using “SILENCE HORN” button on the ALARM HISTORY Screen.
- b. Run-Dry Protection Bypassed
 - i. **RUN-DRY PROTECTION BYPASSED** banner is displayed on all production related HMI screens. (CONTROL, LED & FINAL FIGURE Screens)

RDP is not active; therefore, PLC logic does not monitor the “empty pipe” or low flow signals from the flow meter.

PRODUCT-MODE: This mode is used when Running Product and during Cleaning.

1. The utility water shutoff valve is hardwired to always open when the product pump is running, instead of via PLC logic.
2. The divert valve operation is controlled via PLC logic.
3. The operator can only switch to product mode via the “Inlet Control” button on the Control Screen, provided the following conditions are satisfied:
 - a. Product pump is running
 - b. Sufficient flow rate of water (≥ 0.6 LPM)
4. While the product pump is running:
 - a. Run-Dry Protection Active
 - i. Empty Pipe Detection
 1. **RUN-DRY PROTECTION ACTIVE** banner is displayed on all production related HMI Screens. (CONTROL, LED & FINAL FIGURE Screens)
 2. PLC logic monitors the “empty pipe” signal from the flow meter.
 3. RDP Watchdog starts timing when an “empty pipe” is indicated, as well as annunciates **LOW PRODUCT SUPPLY DETECTED** via HMI warning banner and intermittent audible alarm.
 4. The “empty pipe” signal must persist, otherwise; the watchdog will restart timing once signal reappears.
 - ii. Low Flow Detection
 1. **RUN-DRY PROTECTION ACTIVE** banner is displayed on all production related HMI Screens. (CONTROL, LED & FINAL FIGURE Screens)
 2. PLC logic monitors the analog flow signal from the flow meter.
 3. RDP Watchdog starts timing when flow rate < 0.6 LPM, as well as annunciates **LOW PRODUCT FLOW DETECTED** via HMI warning banner. (CONTROL, LED & FINAL FIGURE Screens)
 4. The low flow signal must persist, otherwise; the watchdog will restart timing once signal reappears.
 - iii. If the RDP Watchdog times out, PLC logic automatically switches back to Water-Mode, as well as annunciates **RUN-DRY PROTECTION TRIPPED ... SWITCHED TO WATER-MODE** via HMI alarm banner and constant audible alarm. The alarm must be reset using “SILENCE HORN” button on the ALARM HISTORY Screen.
 - b. Run-Dry Protection Bypassed
 - i. **RUN-DRY PROTECTION BYPASSED** banner is displayed on all production related HMI screens. (CONTROL, LED & FINAL FIGURE Screens)
 - ii. RDP is not active; therefore, PLC logic does not monitor the “empty pipe” or low flow signals from the flow meter.

PARAMETERS FOR FLOW METER: The following changes from the factory default setting were made to enable empty pipe detection for Run-Dry Protection. These changes were performed by MicroThermics at the factory, but may need to be performed on-site in the case of flow-meter replacement (NOTE: Refer to the “Flow Meter - ABB FEH 300 Series” component manual for more details on this operation.

1. Easy Setup
 - a. $Q_{max} = 10.0$
 - b. Damping = 1.0
 - c. Iout at Alarm = Low
2. Input / Output
 - a. Digital Out Mode = Logic/Logic
 - b. Logic Setup

- i. D01 Signal = Alarm Signal
 - ii. D01 Alarm Config → Empty Pipe = ON
 - c. Current Output
 - i. Iout at Alarm = Low Alarm Value
 - ii. Iout at EP Alarm = Low Alarm
- 3. Diagnostics
 - a. Diagnostics Control
 - i. Empty Pipe Detector
 - 1. Empty Pipe Detector = ON
 - 2. Adjust EP – Performs auto-tuning function to detect empty pipe conditions for varying types of products that may significantly differ from water-type conditions.

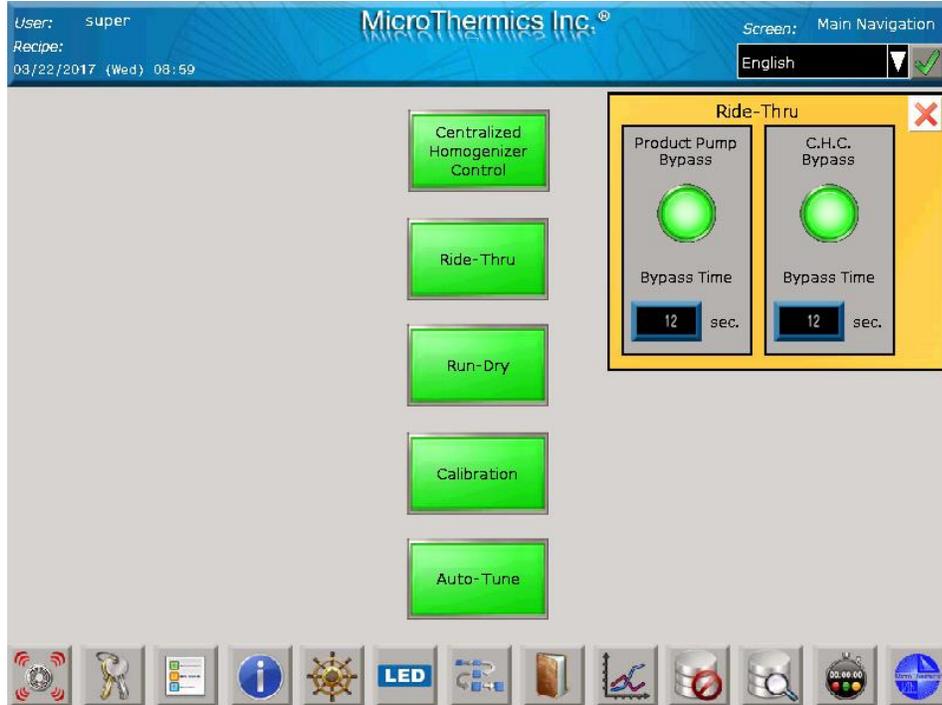
RUN-DRY TIMER AND BYPASS: The default time for the run-dry protection to enable is 5 seconds. This time can be changed, or run-dry protection can be completely bypassed, by pressing “Run-Dry” on the Main Navigation Screen (you must be logged in as a supervisor to access this function).

NOTE: Internal regulators are set at the factory for air and water pressure to allow the run-dry protection system to function properly. If you are having issues, ensure these regulators are set to the following:

- Sampson Control Air = 18-22 psi
- Run Dry Valve Air = 80-90 psi
- Run Dry Water Pressure = 12 psi

33. Ride-Thru Function

The ride-thru functionality prevents temporary abnormalities measured by the flow meter from affecting the integrity of the current process run. This is achieved by maintaining a steady pump speed through these temporary abnormalities. This processor comes equipped with Product Pump and Centralized Homogenizer Control (C.H.C.) ride-thru. These operate identically for their respective pumps, but an MTI processor may include Product Pump ride-thru and not C.H.C. ride-thru.

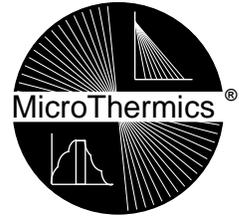


Main Navigation Screen with Ride-Thru Function Pop-Up

1. Turn the MTI processor on and log in as a supervisor.
2. Navigate to the *Main Navigation* screen and press the *Ride-Thru* button to open the Ride-Thru pop-up. Reference Figure 1 below.

3. The ride-thru functionality can be bypassed by pressing the *Bypass* button. The ride-thru status is indicated by the color of the *Bypass* button and is described below.
 - a. Green: Indicates ride-thru functionality is active and not bypassed.
 - b. Yellow: Indicates ride-thru functionality is bypassed and will not engage. Bypassing the ride-thru functionality is not recommended and should be used cautiously.
4. The time that the ride-thru remains active through flow abnormalities can be adjusted within the *Ride-Thru* pop-up.
 - a. It is recommended that this time is greater than the Run-Dry time that is set within the *Run-Dry* pop-up.
 - b. This time can vary between different system types, products, and process conditions.
5. The status of the ride-thru functionality is displayed within the Message Center at the top of the touchscreen. The messages that are displayed are shown below.
 - a. Ride-Thru Bypassed: This message displays when the Product Pump or C.H.C. ride-thru functionality is bypassed. See Figure 2 on the following page.
 - b. Ride-Thru Active: This message displays when the Product Pump or C.H.C. ride-thru functionality is active, but has not yet engaged. See Figure 3 on the following pages.
 - c. Ride-Thru Engaged: This message displays when the Product Pump or C.H.C. ride-thru functionality engages and is maintaining a steady flow rate. See Figure 4 on the following pages.
6. When the ride-thru functionality is engaged, the process flow rate will remain constant through run-dry conditions. If Run-Dry protection is not bypassed, the Run-Dry valve will automatically switch from product to city water to prevent damage to the Product Pump caused from prolonged run-dry conditions.
 - a. Note: Run-Dry protection assumes that city water is always available to the product pump when the processor is operating. For more information regarding Run-Dry protection, please reference your MTI processor's manual.

APPENDIX A



System Warranty-24 months

The system will be fully tested to ensure its safety and proper operation before shipping. MicroThermics System & options shall be free from manufacturing defects for a period of 24 months after arrival to customer's location. If any manufacturing defects appear on the MicroThermics system on non-wearing parts, MicroThermics will provide free replacement parts and labor. Shipping may be charged.

This warranty does not cover consumable/wearing parts. These parts include:

- Mechanical seals & stators on pumps
- O-rings, gaskets, valve seats & seals
- Electrical fuses, heating elements, thermocouples
- Homogenizer wearing parts listed under "Niro Soavi Warranty"
- Clean Fill Hood Filters (pre-filter and HEPA filter)

Service under the warranty may only be used by the original customer and is non-transferable. The warranty does not cover defects or failures due to:

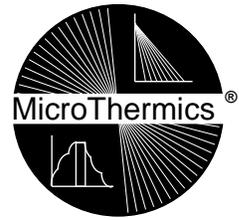
- Processing product failures
- Operation of equipment outside the normal operating parameters of the system
- Faulty installation or irregularity or debris in facility utilities
- Improper set-up, configuration, and/or operation of equipment
- Mismatch of equipment design and attempted process
- Improper troubleshooting of equipment problem

The buyer agrees to pay for all charges associated with repairs required by the buyer if they are found to be not covered by the warranty for the reasons listed above. These charges include; parts, shipping, travel costs and MicroThermics service charges (1 day minimum). Our normal repair services are scheduled at least 2-3 weeks in advance. Emergency service visits are billed at 1.5 times our normal service rates.

Any other warranty is hereby nullified and it is the intent of the parties that there be no other warranties either expressed or implied. MicroThermics will repair or replace components that prove to be defective during the warranty period without charge. The obligation of MicroThermics is limited to such repair.

In no event will MicroThermics or its Distributors be liable for any special, consequential, incidental or other damage (including, without limitation, loss of profit) whether or not MicroThermics has been advised of the possibility of such loss, however caused. This exclusion includes any liability that may arise out of third party claims against MicroThermics. The essential purpose of this provision is to limit the potential liability of MicroThermics arising out of this agreement and/or sale to repair or replacement of the faulty component.

APPENDIX B



Technical Support

MicroThermics provides unlimited, over-the-phone technical support for your system. We have a staff of knowledgeable customer support technicians that are available to answer your questions. For answers to your technical support questions, please feel free to contact us via:

Email: techsupport@microthermics.com

Phone: +1 919 878 8045

Website: www.microthermics.com/services

Please remember that you are our eyes on the process and we rely on your accuracy to provide the best possible support. When you contact us, please help us and have your system model, configuration (i.e. flow diagram), operating conditions and a description of the problem ready. With this information, we have the best way to address your support need.

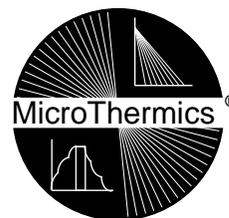
Once you reach out to us with your technical support concerns, we will issue you a ticket number. If follow up is required on your issue, please have this ticket number ready.

If you have an emergency after business hours, call the number above, and follow the prompts for after-hours emergency support. You will be connected with our on-call technical representative. If they do not answer immediately, leave a message, and they will return your call as soon as possible.

Technical support for this system may only be used by the original customer and is non-transferable. Technical support calls should be placed by operators that have been properly trained on the use of your system. MicroThermics cannot provide technical support on systems that are unserviceable, or for clients that have not had their start-up training. Occasionally, a problem will occur that cannot be diagnosed over the phone. These situations will require a contracted visit from one of our qualified service technicians.

In addition to our over-the-phone technical support, MicroThermics offers service visits from our service technicians to your facility. These services include tune-ups, repairs, trainings, and preventative maintenance visits. We also offer spare part support for our systems. For information on these services, please call the number above.

APPENDIX C



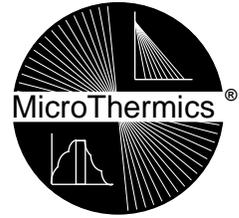
Equipment Safety Compliance

MicroThermics equipment operates at elevated temperatures and pressures to deliver their intended processes. We provide many features to deliver reliable and safe performance. Safety features are included to help protect our clients, their facilities, MicroThermics and our personnel. These include measures that are tested at MicroThermics, and then locked or sealed to prevent tampering, specific installation requirements, and limited access to non-operator areas of the equipment.

MicroThermics is not liable for problems caused by modifications of the equipment that are not outlined in the manual, or operation of the equipment outside those listed in the manual or specified for that specific model. Additionally, MicroThermics has the right to suspend technical support, trainings, and service calls for equipment that has been modified, or operated outside the conditions listed in the manual. If MicroThermics discovers this type of situation, we will notify the user/owner of the equipment in writing along with actions that are required to bring the equipment back into compliance with MicroThermics safety policies.

MicroThermics systems are designed and built to be durable over a wide range of operating conditions. It is unavoidable that eventually, some components will fail and require repair or replacement. A system in disrepair will not operate properly and will prevent efforts to understand or troubleshoot product performance. Operating a system in disrepair can damage other components and endanger bystanders. MicroThermics provides technical support, service calls, preventative maintenance contracts, and stocks spare parts, for overnight shipping, to keep your laboratory operating properly.

APPENDIX D



Recommended On-board Spares

Following is a list of spare parts that we recommend your operators keep with your equipment. The parts in this list are common wear items that will need to be replaced periodically. Having these parts on hand will allow your operators to replace them as they wear out while minimizing downtime.

BASIC ON-BOARD SPARES

Direct/Indirect Processor

Part Description	Part Number	Quantity
Moyno EPDM Stator-High Pressure	4250407304	1
Moyno FKM Stator	4250407502	1
Moyno FKM Gaskets	4230486501	4
Thermocouple, Sanitary, Type T	22196A	1
Thermocouple w/ Ferrules, Type T	1T1XK	1
Plug Valve O-ring Kit	VI-P6T-K2	2
Poppet Kit, 1/2"	SS-3K-CH8-VI	2
Silicone Lubricant and Sealant, Tube	DC-111	1

The parts in this list were provided with the purchase of your system. In addition, a complete set of spare fuses were included with your system. We recommend ordering these parts as you replace them to maintain you on-board stock.

In addition to the parts listed above, we recommend having these additional parts on hand, as these may need to be replaced after years of use:

ADDITIONAL ON-BOARD SPARES

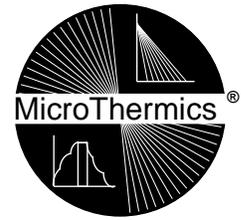
Direct/Indirect Processor

Part Description	Part Number	Quantity
Circ Pump Seal, Low Temp	0553	1
Circ Pump Seal, High Temp	0609	1
Face Seal Gasket	317	2
Back Pressure Valve Diaphragm Kit	PBS4-02-1/2-EEE-KIT	1
Moyno Mechanical Seal	4220457000	1

Please note that this list does not include parts for Niro Soavi Inline homogenizers. These homogenizers come with a kit full of tools and spare parts with them. When a part is replaced on a Niro homogenizer, we recommend ordering a replacement for your stock as soon as possible.

Parts for your MicroThermics processor and Niro homogenizer can be purchased from MicroThermics. For the current price and availability for MicroThermics spare parts, please call us at +1 919 878 8076.

APPENDIX E



Connection and Operation of Bertoli Atomo 3.0 Homogenizer

- A. The homogenizer break (product pump recirculation valve) needs to be placed in-line, and pressure sensors must be located in-line before and after the homogenizer (usually Pressure #1 at the “Product Pump Outlet” port, and Pressure #2 at the “Product Outlet” port).
- B. All utilities (electrical and piston lubrication water) should be on. Lubrication water should be flowing on pistons BEFORE starting the homogenizer.
- C. Homogenizers should be connected as follows:
1. The outlet port of the component that precedes the homogenizer (i.e. Preheater Outlet), connects to the inlet of the homogenizer.
 2. The outlet port of the homogenizer then connects to the inlet port of the next component in the process line (i.e. Final heater Inlet).
 3. High-pressure hoses (included with homogenizer purchase) are used to make the product connections between the main system and the homogenizer.
- D. The operation of the equipment (system and homogenizer together) is basically the same with homogenizers of any brand (although some specific differences will occur and are not covered herein). I have the following notes regarding operation of the Atomo 3.0 homogenizers from MicroThermics:
1. The feed pressure going into the homogenizer (shown on pressure indicator should be maintained between 4.2 and 6 kg/cm² (60-90 PSI).
 2. To turn the homogenizer electricity on, simply turn on the main switch.
 3. To start the homogenizer, push the green key on the keypad.
 4. The homogenizer speed is controlled with the up and down arrows on the keypad on the homogenizer.
 5. You can also input a speed and press the “enter” key and the homogenizer will go to that speed.
 6. The speed is displayed as a percentage output (0% to 100%). Flow rate should be measured with a graduated cylinder and stopwatch (unless an integral flow meter with automatic control is included with the homogenizer).
- E. When a homogenizer is in-line and the homogenizer valves are actuated, pressure in the product flow is controlled as follows:
1. Pressure between the product pump and the homogenizer is controlled by the relative speeds of the two pumps. In other words, the product pump must be running faster than the homogenizer to create positive pressure feeding the homogenizer. In general, the product pump must be run 50% faster than the homogenizer.
 2. Pressure between the homogenizer and the product outlet is controlled with the product back-pressure valve.
 3. When the homogenizer is in-line, but the valves are not actuated, product pressure throughout the product line is controlled with the product back pressure valve.

A full manual was also sent with the homogenizer. It shows how to disassemble the homogenizer and it has a troubleshooting section.

Timing Product through the system

Two Procedures:

Standard system

SPO system

Procedure 1: (Standard Procedure (Non-SPO))

Description

These are instructions describing how to time a product through the system equipped with a single product outlet and apply this time to subsequent batches. This procedure assumes that the system is operating properly at steady state conditions.

Materials Needed: Digital stopwatch.

Processing product into Product Inlet Valve 1

Warnings: Failure to comply with these warnings will damage the equipment.

- A. Monitor product and feed levels to maintain a constant supply to the system.
- B. When working with inlet valves, always open one before closing the other.
- C. Do not close both product inlet valves simultaneously.

Definitions

SRT: System residence time. This is the time product takes to flow from the inlet until it first is observed at the outlet.

FST: Filling start time. This is the time between starting product at the inlet until the proper concentration is reached at the filling port. (Usually $FST=SRT+30$ at 1 LPM.)

EOF: End of filling time. This is the time water takes to flow from the inlet until filling must be stopped or product will be diluted. $EOF=SRT-30$ at 1 LPM.

Procedure

- 1 Verify that Product Inlet Valve #2 is feeding water to the system freely and Product Inlet Valve #1 is closed.

- 2 Flood the hose for Product Inlet Valve 1 and place it into the product reservoir without adding a bubble.
- 3 Start the product into the system, as follows:
 - Without interruption
 - Open Product Inlet Valve 1, and only then
 - Close Product Inlet Valve 2.
- 4 Begin timing the product as it flows through the system with a digital stopwatch.
- 5 Monitor the system's operating conditions.
- 6 Record the time when the product exits the system. This is the system's residence time (SRT). Subtract 30 seconds from the SRT to get the end of filling (EOF) time.
- 7 Wait approximately 30 seconds and check the product for dilution. If the product is at the proper concentration, it is ready to be filled. Add the time it takes until the proper concentration is reached to the system's residence time. This is the filling-start time (FST).
- 8 Flush the filling tube. Allow product to rinse through the outlet for 10 seconds for the first package only. This flushes water out of the filling tube.
- 10 Begin filling the product as needed.
- 11 Monitor the level of product in the vessel supplying Product Inlet 1.
- 12 Switch back to water fed from Product Inlet Valve 2 before air is drawn into the hose for Product Inlet Valve 1 as follows:
 - Without interruption
 - Open Product Inlet Valve 2, and only then
 - Close Product Inlet Valve 1
 - Begin timing the water as it flows through the system.
- 13 Continue to fill until the end of filling time (EOF) has been reached.
- 14 Stop filling and allow the product to continue to rinse out of the system.
- 15 Use the filling-start time and end of filling time for the next batch. Begin timing down from the filling-start time when the next product is started. The product will be at the fill tube when the time expires. Once the feed to the system has been switched to water, time down from the end of filling to for the end of filling.

16 These times can be used only for the system with its current configuration and flow rate.

Procedure 2: Description: (SPO Procedure)

These are instructions describing how to time a product through the system equipped with an SPO/DPO and apply this time to subsequent batches. This procedure assumes that the system is operating properly at steady state conditions.

Materials Needed: Digital stopwatch.

Processing product into Product Inlet Valve 1

Warnings: Failure to comply with these warnings will damage the equipment.

- A. Monitor product and feed levels to maintain a constant supply to the system.
- B. Do not close both product inlet valves, simultaneously.
- C. When working with inlet and outlet valves, always open one before closing the other.
- D. Do not close both product outlet valves, simultaneously.

Definitions

SRT: System residence time. This is the time product takes to flow from the inlet until it first is observed at the outlet.

FST: Filling start time. This is the time between starting product at the inlet until the proper concentration is reached at the filling port. (Usually $FST=SRT+30$ at 1 LPM.)

EOF: End of filling time. This is the time water takes to flow from the inlet until filling must be stopped or product will be diluted. $EOF=SRT-30$ at 1 LPM.

Procedure

- 1 Verify that Product Inlet Valve #2 is feeding water to the system freely and Product Inlet Valve #1 is closed.

- 2 Verify that the product outlet intended for water (outlet A) is open and the one intended to fill product (outlet B) is closed.
- 4 Flood the hose for Product Inlet Valve 1 and place it into the product reservoir without adding a bubble.
- 5 Start the product into the system, as follows:
 - Without interruption
 - Open Product Inlet Valve 1, and only then
 - Close Product Inlet Valve 2.
- 6 Begin timing the product as it flows through the system with a digital stopwatch.
- 7 Monitor the system's operating conditions.
- 8 Record the time when the product exits the system. This is the system's residence time. Subtract 30 seconds from the SRT to get the end of filling (EOF) time.
- 9 Wait approximately 30 seconds and check the product for dilution. If the product is at the proper concentration, it is ready to be filled. Add the time it takes until the proper concentration is reached to the system's residence time. This is the filling-start time (FST).
- 10 Flush the filling tube as follows:
 - Open the product outlet intended for filling product (B), and only then
 - Close the outlet A.
 - Wait 10 seconds, then open outlet A then close outlet B.
- 11 Begin filling through one outlet as follows:
 - Position the package beneath outlet B.
 - Open outlet B and then close outlet A.
 - When the package is filled open outlet A and close outlet B.
 - Replace the package under outlet B.
 - Continue with in this manner as needed.
- 12 Monitor the level of product in the vessel supplying Product Inlet 1.
- 14 Switch back to water fed from Product Inlet Valve 2 before air is drawn into the hose for Product Inlet Valve 1 as follows:
 - Without interruption

Open Product Inlet Valve 2, and only then

Close Product Inlet Valve 1

Begin timing the water as it flows through the system.

15 Continue to fill until the end of filling time (EOF) has been reached.

16 At that time, open outlet B and close outlet A to send water to the drain.

17 Allow the product to continue to rinse out of the system.

18 Use the filling-start time and end of filling time for the next batch. Begin timing down from the filling-start time when the next product is started. The product will be at the fill tube when the time expires. Once the feed to the system has been switched to water, time down from the end of filling to for the end of filling.

19 These times can be used only for the system with its current configuration and flow rate.

PID Auto-Tuning Instructions

Prerequisites

The loop that you want to auto-tune must be in automatic mode. Auto-tune will fail if the loop is in manual mode.

Before initiating an auto-tune operation your process must be brought to a stable state, which

means that the Process Variable has reached setpoint, and the output is not changing erratically.

Ideally, the loop output value needs to be near the center of the control range when auto-tuning is started.

Auto-Tune Sequence

Hint: Record the current PID values as presented on the Auto-Tune screen prior to initiating the Auto-Tune Process.

Firstly from the Auto-Tune index select the control loop that you wish to Auto-Tune.

Change the setpoint using the setpoint input field box on the chosen Auto-Tune screen; the value entered must be a

minimum of 25 degrees above the current temperature. After the value is set, press the 'Start Auto-Tune' button.

This will initiate the Auto-Tune and display "Auto-Tune Active". After approximately 4 minutes, and a successful Auto-Tune, the new PID values will display in the Suggested Values box on the left hand side of the screen.

At this point the new values need to be accepted by pressing the 'Apply Suggested Values' button. This will write the new values

into the PID loop, and display 'Auto-Tune Completed With No Errors'. If any problems arise with the Auto-Tune then an 'Auto-Tune Error'

box will appear on the screen.

In the event of pressing the 'Abort Auto-Tune' button, the process will end and allow the user to attempt another Auto-Tune.

When the Auto-Tune is initiated, the user can at any point press the 'Abort Auto-Tune' button. This will stop the process and the PID control

loop will continue to use the current values.

Tips

Please note that if a process is Auto-Tuned as close to perfect as the algorithm is capable, and an Auto-Tune is initiated, then the values provided after such attempt may be radically different from the current values deployed. Should this occur, do not apply the Suggested Values; rather, perform the following.

In the current PID values, manually input 50% of the displayed value for each of the 4 values. Then initiate the Auto-Tune with the minimum of 25 degrees increase in setpoint as laid out under the Auto-Tune Sequence section.

Upon completion of the Auto-Tune sequence, apply the Suggested Values and operate the system for a few minutes. If the operation's standard deviation is now within parameters, this effort is complete. If the standard deviation is not acceptable, the initiate Auto-Tune, as per original instructions. Once acceptable standard deviation is achieved, you may continue with normal operations.

MICROTHERMICS, INC.
e*Connect™ SERVER IP ADDRESSES



Purpose

This document outlines the server IP addresses that MTI's e*Connect™ service uses, and is intended to be used by the client's IT department. For the e*Connect™ service to function properly, different ports must be opened for an outgoing connection.

Procedure

The following is a list of servers the e*Connect™ software will need to connect to.

NOTE: If the internet connection is established through a Proxy server, then the software will use the TCP protocol. The software will also use the hostname, not the IP address, to connect to the VPN server. The Proxy should allow outbound connections on Port TCP 443 to hostname: *.talk2m.com.

1. Access Server
 - 1.1. Protocol/Port: HTTPS (TCP port 443)
 - 1.2. Address: as.pro.talk2m.com (92.52.111.210)
2. VPN Servers
 - 2.1. UDP port 1194
 - 2.2. TCP port 443
3. VPN Server (Europe)
 - 3.1. Addresses: 92.52.111.211, 92.52.111.208, 87.98.142.151, 188.165.49.240, 46.105.61.41, 87.98.174.164, 87.98.169.126
4. VPN Server (USA)
 - 4.1. Addresses: 50.56.154.220, 208.43.241.76
5. VPN Server (Australia)
 - 5.1. Address: 101.0.90.58
6. VPN Server (Japan)
 - 6.1. Address: 133.242.13.198

The following is a list of servers the e*Connect™ hardware will need to connect to.

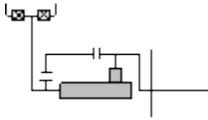
NOTE: Under some circumstances, it is necessary to shift your account from one VPN server to another. If modifications are required to your network to allow outbound connections to one of the IP addresses listed below on either port 443 or port 1194, we recommend allowing outbound connections at this port to all addresses to prevent connection problems if your account is moved or if new VPN servers are added.

NOTE: If the hardware connects through a proxy server, it will use the hostname, not the IP address, to connect to the VPN server. The Proxy should allow outbound connections on Port TCP 443 to hostname: *.talk2m.com. There is no need to encode all VPN server IP addresses on the Proxy server.

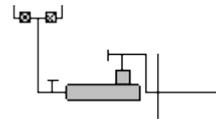
1. Access Server
 - 1.1. Protocol/Port: HTTPS (TCP port 443)
 - 1.2. Address: as.pro.talk2m.com (92.52.111.210)
2. VPN Servers
 - 2.1. UDP port 1194
 - 2.2. TCP port 443
3. VPN Server (Europe)
 - 3.1. Addresses: 94.236.12.2, 94.236.12.0, 87.98.142.168, 188.165.49.241, 46.105.61.42, 87.98.174.179, 46.105.42.131
4. VPN Server (USA)
 - 4.1. Addresses: 50.56.154.221, 208.43.241.77
5. VPN Server (Australia)
 - 5.1. Address: 101.0.90.59
6. VPN Server (Japan)
 - 6.1. Address: 133.242.197.233

MicroThermics Flow Diagram Symbol Key

Dual Product Inlet & Product Pump with Relief Valve



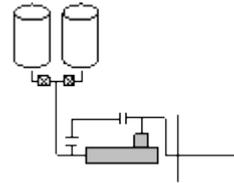
Dual Product Inlet & Product Pump without Relief Valve



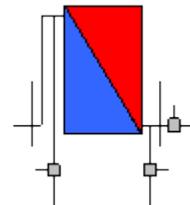
Relief Valve



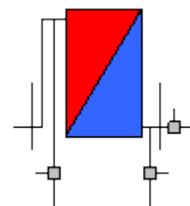
Product Inlet Funnel & Product Pump with Relief Valve



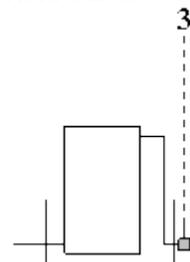
Heater



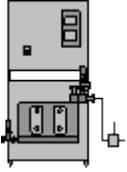
Cooler



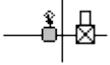
Hold Tubes



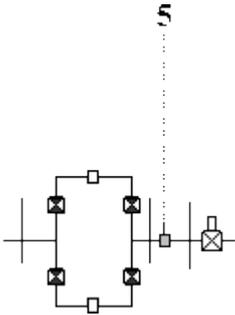
Homogenizer



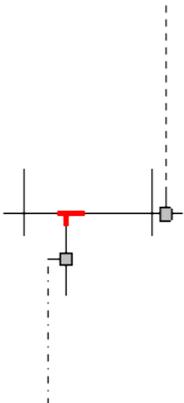
Product Outlet



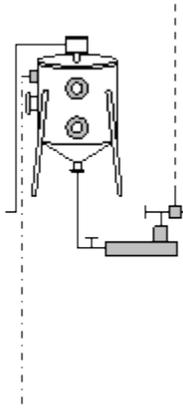
SPO



Steam Injection Heater



Vacuum Chamber with Extraction Pump



Thermocouple



Pressure Sensor (product)



Product Pump



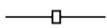
Back Pressure Valve



Jumper Panel Connection



Process Break (Product SPO Outlet)



Product On/Off Valve

