Autoclave

INSTALLATION & OPERATING INSTRUCTIONS

WARNING: A complete understanding of this equipment is required before attempting to operate or maintain the equipment. Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage.

FOR YOUR SAFETY: The equipment should be operated and maintained only by personnel who have read this manual and who have a working knowledge and understanding of the equipment.

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Industrial boiler equipment design and manufacturing excellence for over 85 years.

Proudly made in Danville, Kentucky, USA.

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1. Introduction

This manual is intended as a guide for the installation contractor and as a reference for the operator, owner, and serviceman for the operation and maintenance of the Sellers Autoclave Systems retort autoclave.

The instructions contained in this manual are intended as a guide only and do not supplant any National, State, or Local Codes. This unit must be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installation is made.

This unit is designed to process potentially infectious biological waste. All operators and supervisors should carefully review and understand the instructions and warnings in operating this equipment.

2. Basic Safety Information

Sellers autoclaves are designed and engineered to provide excellent service and to give long life on the job. Although the unit and its components afford a high degree of protection and safety, operation of the equipment is not to be considered free from hazards inherent in the handling of electricity and pressurized hot water or steam.

Pay close attention to WARNINGS and CAUTIONS, as these present situations of potential hazard, and remember no amount of written instruction can replace intelligent thinking and reasoning.

- Autoclave operates at high temperatures (typically 285°F) and can cause serious burns.
- Keep fingers and clothing clear of the locking ring.
- Carts and materials removed from autoclave can remain hot for some time. Hot liquids and steam from contents of cart may also cause burns or injury.
- Observe all hospital rules concerning hazardous waste.
- Sealed containers (ampule type, crimped sealed, screw capped, etc.) or aerosol containers are not allowed to be processed in the unit. Potential of explosion exist with debris that could cause personal injury.
- Always process infectious waste through entire cycle.
- Do not overfill carts. Maximum safe load is 200 lbs. per cart.
- Use caution when using the ramp and carts to prevent slipping, falling, and tripping when loading or unloading carts.

3. Storage, Handling and Placement

3.1 Receiving

Each unit is completely inspected at the factory and carefully packaged for shipment. Upon receipt of the shipment, immediately inspect the unit for signs of damage. Verify receipt of all packages listed on the packing slip. Notify carrier of any shortage or damage. Any such claims should be filed with the carrier. The carrier, not the shipper, is responsible for shortages and damage to the shipment.

3.2 Storage

Storage - Electrical equipment can be damaged if exposed to adverse weather. *The unit must be stored inside.* The electrical panel and controls must be covered with plastic throughout all construction to avoid accumulation of dust and moisture on the controls and load components.

3.3 Handling

Do not pick up vessel with a forklift or wrap slings under the body of the unit. The insulation cover will be damaged, and insulation may shift and cause injury.

Unit should be lifted with lifting eyes on top of unit. It can also be lifted on each end by placing forks under saddle. If special lifting beams are installed between the saddles, then the unit can be lifted by correctly sized forklift.

3.3 Placement

1. Provide a *firm, level* foundation for the unit. Standard autoclaves are not suitable for placement on combustible flooring.
2. Leave a permanent space of 24 inches minimum around unit for access to valves and piping and 36 inches opposite electrical panels.
3. Be sure to keep electrical panels and controls covered while work is in progress.
4. DO NOT USE THE UNIT HOUSING TOP FOR SCAFFOLDING!!
5. The unit may be mounted on concrete foundation using anchor bolts (7/8” holes in saddles – 4 places) as deemed necessary. Typical floor loading under the saddles is less than 10 lbs./sq in. It is recommended that supporting structures be at least 4 times this load (i.e., 40 lbs./sq in)

4. Installation

4.1 Piping Connections

1. Unit piping connections and valves MUST comply with state and local codes, in addition to compliance with the ASME piping requirements.
2. Plumb the relief valve outlet connection full size to the floor drain. Check local codes for proper safety valve discharge for steam above 15 psi which normally must be piped to overhead discharge outside and safely away from personnel.
3. *Cooling water supply* (1" NPT) is connected to the strainer as show on the dimensional diagram. A manual shut off valve (ball valve) is normally installed in line before attaching to unit.
4. Connect the *steam supply line* to the steam strainer (1-1/2" NPT). A manual shut off valve, drip leg, and steam trap with condensate return line (or to drain) should be installed.
5. The *drain line* (1 $^{1}/_{2}$" NPT) should be run to the 4" floor drain and angled into the drain while keeping the required air gap.
6. The *hydraulic pump* may be shipped loose (depending on configuration). If it is shipped loose each connection will need to be reattachment to the hydraulic lines near the vessel door.
7. Some units may have *pneumatic (air)* operated solenoid valves. Check the drawing to determine if the solenoid valves are electric or air operated. If air operated there will be a $^{1}/_{4}$" NPT connection for shop air near the control cabinet. Please provide a regulated, lubricated, and filtered air connection that provides between 80 and 125 psi.

4.2 Electrical Connections

1. *Power Feed Wiring* - The recommended wire size is listed on the WD (Wiring Diagram in Notes section). There are normally 3 electrical connections, and the voltages and amp ratings are shown on the WD. The typical system will have a 480 volt /3 phase /60 HZ (can be 208 or 230V) connection for the vacuum pump and hydraulic pump and a 120 Volt / 1 Phase / 60 HZ connection for the controls. The manufacturer recommends copper wiring for all power connections.
2. *Equipment Grounding Conductors* - The unit is equipped with grounding lug(s) inside the power panel(s). The grounding conductors must be installed and sized in accordance with current publications of the NEC.
3. *Control Wiring* - Alteration of or additions to control wiring will void the manufacturer's warranty. Field-installed controls and modifications (other than shown in Factory Wiring Diagrams) must be approved in writing.

5. PRE-START UP INSPECTION

5.1 Mechanical System Checks

Check plumbing connections for correct connection and leaks.

- Cooling Water
- Steam Inlet
- Drain
- Compressed Air (if needed)
- Hydraulic Lines for Door

5.2 Electrical System Checks

- Check electrical panels for loose material, dust and/or moisture. Clean as needed.
- Primary system voltage should be verified
- Vacuum pump wired, checked for proper rotation (arrow on housing)
- Hydraulic pump wired, checked for proper rotation. (arrow on housing)
- Control voltage correct (check before turning on power to control cabinet)

6. Initial Startup Instructions

The autoclave system is fully automatic during normal operation but, requires a knowledgeable technician to test the controls before applying steam to the unit. Each valve should be tested to confirm proper operation.

Briefly turn each valve on to test the system for leaks before attempting to run a full cycle. The manual controls are accessed by a pass code. The PLC uses a touch screen panel to display parameters and allow testing and operation.

The first PLC is the “Start Screen” (see Photo #1) shown below.

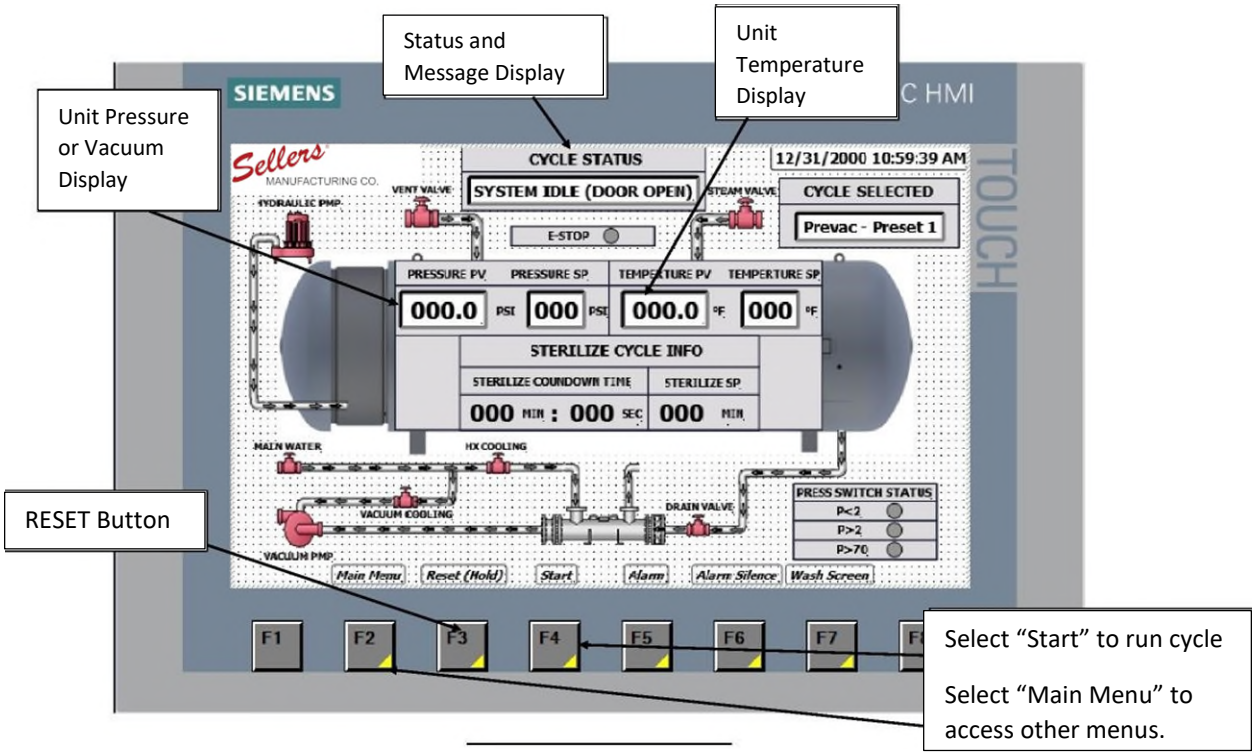

Photo #1 Start Screen

To access detail menus for testing and initial startup press the “Main Menu” button. Enter the access code and press the enter key (down and left pointing arrow). The “Main Menu” screen will be displayed (see Photo #2).

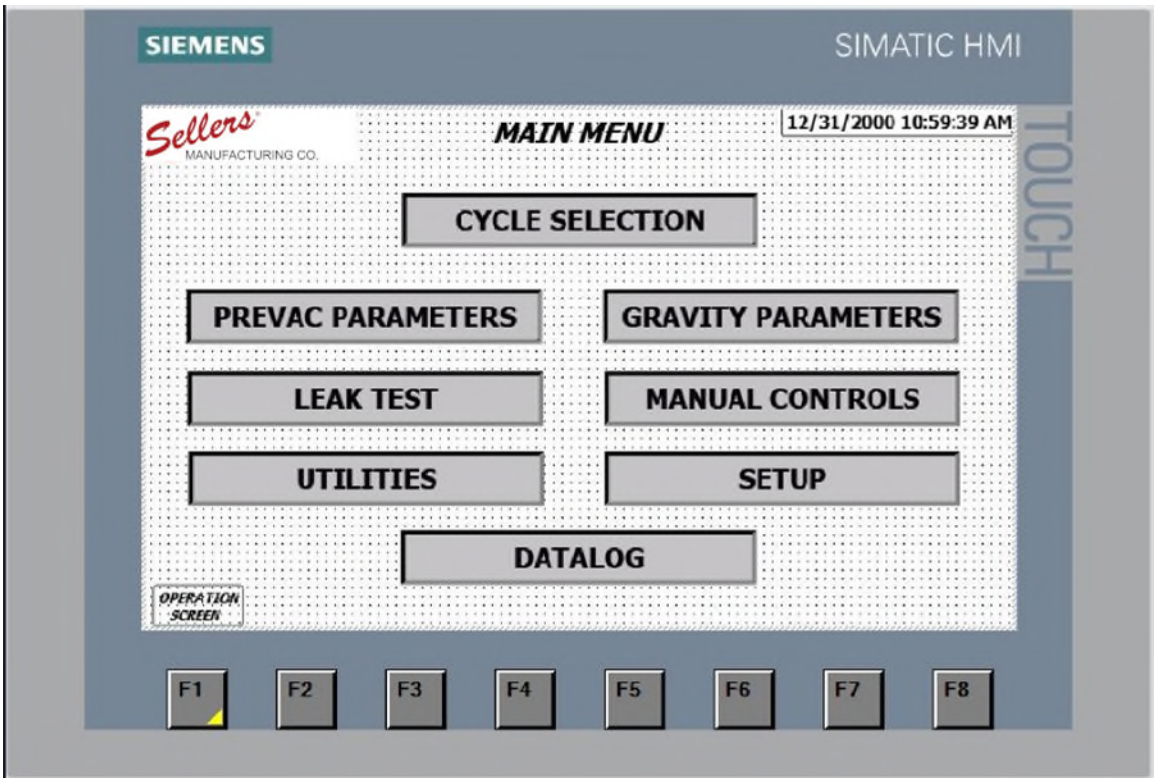

Photo # 2 Main Menu

Select “Manual Controls” button to allow manual testing of all valves. The manual control screen will appear (see Photo #3).

By pressing the buttons on the appropriate device, the item will turn on or off. Each device including the vacuum pump and hydraulic pump can be tested. Status of all inputs is also shown on this screen.

Press the “F1 Main Menu” button to return to the main menu screen.

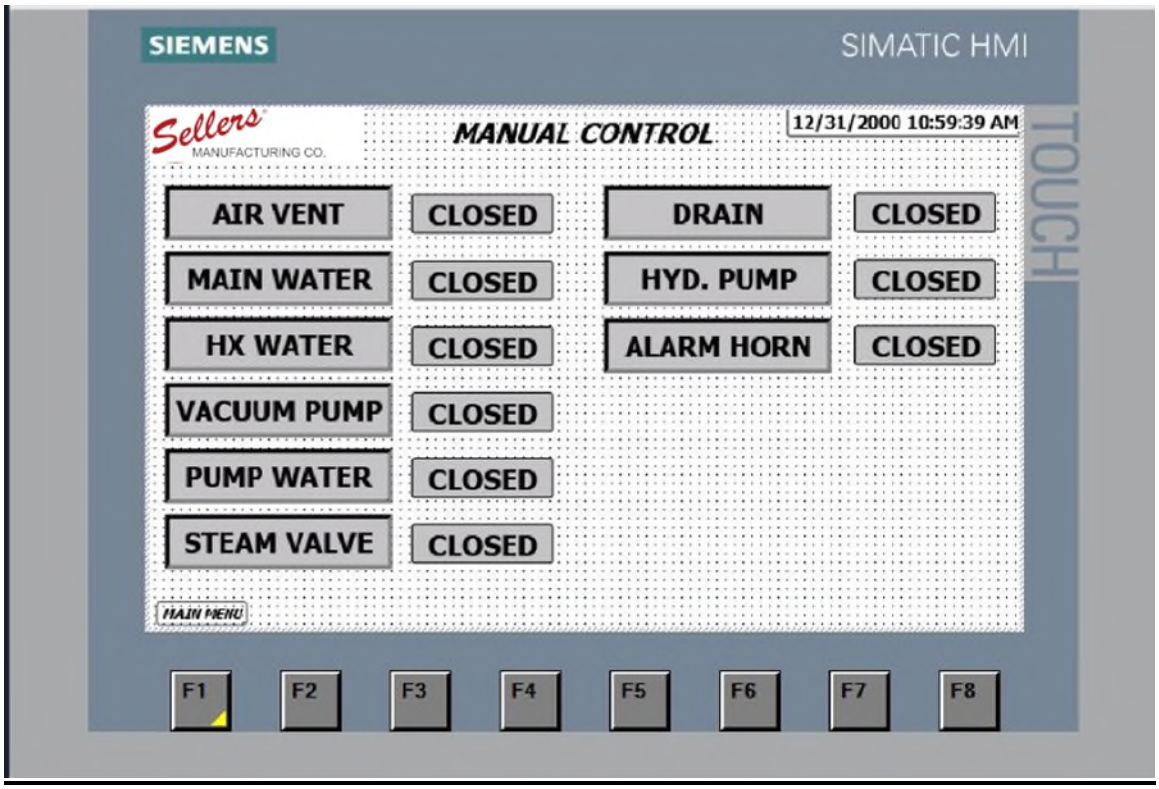

Photo #3 Manual Screen Control Buttons

Engineering testing, different type of cycles, or sterilization cycle changes may result in the need for different cycle parameters. The autoclave control system will allow changes to the parameters (must have special password).

Two basic types of cycle parameters are available: the Pre-Vac Cycle and the Gravity Cycle. The “Cycle Selection” Button on the Main Menu (Photo #2) allows the cycle type to be selected. It also allows a leak check cycle to be run. The “Cycle Selection” screen is shown in Photo #4. Once the cycle to be run is selected then press the “Enter” button. The “Main Menu” will appear if Pre-Vacuum or Gravity cycle is selected. To change the pre-set parameters for either cycle press the appropriate button and a screen showing 4 possible cycles for each will appear. The first two cycles are identical, and parameter can be change by selecting the corresponding button to edit the parameter (must have special password). Different times and temperature can be selected on the “Parameters Selection Screen” shown in Photo #5.

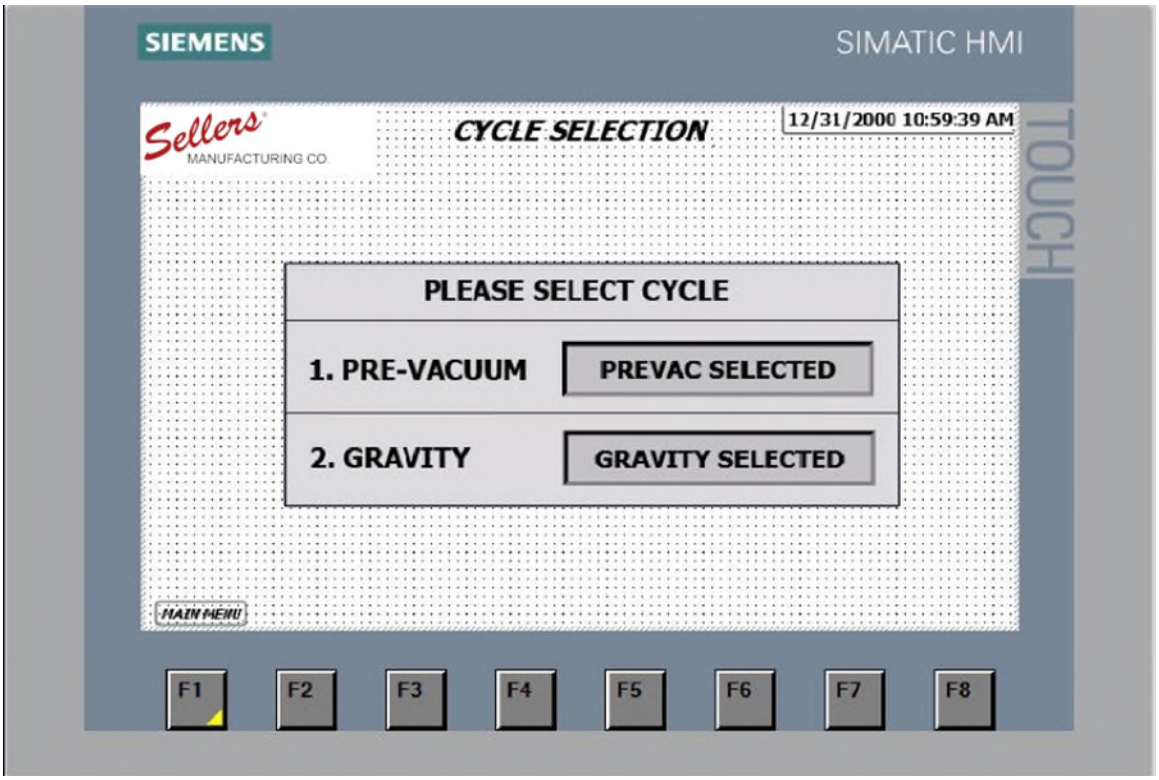

Photo #4 Cycle Selection Screen

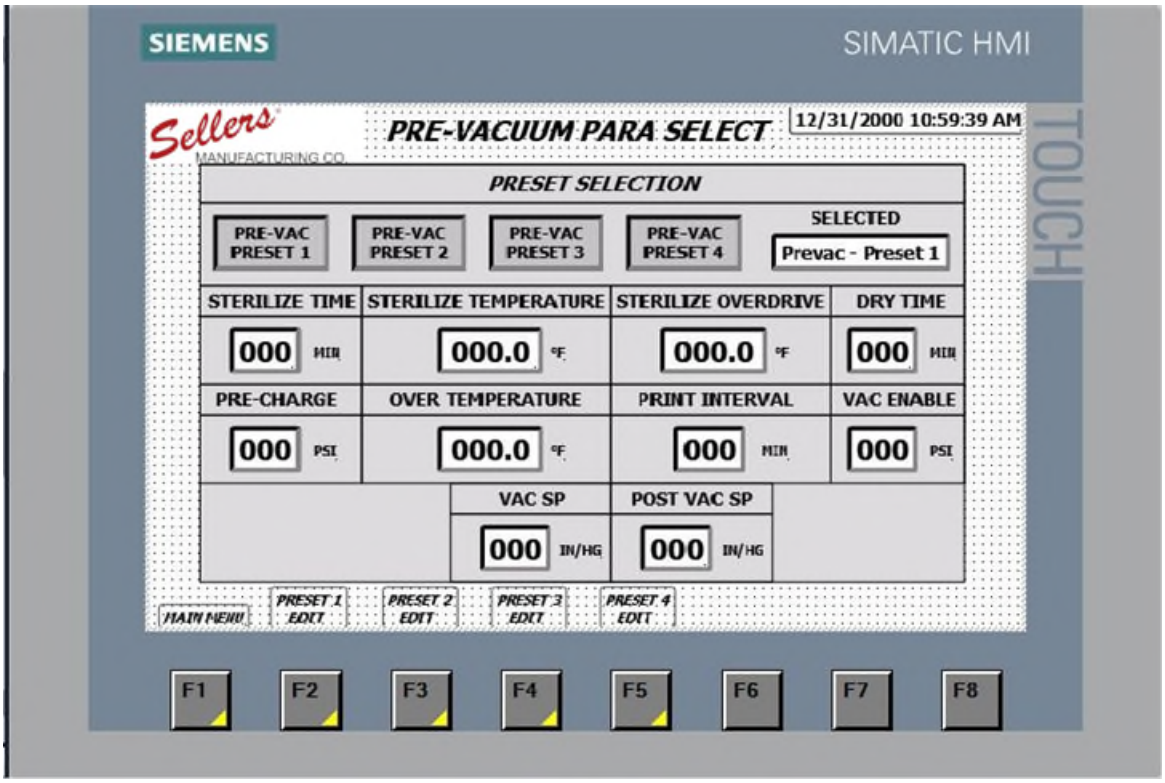

Photo #5 Parameter Selection Screen

The sterilize time is the number of minutes the autoclave must stay at the sterilization temperature before the unit starts cooling down.

The sterilize temperature is the minimum temperature the autoclave must maintain to count toward the sterilization time.

Sterilize Overdrive is the number of degrees above the sterilization temperature the unit will ascend to before turning off the steam valve. The autoclave will cool gradually until approximately 1 degree above the sterilization temperature before the steam valve will open and heat the unit back up to the sterilization temperature plus the overdrive temperature.

Dry Time is the minimum cool down / depressurization time before the unit begins to equalize interior and exterior pressure so the door can be opened. During this time the drain valve is opened to relieve pressure from the vessel. When the pressure is decreased to approximately 5 psi the vacuum pump will be turned on to assist in removing the remaining steam and condensate (the vacuum pump will turn off when vessel reaches approx. -10 in/Hg). When this minimum value is reached, or the dry time is expired the vacuum pump is turned off and the vent valve opened to allow equalization of pressure. Once the pressure is between -1 in Hg and 1 psi the hydraulic pump interlock circuit will be energized (green light) so the door may be opened.

Over Temp is the maximum temperature the unit will allow. If this temperature is exceeded, the cycle is shut down.

Print Interval is the time increment when the printer will print the temperature and pressure automatically for record. Any alarm messages will print as they occur, and the cycle summary will print at the end of the cycle.

Select the “Back” button to return to the main menu.

Select the “Start” button to return to the start menu.

The “Setup Menu” button will show the Setup screen (Photo #6). This screen allows one to change the scaling of the analog inputs.

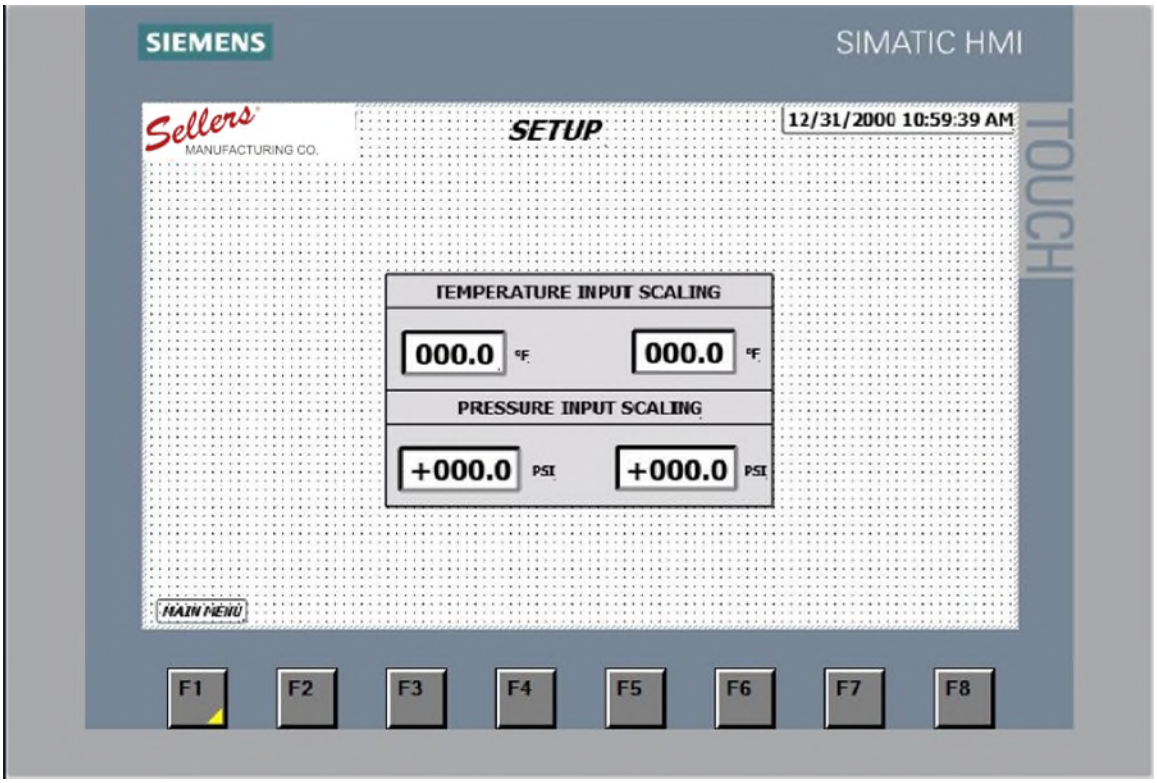

Photo #6 Setup Menu

The “Utilities Menu” is for the PLC program uploading etc. and is not explained further here.

7. Controls Operating Instructions

7.1 Description of Controls

Control of the autoclave is accomplished using a Siemens S7-1200 PLC with an attached KTP900 touch-screen display. The ladder logic in the PLC directs the sequencing of valves and motor starters necessary to perform the autoclave sterilization cycles. The touch-screen display provides the operator with the status of the autoclave, a way to initiate cycles, and perform maintenance functions.

7.2 Operator Controls

Starting the Sterilization Cycle

Before a sterilization cycle can be started, the autoclave door must be closed and locked. Once the door is closed and locked, the first step in starting a cycle is to press the START button on the “Start Screen” shown below.

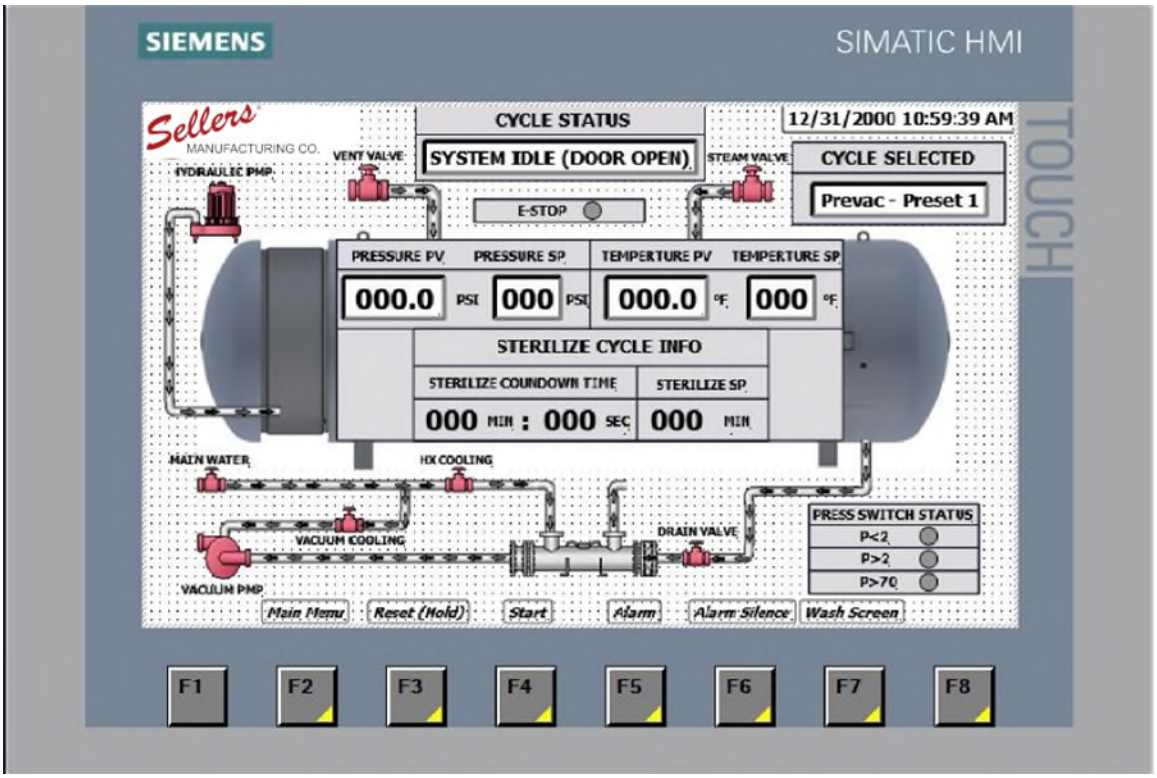

Photo #7 Start Screen

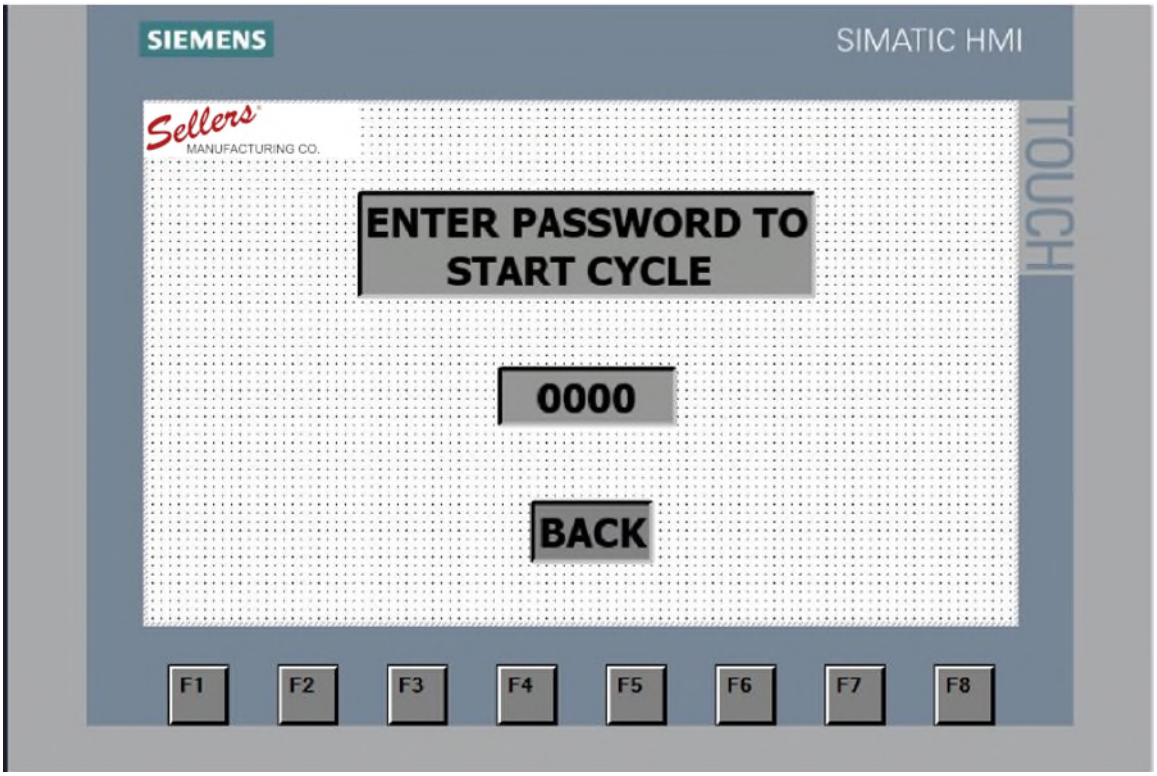

Photo #8 Password Screen

The screen will then change to a keypad for entering the password characters. When finished entering the password, touch the enter key (bottom right corner) to activate the password. If the password has been entered correctly, the screen will change back to the "Start Screen" and the cycle will begin. If the password has been entered incorrectly, the screen will change back to the password screen, and another password can be entered.

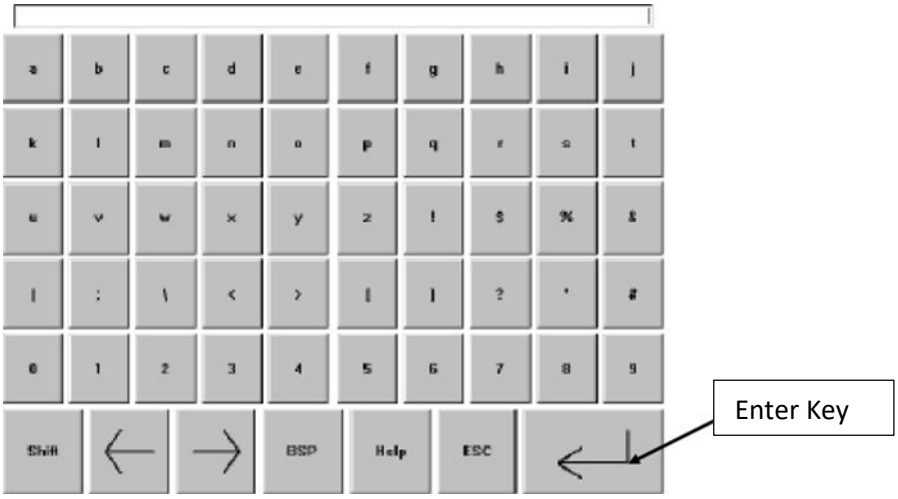

Photo #9 Keypad

After the correct password has been entered the sterilization cycle will begin and the "Start Screen" will be displayed. This screen displays the current pressure and temperature inside the vessel, the status of the current cycle, the remaining sterilization time, and the current time and date. The screen also contains a reset button for clearing alarms and resetting the cycle.

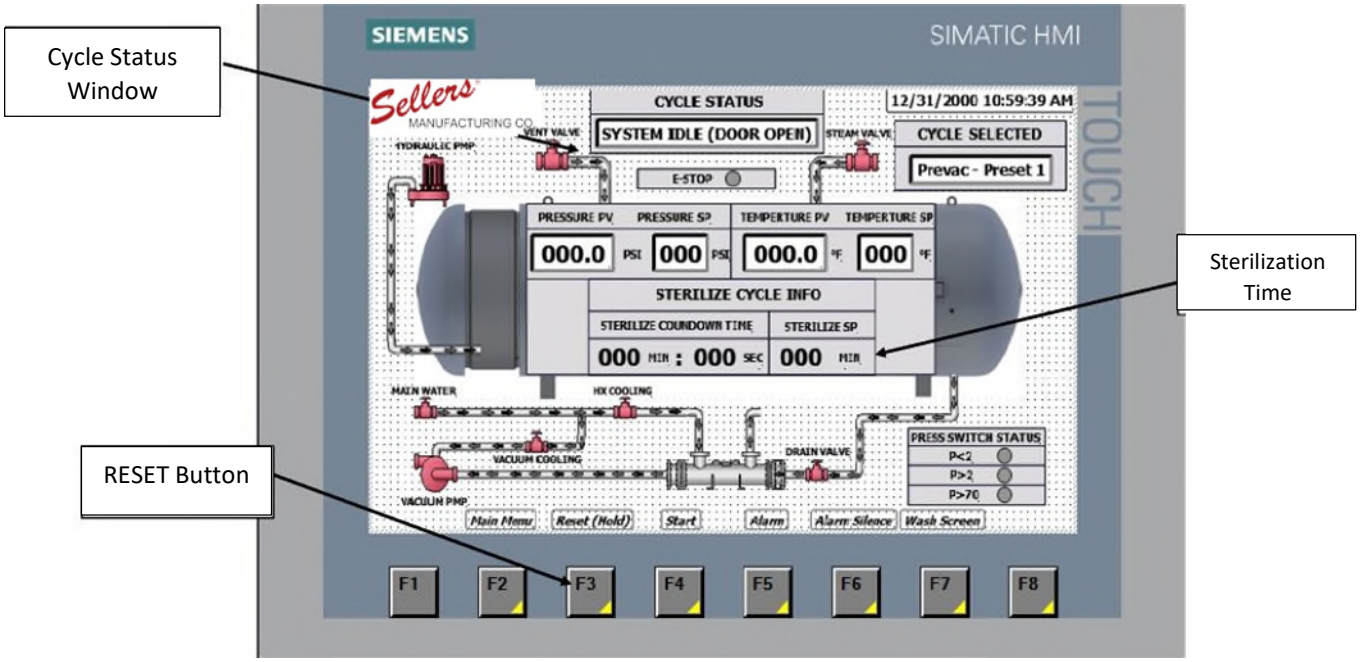

Photo #10 Start Menu

Cleaning the Touch Screen

The touch screen must be kept clean to function properly and to keep operating information visible. To clean, first press the “Wash Me” button located on the middle of the right-hand side of the “Start Screen”. This disables all screen functions for 25 seconds, so that the screen can be cleaned without affecting the controls. A soft cloth moistened with clean water should be used.

7.3 Automatic Control Steps

Preliminary Steam Charge

The first step of the Pre-vac cycle is a preliminary steam charge. The steam valve will open and pressurize the autoclave to 10 PSI. If the preliminary charge takes longer than 10 minutes, the autoclave cycle will abort, and “LOW PRESSURE FAILURE” will be displayed in the cycle status window.

Pre-vacuum

The second part of the cycle is the pre-vacuum step. The vacuum pump is turned on and pulls a vacuum inside the vessel until reaching a set point between –16 and –22 inches of Mercury (-8 and –11 PSI). If the vacuum set point is not met after running the vacuum pump for 10 minutes, the cycle will abort, and “VACUUM PUMP FAILURE” will be displayed in the cycle status window.

Charging

The next part of the cycle is the charging step. The steam valve is opened to bring the vessel pressure and temperature up to the sterilization set point levels. During charging, the steam input is controlled by the temperature and pressure. If the pressure exceeds the set point by more than 15PSI, the steam valve is closed to give the temperature sensor time to catch up. Once the pressure and temperature set points have both been met, the cycle advances into the sterilization portion of the cycle.

Sterilization

During the sterilization step, the sterilization timer will count down. The sterilization timer will only count down while the temperature and pressure are above the set point levels. If the temperature or pressure levels fall below their respective set points, the countdown timer will stop until the pressure and temperature levels are restored. If the pressure or temperature falls below the set points for more than 10 minutes or the temperature drops to less than 250 Deg. F, the cycle will be aborted and “LOW TEMPERATURE FAILURE” will be displayed in the cycle status window. When the temperature and pressure have stayed above the set points for the complete sterilization time setting, the sterilization cycle is complete, the cycle will then move into a cool down step.

Cool Down

First the drain is opened, and the pressure is relieved down to 5 PSI. When the vessel pressure reaches 5 PSI the vacuum pump is turned on to help pull out the remaining steam in the vessel. The vacuum pump will remain on until the pressure is a -10 in/hg.

Once the post vac setpoint is meet the drain valve will close and start a dry time. At the end of the dry time the air vent on top of the vessel is opened to relieve pressure differences remaining from the cycle, so that the door can be opened. When the pressure is between –0.5 and 1 PSI, the door may be unlocked. When the door is unlocked the cycle will be reset and the hydraulic pump will start immediately. The hydraulic pump will remain on for 60 seconds and then power down. If the door is not fully unlocked before the pump powers down the pump can be restarted by pressing the momentary pump start push button. When the door has been opened the cycle is complete, and the vessel is ready to be unloaded.

Gravity Cycle Steps

The gravity cycle is similar to the pre-vac cycle, except that there is no pre-vacuum step after the preliminary charging, and the sterilization cycle time is increased from 30 minutes to 60 minutes. The gravity cycle must be accessed thru the cycle selection on the password protected “Main Menu”.

7.4 Cycle Counters

To access the cycle counters, press the “Utilities Screen” button on the main menu. The counter keeps track of the total sterilization cycles and can be reset. (See pictures below)

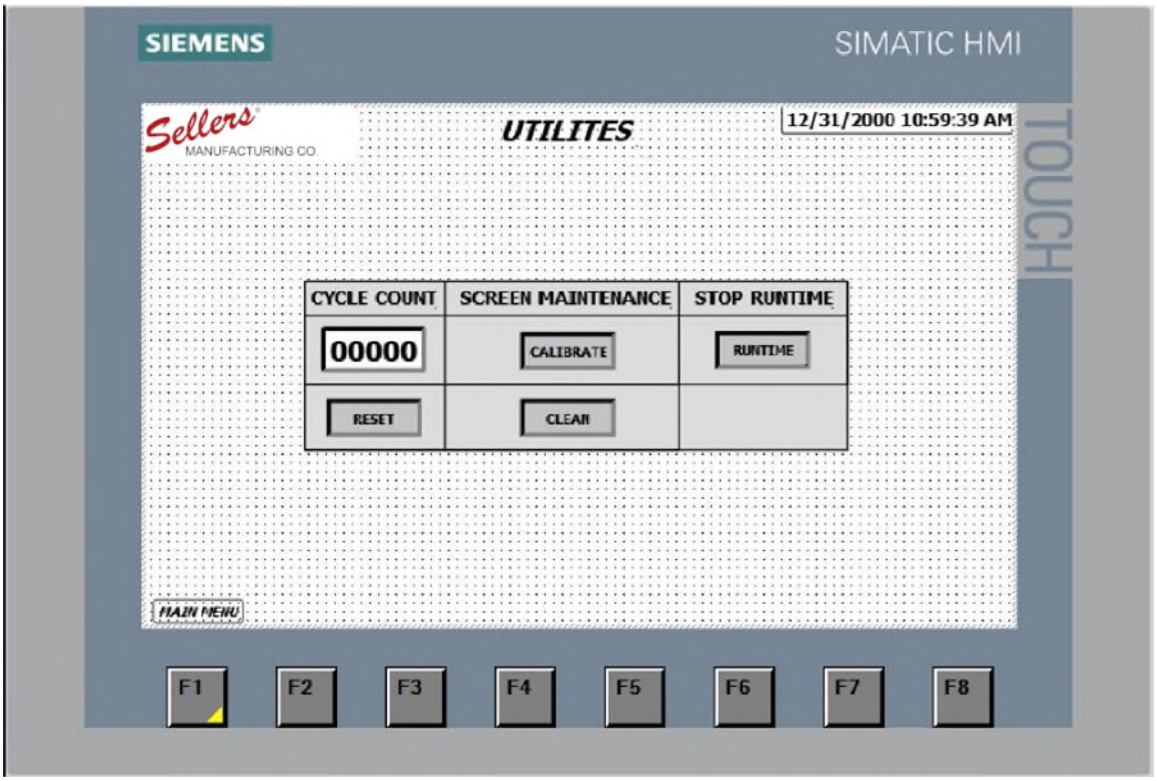

Photo #11 Cycle Counters

7.5 Alarm History

To review alarms, press the “Alarm” button on the Start Menu. The most recent alarm will be at the top of the log. (See picture below)

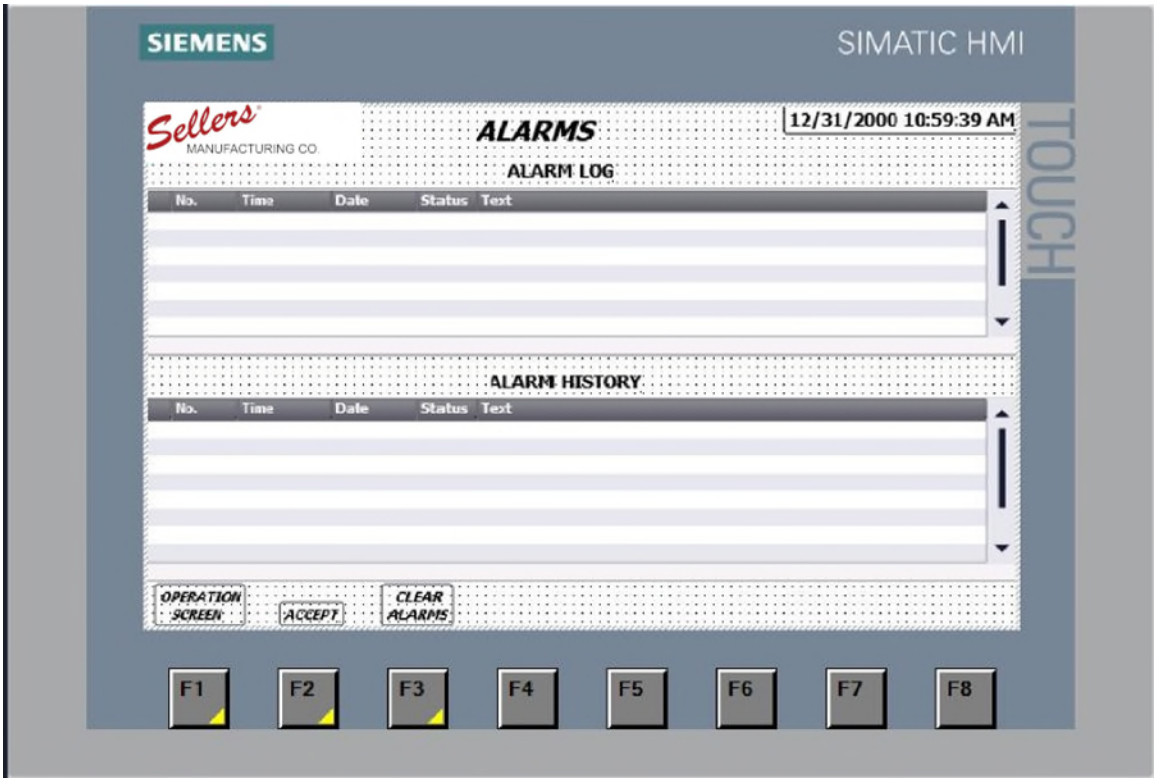

Photo #12 Alarm History

7.6 Maintenance and Setup

To access the setup and maintenance menus a password must be entered. To bring up the password entry screen, press the main menu button on the “Start Screen”. When the password is entered correctly the screen will change to the “Main Menu” screen. From this screen the setup and maintenance screens can be accessed.

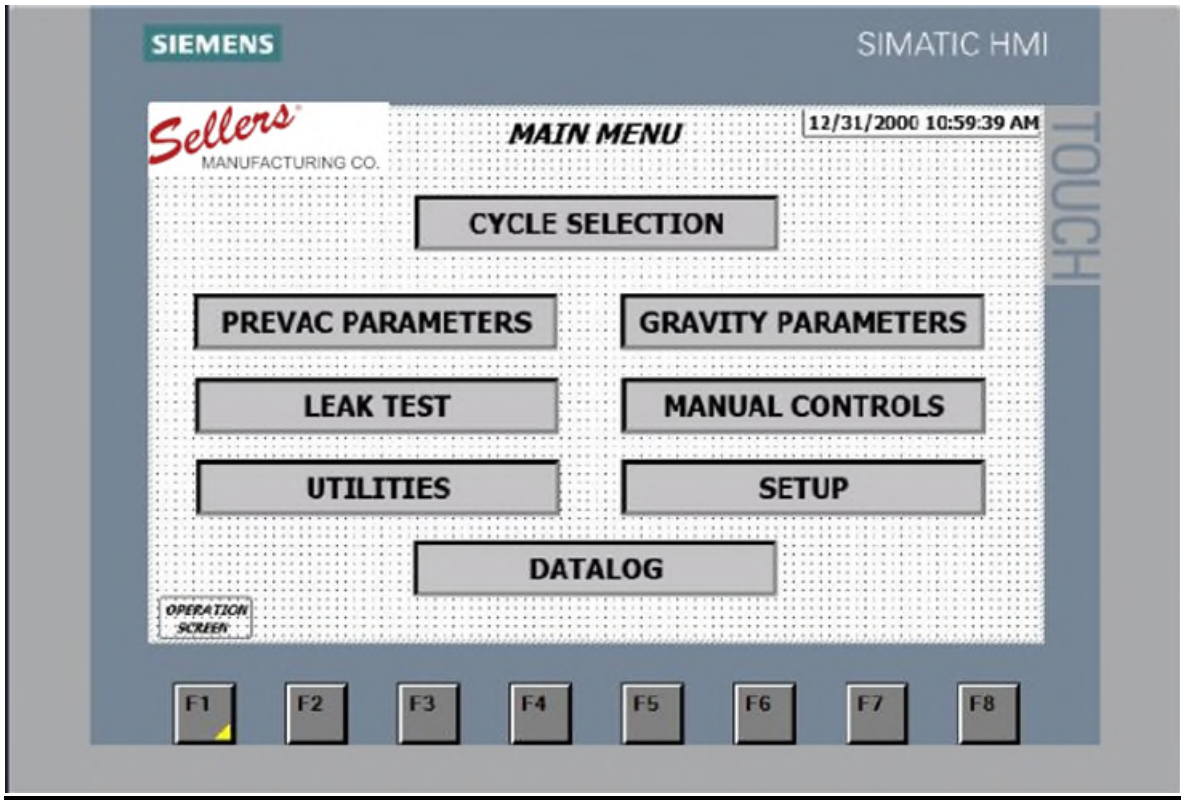

Photo #13 Setup Main Menu

Cycle Selection

Pressing the “Cycle Selection” button on the main menu accesses the cycle selection screen. To change the type of cycle to be run in the autoclave, press the bar located to the right of the cycle. When the controls have accepted the change, the bar will change from gray to green. when satisfied with the selection, press the “F1 Main Menu” key at the bottom of the screen to return to the “Main Menu”.

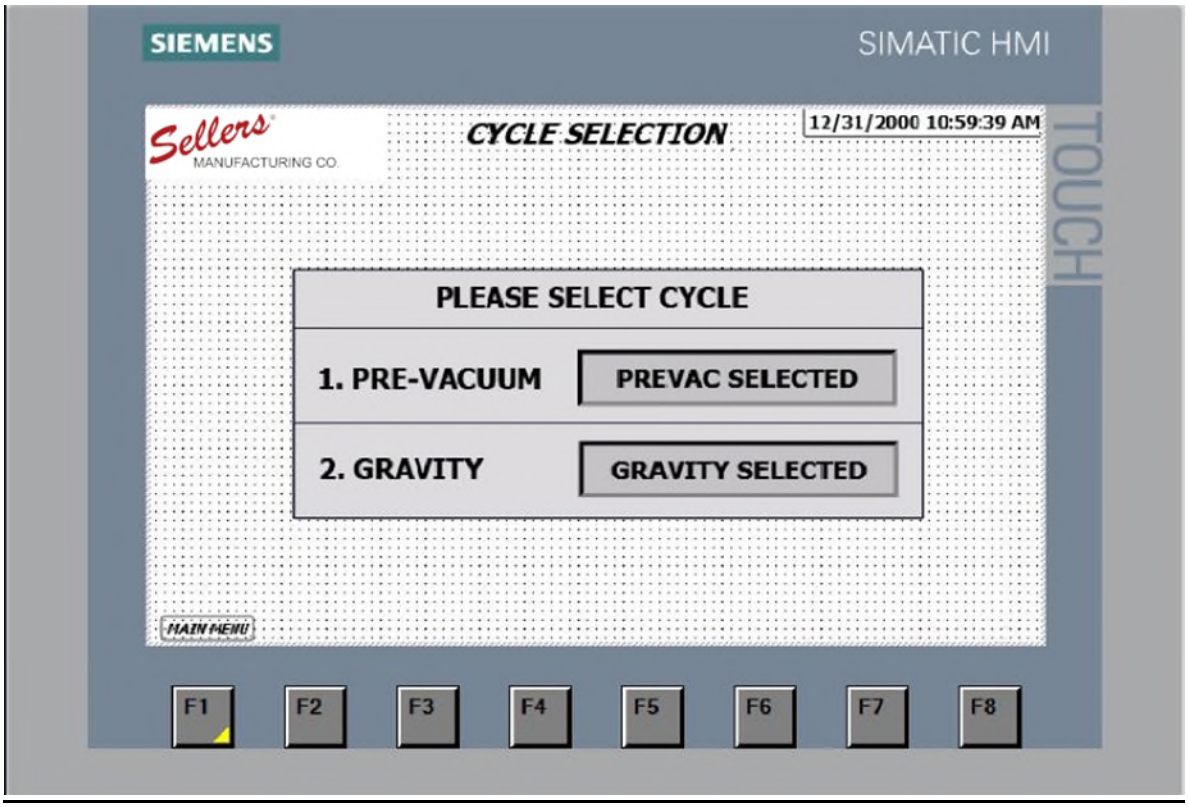

Photo #14 Cycle Selection

Pre-vac Cycle Parameters

Pressing the “Prevac Parameters” button on the main menu accesses the pre-vacuum cycle parameters selection screen. A total of four different preset parameters can be selected for the pre-vac cycle. Different presets can be selected by pressing the numbers below of the “Presets” heading. The corresponding cycle data will be displayed in the boxes below the parameter name. Cycle data for all presets can be changed. To access the screen to change the data press the corresponding button at the bottom of the screen and enter the password. To change the values, enter the desired value under each parameter name. When finished modifying data, press “F1 Prevac Para” to go back to pre-vacuum cycle parameters selection screen.

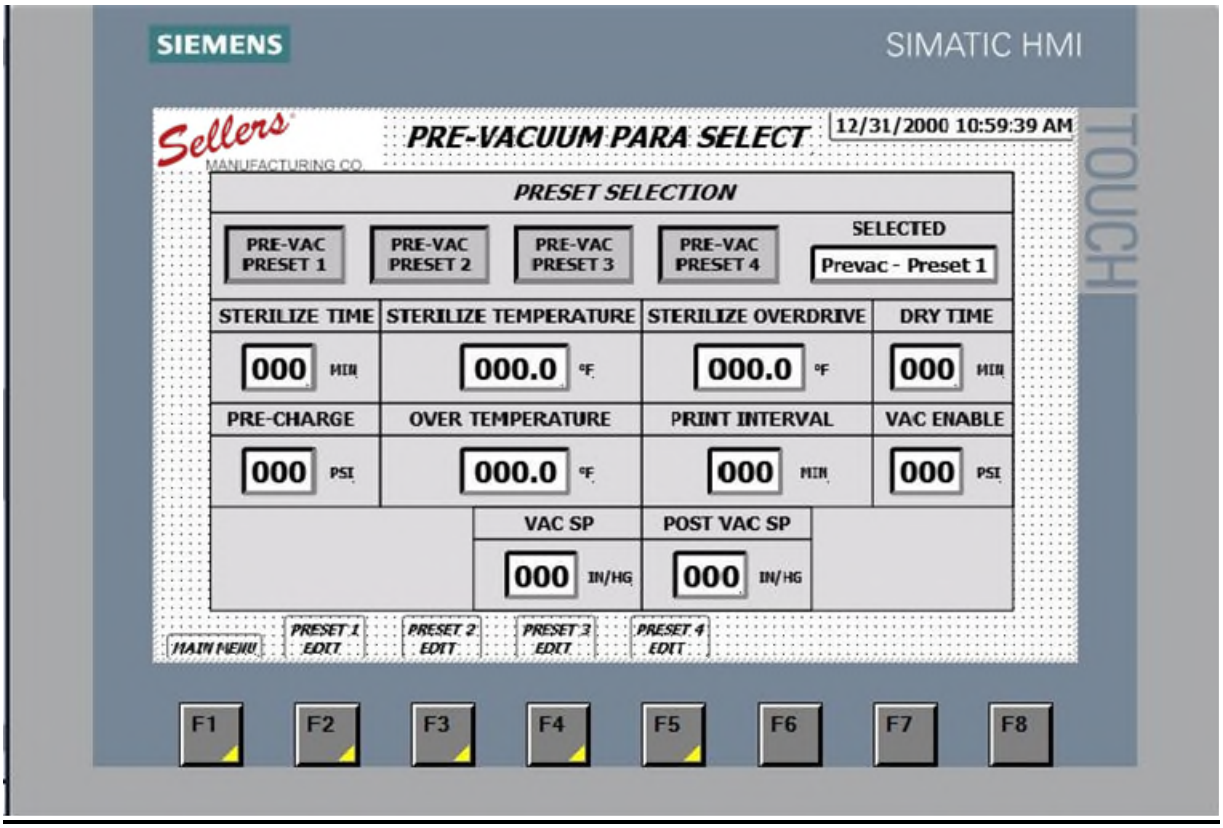

Photo #15 Pre-vac Cycle Parameters

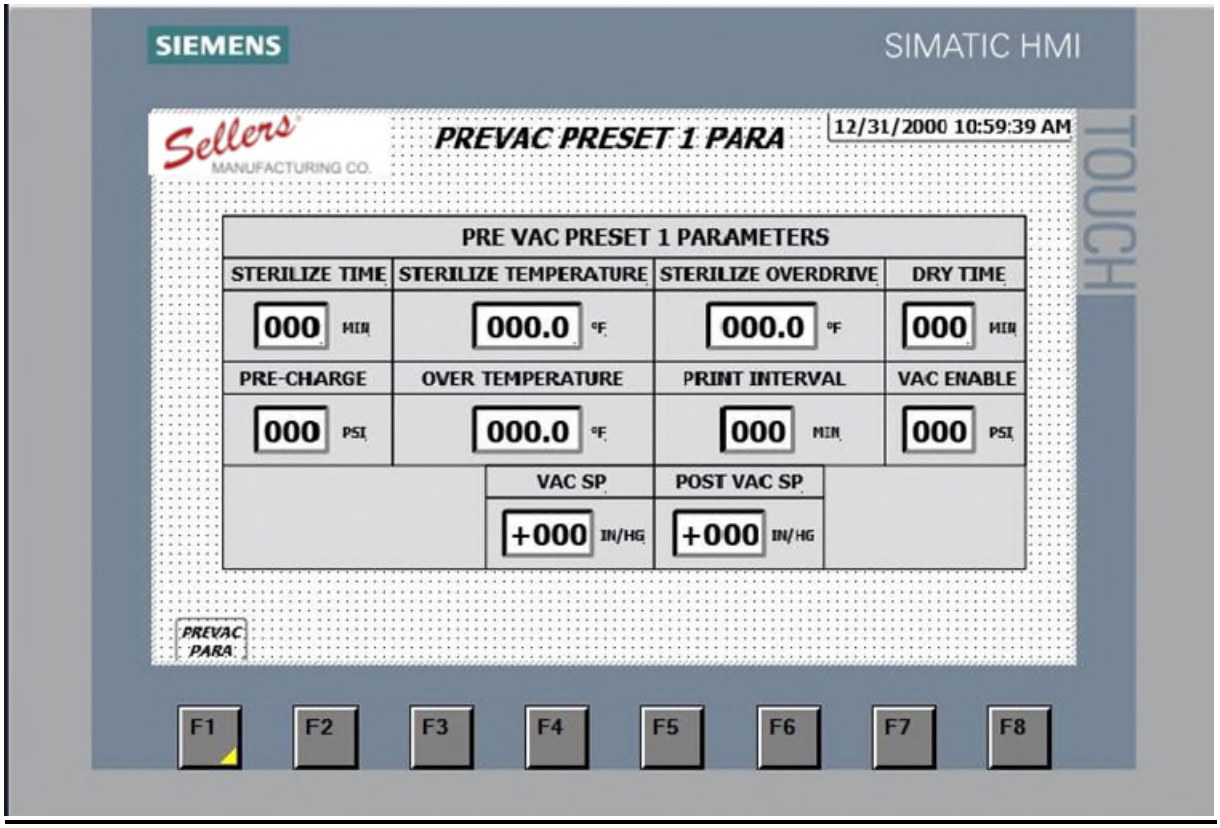

Photo #16 Custom Pre-vac Cycle Parameters

Gravity Cycle Parameters

Pressing the “Gravity Parameters” button on the main menu accesses the gravity cycle parameters selection screen. A total of four different preset parameters can be selected for the gravity cycle. Different presets can be selected by pressing the numbers below the “Presets” heading. The corresponding cycle data will be displayed in the boxes below the parameter name. Cycle data for presets can be changed. Cycle data for all presets can be changed. To access the screen to change the data press the corresponding button at the bottom of the screen and enter the password. To change the values, enter the desired value under each parameter name. When finished modifying data, press “F1 Gravity Para” to go back to gravity cycle parameters selection screen.

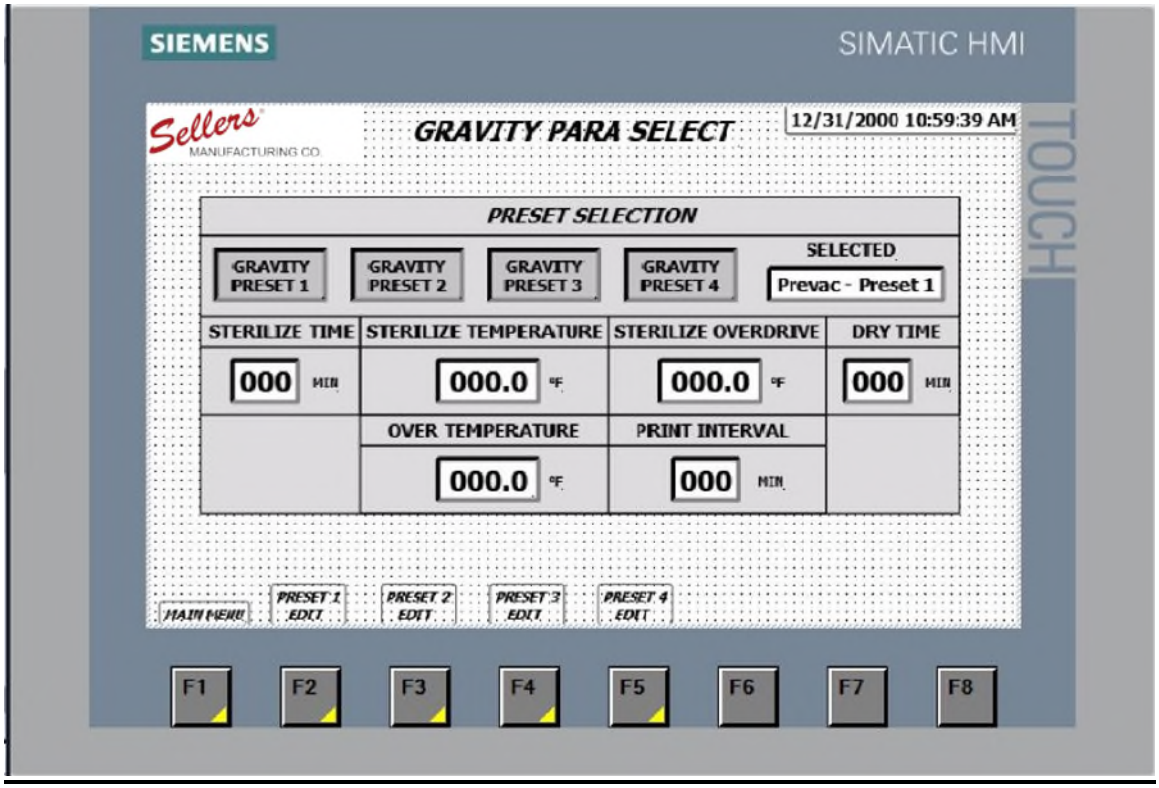

Photo #17 Gravity Cycle Parameters

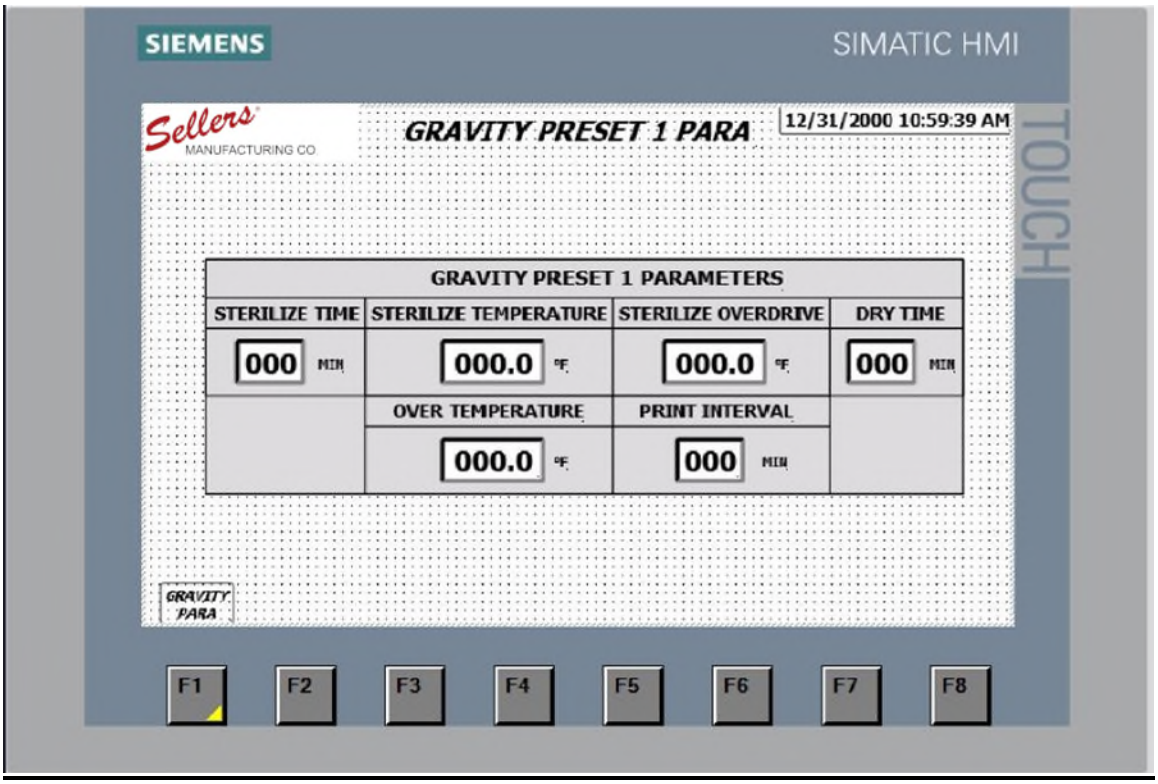

Photo #18 Custom Gravity Cycle Parameters

Manual Controls

Pressing the “Manual Controls” button on the main menu accesses the manual controls screen (Photo #19). While this screen is in view, the buttons can be used to manually control the outputs of the system for maintenance and troubleshooting of the autoclave. The outputs can be left in any position when finished, because the automatic controls will take over once the screen has been exited. **CAUTION: The STEAM valve can cause over-pressurization!**

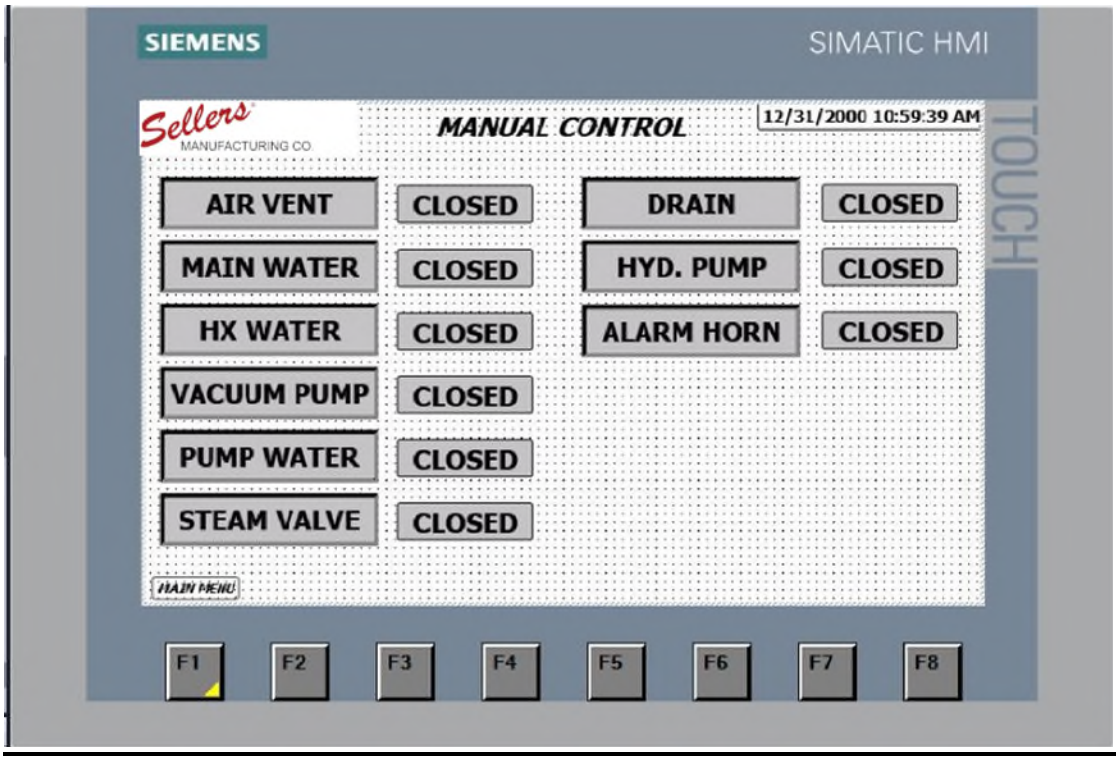

Photo #19 Manual Control

Setup Menu

Pressing the “Setup Menu” button on the main menu accesses the setup screen. This screen is used to change scaling of the analog inputs.

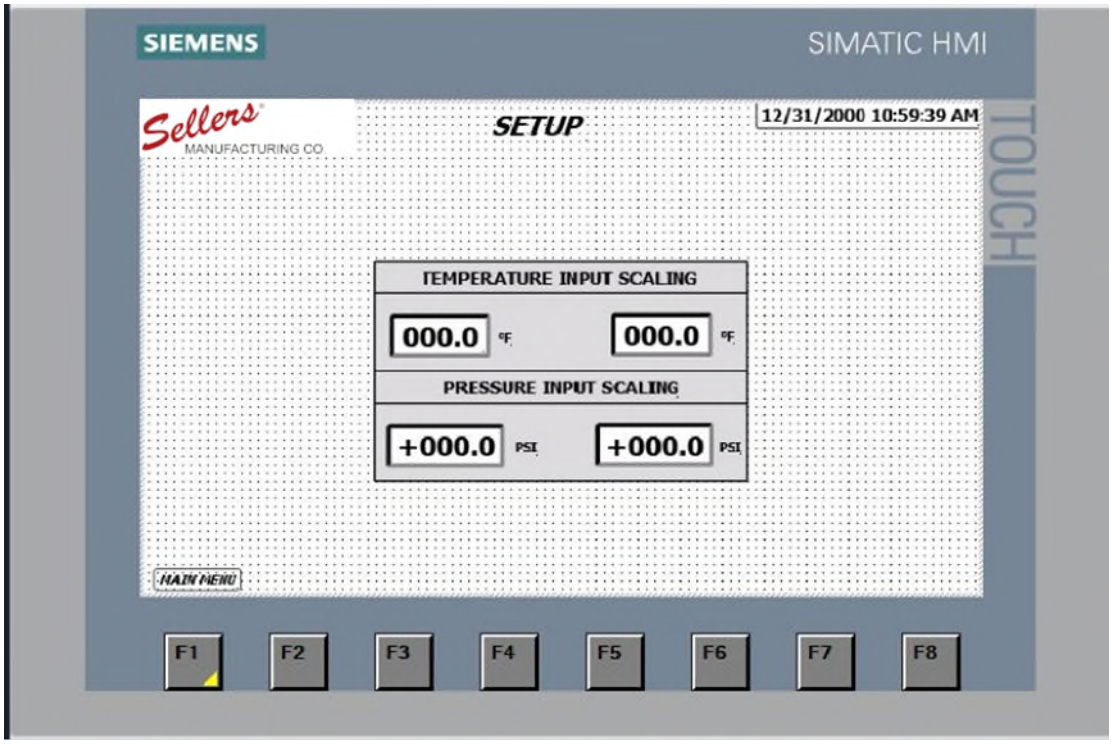

Photo #20 Setup Menu

Utilities

Pressing the “Utilities” button on the main menu accesses the screen utility. This screen is used to adjust screen settings.

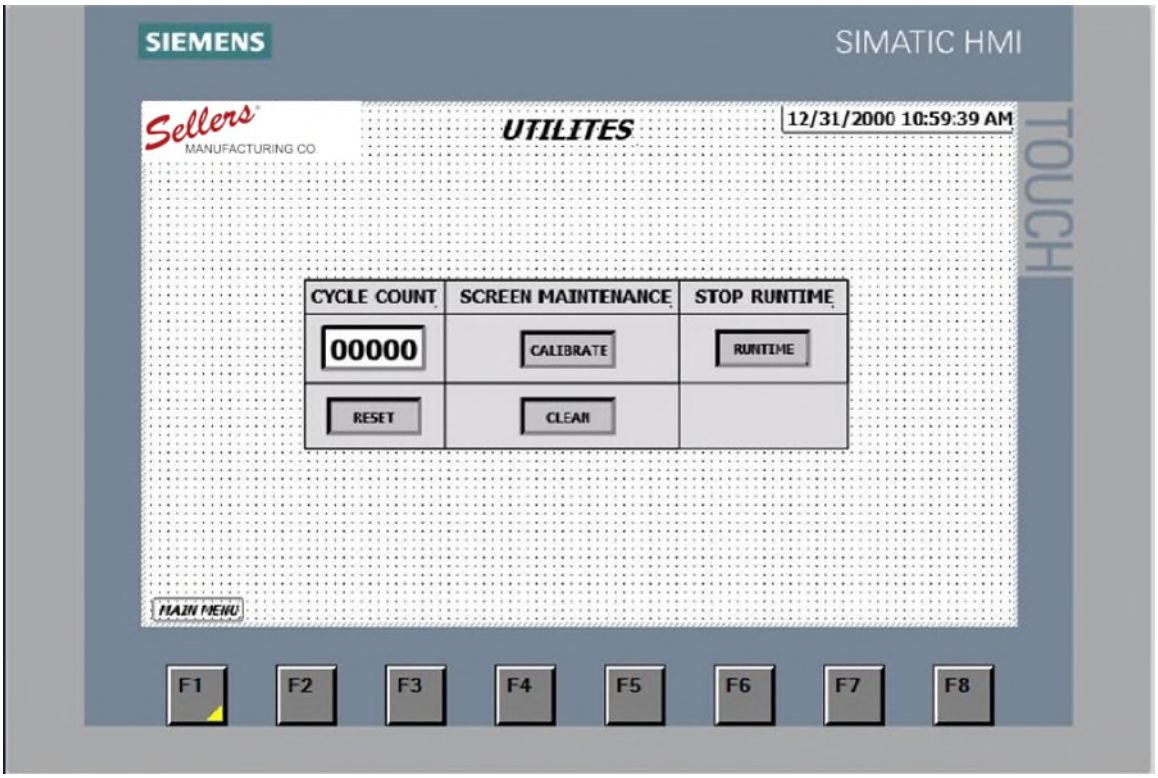

Photo #21 Utility Screen

8. Minor Maintenance

The following preventative maintenance actions should be performed by knowledgeable operators or maintenance personnel. Detailed information about a particular piece of equipment can be obtained from its operation and maintenance manual.

8.1 Daily

1. Clean chamber and remove any debris from unit and tracks.
2. Check gauges and controller for damage.
3. Inspect piping and fittings for signs of leakage.
4. Inspect gasket for signs of leakage. Clean and grease as necessary.

8.2 Weekly

1. Verify printer paper is adequate for the next week. If not replace with new spool. Paper will advance with LF (line feed key). Do not pull paper backward thru printer, damage may occur.
2. During cycle, visually inspect door gasket area for proper sealing of o-ring and perform necessary maintenance per door instruction manual.
3. Check gasket for light coating of grease. Ensure gasket sealing surface is clean.
4. Visually check any piping connections for leaks.

5. Use recommended solution to clean drain line each week. Some possible solutions are a bleach or tri-sodium phosphate dissolved in water.
6. Clean drain strainer.
7. Inspect track for proper fit and damage.

8.3 Monthly

Check hydraulic fluid level. Open breather cap on reservoir chamber. Height should be approximately at or above center of sightglass on front of reservoir. (Use Mobile PTE 24 or equivalent).

1. Inject a high temperature grease into top and bottom of door hinge at grease fittings. (Use Neptune 7 from Ore-Lube Corp or equivalent).
2. Grease door lock, wedges, and back surface of sliding ring. (Use Neptune 7 from Ore-Lube Corp or equivalent).
3. Grease fittings on vacuum pump bearings per pump operation and maintenance manual.
4. Verify all openings in unit are free from debris, excessive rust or anything that could restrict openings.

9. Troubleshooting

Problem	Possible Cause	Correction
No Power	Main power supply OFF Control power OFF	Turn ON Turn power switch ON
Unable to Start Cycle	Chamber door open or safety latching lever open	Close door and shut latching lever
Safety latching lever will not close	Rotating ring on door not fully closed	Use hydraulic lever to rotate ring fully closed
Door ring will not rotate (pump is ON)	Hydraulic fluid may be low Hydraulic lines may be leaking	Fill reservoir Check condition of lines
Hydraulic pump won't turn on	Pressure too high or low Safety latching lever closed	Equalize pressure
Steam pressure or temperature does not rise during cycle.	Steam pressure supply insufficient Chamber drain line or strainer plugged	Check incoming steam Clean drain line (orifice) or strainer when system cool
Pressure too high and temperature remains low	Water covering temperature sensor may keep temperature from rising.	Check drain line and orifice for debris. Clean as required
Steam leaks around door during cycle	Door gasket or o-ring worn or damaged	Replace gasket or o-ring
Printer not operating	SEL button may be not be pressed	Press SEL button on printer (both LEDs should be lit.)

Note: BEFORE ATTEMPTING ANY REPAIR OR MAINTENANCE, MAKE SURE POWER IS OFF AND UNIT IS DEPRESSURIZED AND COOL.