K244XX
Programmable Muffle Furnace

Operation and Instruction Manual

REV A

Koehler Instrument Company, Inc.
1595 Sycamore Avenue • Bohemia, New York 11716-1796 • USA
Toll Free: 1-800-878-9070 (US only) • Tel: +1 631 589 3800 • Fax: +1 631 589 3815
http://www.koehlerinstrument.com • e-mail: info@koehlerinstrument.com
Petroleum Testing & Analysis Instrumentation • Custom Design & Manufacturing

CERTIFICATE OF CONFORMANCE

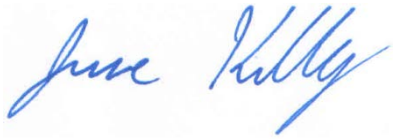
Programmable Ashing Furnace
K24410, K24419, K24420, K24429, K24430, K24439

This certificate verifies that part number K244XX, Programmable Ashing Furnace, was manufactured in conformance with the applicable standards set forth in this certification.

Specifications:

ASTM D482
ASTM D874
ASTM D3174
ASTM D4422
ASTM D5184
IP 4
IP 163
ISO 3987
ISO 6245
NF M 07-045
DIN 51352
DIN 51575

This unit is tested before it leaves the factory, to ensure total functionality and compliance to the above specifications and ASTM standards. Test and inspection records are on file for verification.



Jesse Kelly
Application Engineer
Koehler Instrument Company

Table of Contents

1 Introduction

The Koehler K244XX Ashing Furnace is the latest design for performing Ashing of petroleum products according to the ASTM test methods listed in Section 1.2.

This manual provides important information regarding safety, technical reference, installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the Koehler Muffle Furnace. This manual should also be used in conjunction with applicable published laboratory procedures. Information on these procedures is given in section 1.2.

1.1 Koehler's Commitment to Our Customers

Providing quality testing instrumentation and technical support services for research and testing laboratories has been our specialty for more than 50 years. At Koehler, the primary focus of our business is providing you with the full support of your laboratory testing needs. Our products are backed by our staff of technically knowledgeable, trained specialists who are experienced in both petroleum products testing and instrument service to better understand your requirements and provide you with the best solutions. You can depend on Koehler for a full range of accurate and reliable instrumentation as well as support for your laboratory testing programs. Please do not hesitate to contact us at any time with your inquiries about equipment, tests, or technical support.

Toll Free: 1-800-878-9070 (US only)
Tel: +1 631 589 3800
Fax: +1 631 589 3815
Email: info@koehlerinstrument.com
http://www.koehlerinstrument.com

1.2 Recommended Resources and Publications

1. American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
West Conshohocken, Pennsylvania 19428-2959, USA
Tel: +1 610 832 9500
Fax: +1 610 832 9555
http://www.astm.org
email: service@astm.org

ASTM Publication:

- ASTM D482: Standard Test Method for Ash from Petroleum Products
- ASTM D874: Standard Test Method for Sulfated Ash from Lubricating Oils and Additives
- ASTM D3174: Standard Test Method for Ash in the Analysis Sample of Coal and Coke from Coal
- ASTM D4422: Standard Test Method for Ash Analysis in Petroleum Coke
- ASTM D5184: Standard Test Methods for Determination of Aluminum and Silicon in Fuel Oils by Ashing, Fusion, Inductively Coupled Plasma Atomic Emission Spectrometry, and Atomic Absorption Spectrometry

1.3 Instrument Specifications

Models:	K24410,K24420, K24420-18L, K24430 K24419,K24429, K24429-18L, ,K24439
Electrical Requirements:	115V 60Hz 1 ph 230V 50/60Hz 1 ph
Temperature Range:	Ambient to 1200°C
Temperature Control Accuracy:	± 1 °C
Temperature Control Uniformity:	± 3 °C
Temperature Control Resolution:	± 0.1 °C
Oven Volume:	0.17 ft^3. model: 5 L 0.52 ft^3. model: 15 L 0.64 ft^3. model: 18 L 1.41 ft^3. model: 40 L
Power:	K2441X: 2700 W K2442X: 5500 W K2443X: 11,000 W
Chamber Internal Dimensions: (wxdxh,in.(cm)	K2441X:8x7x5 (20.32x17.78x12.70) K2442X 9x13x7 (22.86x33.02x17.78) K2443X: 13x19x10 (33.02x48.26x25.40)

2 Safety Information and Warnings

Safety Considerations. The use of this equipment may involve *hazardous* materials and operations. This manual does not purport to address all of the safety problems associated with the use of this equipment. It is the responsibility of any user of this equipment to investigate, research, and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Equipment Modifications and Replacement Parts. Any modification or alteration of this equipment from that of factory specifications is not recommended voids the manufacturer warranty, product safety, performance specifications, and/or certifications whether specified or implied, and may result in personal injury and/or property loss. Replacement parts must be O.E.M. exact replacement equipment.

Unit Design. This equipment is specifically designed for use in accordance with the applicable standard test methods listed in section 1.2 of this manual. The use of this equipment in accordance with any other test procedures, or for any other purpose, is not recommended and may be extremely hazardous.

Chemical Reagents Information. Chemicals and reagents used in performing the test may exhibit potential hazards. Any user must be familiarized with the possible dangers before use. We also recommend consulting the Material Data and Safety Sheet (MSDS) on each chemical reagent for additional information. MSDS information can be easily located on the internet at http://siri.uvm.edu or http://www.sigma-aldrich.com.

Disposal. Upon delivery the furnace does not contain any material which is to be classified as hazardous waste. However, process residues may collect in the insulation during operation. These may be dangerous to health and/or dangerous to the environment.

Therefore we recommend proceeding as follows:

- Remove electrical components and dispose of as electrical waste.
- Remove insulation and dispose of as special/ hazardous waste (wear a protective mask P2, protective gloves and a protective suit).
- Dispose of the housing as scrap metal

3 Getting Started

The instructions for preparing the equipment assume that the user is aware of the contents of this document, which lists the warranty conditions and important precautions.

3.1 Unpacking

Carefully unpack and place the instrument and accessories in a secure location. Ensure that all parts listed on the packing list are present. Inspect the unit and all accessories for damage. If any damage is found, keep all packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment. Do not return goods to Koehler without written authorization.

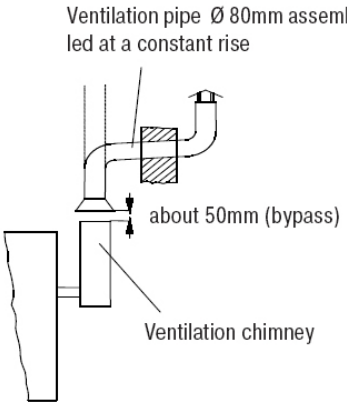
3.2 Setup

3.2.1 Installation Site

Place the furnace on a non-flammable support (stone, metal or similar). Keep a safe distance from flammable components, 0.5 m from the furnace sides and 1 m from the top. The minimum distance between the furnace sides and non-flammable materials can be reduced to 0.2 m.

Ventilation. Provide sufficient room ventilation to carry off exhaust heat and gases which develop during the process. Non-observance can result in a fire risk and danger to health.

3.2.2 Assembling the Ventilation Pipe



- The Ventilation Chimney must be attached to the top of the furnace using the 3 supplied screws.
- In all cases, we recommend connecting the furnace to an exhaust ductwork, leading the arising gasses out of the facility
- A standard ventilation pipe of metal with NW80 – NW 210 can be used. It must be laid at a constant slope and fastened to the wall or ceiling.
- **Caution:** The exhaust gases can only be carried off if the room is ventilated by a corresponding fresh air opening.

3.2.3 Electrical Connection

- Attach the correct plug to the power supply cord(s) and connect the main plug in a corresponding receptacle which is protected sufficiently depending on the rated power of the furnace. If the furnace is ordered / delivered without a plug, a qualified electrician must connect the furnace.
- **NOTE:** Using extension cables and/or junction boxes may lead to a reduced furnace output due to the voltage drop in the lines. The power is also reduced if the connection line to the junction box is very long, and the furnace will not reach its nominal temperature. Please have the connection checked by an electrician. The voltage may not drop below the rated load by more than 10%.

WARNING: For safety, disconnect the power when performing any maintenance and/or cleaning.

3.2.4 Initial Heating Procedure

- To dry out the brick lining and to create an oxide protection layer on the resistance wire, an initial heat run must be performed prior to testing. This may cause an unpleasant smell. Provide sufficient ventilation.
- Heat the empty furnace up to 1050 ºC over the course of six hours. At each change rise in temperature, run the AUTO TUNE on the tuning page. Once 1050 °C is reached, maintain this temperature for one hour, and then let the furnace cool down on its own.
- The furnace is now ready to operate.

4 Temperature Controller

4.1 Description of Controller

4.1.1 Main Breaker and Power Switch/ Control Current Switch

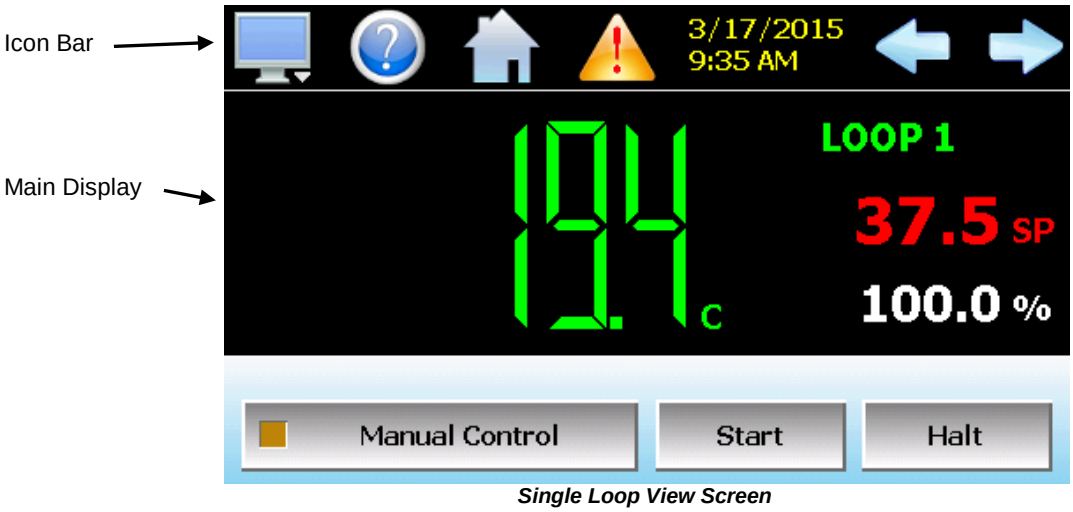
The main breaker is located on the right rear bottom corner and the power switch / control current switch is located on the right side of the control panel. Stop running a heating program before turning off the furnace with the power switch.

4.2 Basic Controller Operation

This section is designed to help guide you through the touch screen interface and menu structure, so that you can navigate through the various operation, monitor and setup screens and learn how to use them.

Touch Screen Interface

The display is split into two sections; the icon bar and main display area.



Single Loop View Screen

The menu icon will open the main menu for navigating to the different control and monitoring screens. Menu items will dynamically appear providing available options based on the system area the user is in, i.e., security, data logging, setup, etc.

The information (help) icon will display text based help associated with the current screen. Help is available in 28 languages based on the user selection in the offline setup of section of the display.

The home icon will return the user to the main view from anywhere in the the display application. The main view is set by the OEM in the the display configuration and can be the single or dual loop, chart, alarm, alarm history, event or digital IO view.

The alarm icon will appear and flash when a new system alarm occurs. Pressing the alarm icon will take the user directly to the alarm monitor screen in order to view and /or reset the active alarm condition.

The left and right navigation arrows will appear on screens that provide additional information that the user can scroll to such as the loop view screens, charts or program entry screen in order to cycle through each step of a ramp/soak program.

NOTE: *A single press of the left or right arrows will scroll program steps to the next step or screens to the next available loop or chart. Pressing and holding the arrow keys will continue the item scrolling until the last step of the program is reached or the button is released.*

IMPORTANT: *Do not use any sharp or metal objects on the touch screen as they may damage the surface. Also be sure that hands and fingers are free from oils or chemicals which may mar the surface of the touch screen.*

5 Operation

5.1 General Notes

- The insulation consists of high-quality refractory material which is susceptible to shock. Take care not to knock against the refractory material when charging the furnace to avoid damage.

- In order to achieve an even temperature distribution the furnace should be charged in such a way that products have a certain distance to each other and also to the side walls. Koehler offers shelves, etc. so that the furnace chamber can be used in the most efficient way possible.

- If the furnace is charged with a high quantity of products the heating time may be prolonged considerably.

- The furnace heating is stopped when the door is opened and is switched on automatically when the door is closed.

- Do not open the furnace when it is hot. If the furnace must be opened at high temperatures do this as quickly as possible. Wear personal protective equipment and clothing and provide sufficient room ventilation.

- Make sure that the door is properly closed during heating.

- Discolorations may occur on the stainless steel housing (especially when the hot furnace is opened); these, however, do not affect the functionality of the oven.

5.2 Maintenance and fault clearance

Regularly clean the ventilation holes/pipes so that the ventilation cross-section remains unobstructed and the suction functions well.

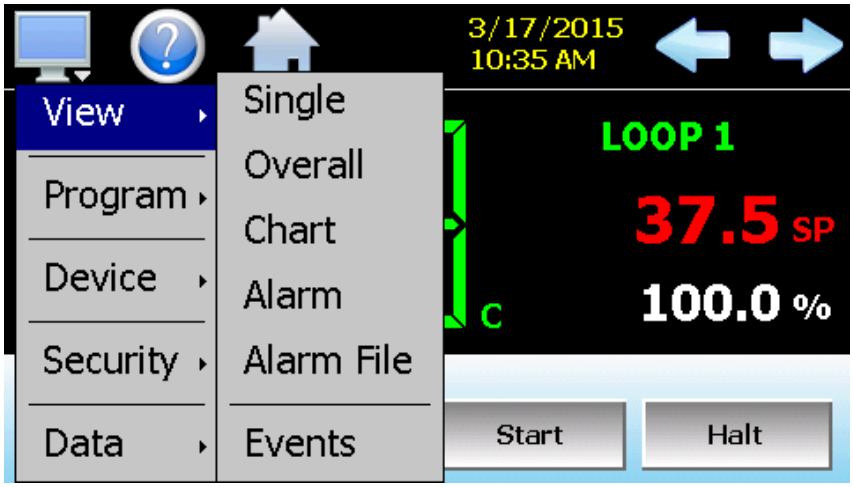
In the case of commercial use:

Please observe the safety regulations applicable to your country.

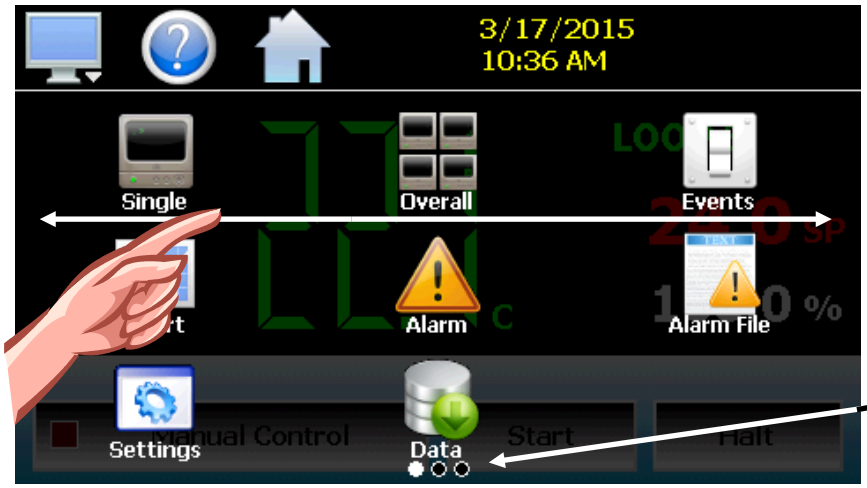
When ordering replacement part(s), please provide the model number, serial number, and product shipment date of your equipment so that we can ensure you will receive the proper replacement part(s).

5.3 Display Menu Navigation

The display provides the user with the ability to select text based menu navigation, much like the typical file menu system of a PC, as well as an icon based navigation system like that of a "smart" device. The user can switch back and forth between the two from the Setup menu.



Text Based Navigation



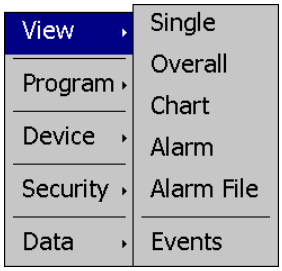
Icon Based/Slide Page Navigation

The available menu items are dependent upon the OEM configuration of the display. Not all of the menu items shown may be available on your system. The following information is provided as an overview of the full navigational menus for the display.

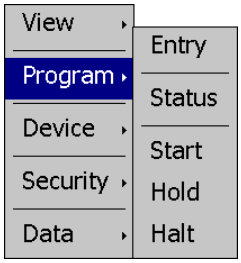
Home Menu

The home menu is the top level, default menu provided when the display first powers on. Pressing the menu (monitor) icon will display the main menu offering the selections shown below.

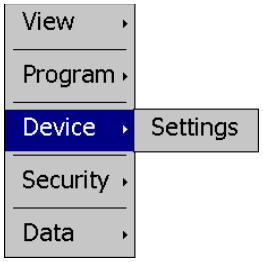
Text Based Home Menu



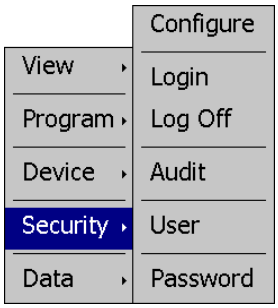
The **View** menu provides navigation to all standard view screens. These include the Single and Overall loop views, real time Charts, Alarm monitor, Alarm File and Events control screens.



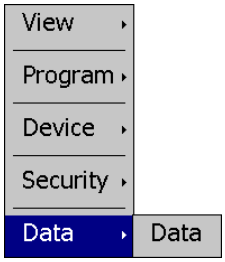
The **Program** menu provides access to the automatic ramp/soak program actions, Entry and Status views. The program Start, Hold and Halt menu items allow quick access to these functions if a program is already downloaded to the display loop controls.



The **Device** menu provides access to the display controller settings. These include, loop set point entry limits, alarm set points, communication settings, email setup as well as access to offline settings for date/time, etc.

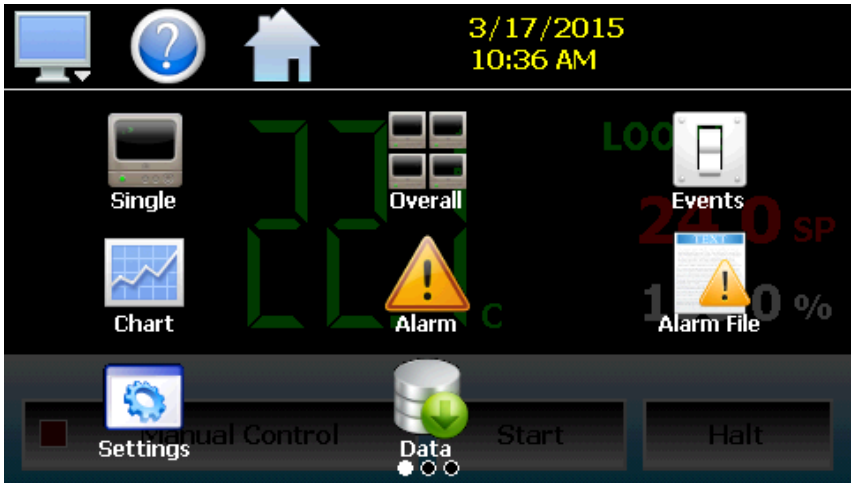


The **Security** menu provides access for user login, security settings and audit trail viewing if the security system is enabled.



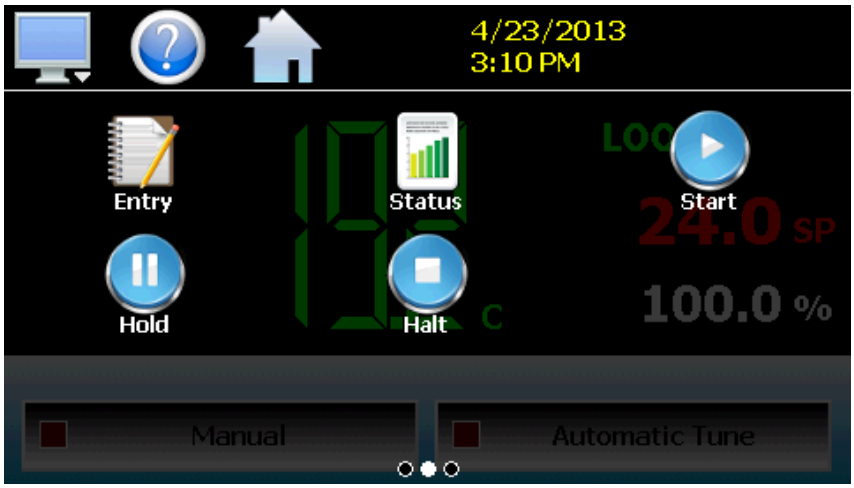
The **Data** menu provides access to data log functions, file utilities, FTP\WAN back-up settings as well as the historical data viewer.

Icon/Slide Page Based Home Menu



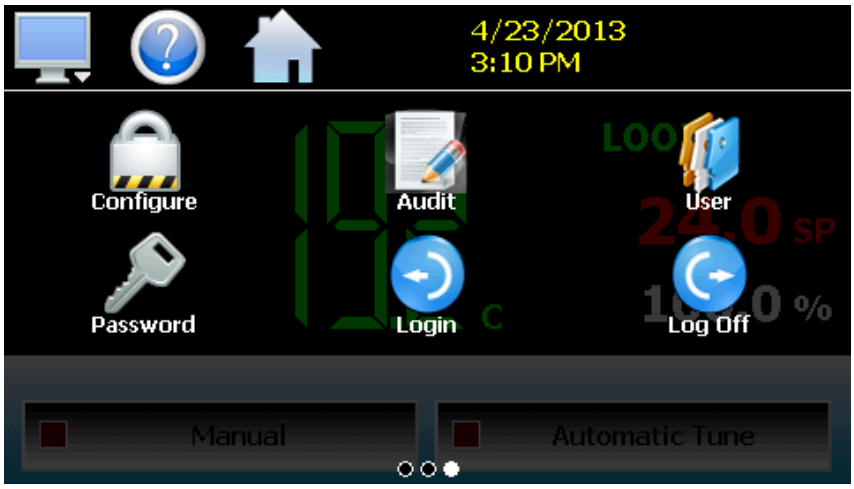
Slide page 1 provides navigation to all standard view screens. These include the Single and Overall loop views, Event control, trend Charts, Alarm monitor, and Alarm File.

It also provides quick access to the display Settings and Data file functions which include file utilities, FTP\WAN back-up settings as well as the historical data viewer.



Slide page 2 provides access to automatic ramp/soak program actions, Entry and Status views.

Start, Hold and Halt program menu items allow quick access to these functions if a program is already downloaded to the display loop controls.

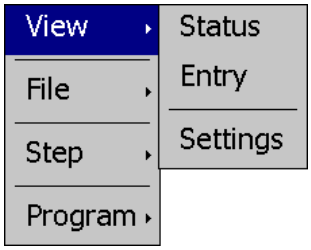


Slide page 3 provides access to security settings, Audit trail viewing, current User information, user Password editing and user Login and Log Off functions.

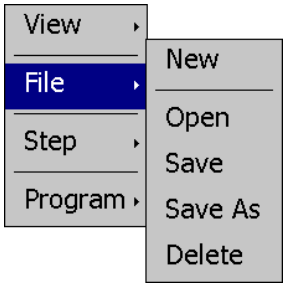
Automatic Ramp/Soak Program Menu

The automatic ramp/soak program menu is provided when the user selects either “Entry” or “Status” from the Program menu. The menu provides all functions related to the creation, editing and operation of programs. See section 5 on Automatic Ramp/Soak Program Operation for detailed information on how to create and run programs.

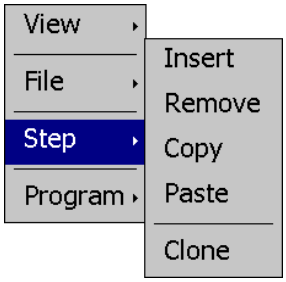
Text Based Program Menu



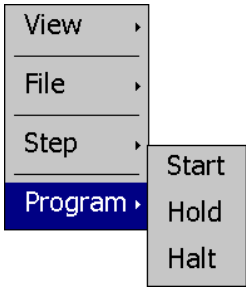
The **View** menu provides navigation to the program view screens. These include the Status, Entry and Settings screens.



The **File** menu provides functions needed to create, open, save and delete automatic ramp/soak programs.

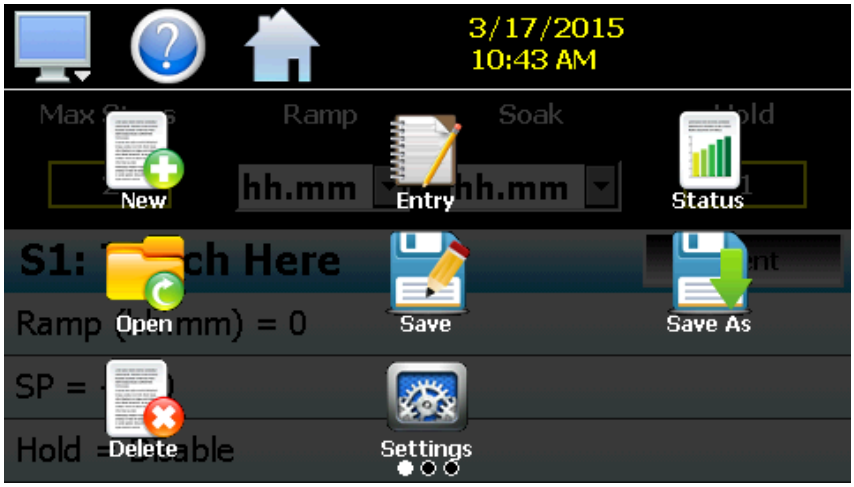


The **Step** menu provides all of the functions needed to edit programs. These include Insert, Remove, Copy and Paste step functions as well as the Clone event function which allows the user to transfer the current step event selections to all following program steps with a single click to simplify and speed program entry.

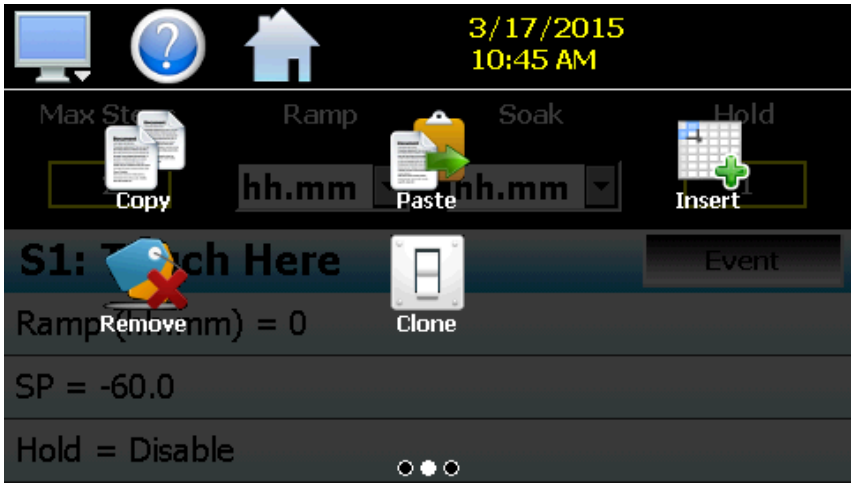


The **Program** menu provides the program control selections for Start, Hold and Stop.

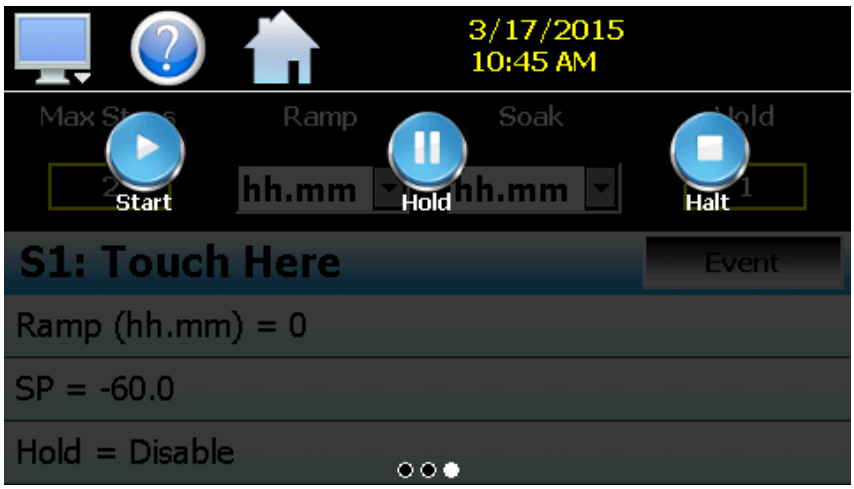
Icon/Slide Page Based Program Menu



Slide page 1 provides navigation to the program Status, Entry and Settings screens and also provides access to the functions needed to create, open, save and delete automatic ramp/soak programs.



Slide page 2 provides all of the functions needed to edit programs. These include Copy, Paste, Insert and Remove step as well as the Clone event function which allows the user to transfer the current step event selections to all following program steps to simplify and speed program entry.

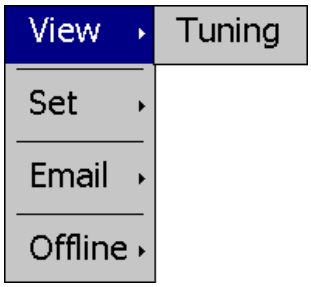


Slide page 3 provides the program control selections for Start, Hold and Halt.

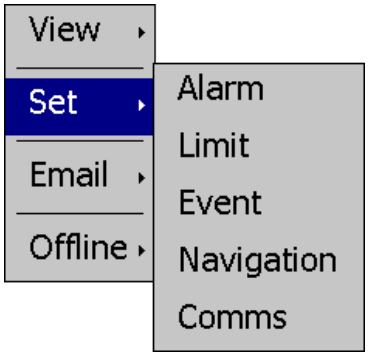
Device Settings Menu

The device settings menu is provided when the user selects “Settings” from the main “Device” menu. See section 8 on Device Settings for detailed information on these settings and their use.

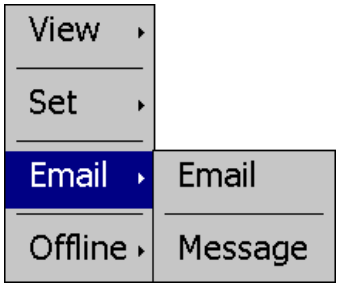
Text Based System Setup Menu



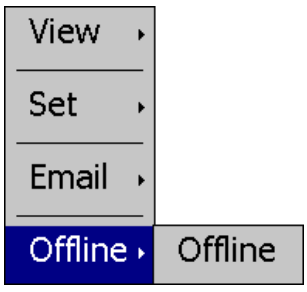
The **View** menu provides navigation to the manual loop Tuning screen.



The **Set** menu provides access to settings Alarm set points, control loop set point Limits, Event tagnames, Navigation type selection and Communications options.

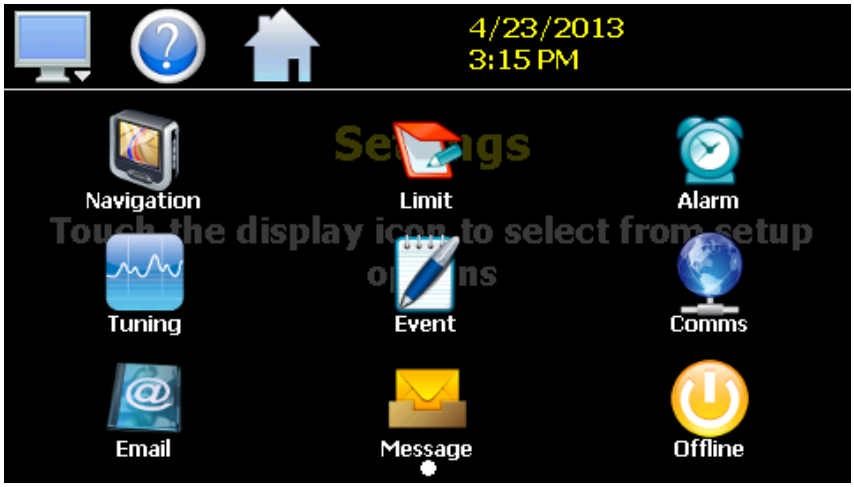


The **Email** menu provides settings for the email server to send SMS text messages and/or emails on alarm and allows the user to compose and send a Message to any user configured in the system.



The **Offline** menu provides access to the display offline setup which provides the user with the ability to adjust the date/time, calibrate the touch screen, configure profile power recovery options, etc.

Icon/Slide Page Based Device Settings Menu



The Setup slide page provides access to the display controller settings. These include options for Navigation type, control loop set point Limits, Alarm set points, loop Tuning, Event tagname entry and Email server settings and Messaging.

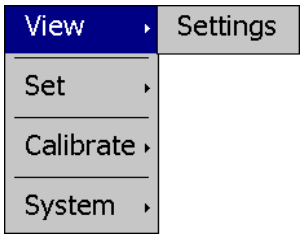
It also includes access to the communications settings for the web page, VNC server and Modbus user communications.

Offline Menu

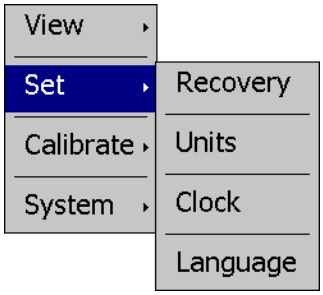
The offline menu is provided when the user selects “Offline” from the device settings “Offline” menu. See section 9 on Offline Settings for information on these settings and their use.

NOTE: *Offline settings can only be accessed when an automated ramp/soak program is not running and data logging is turned off.*

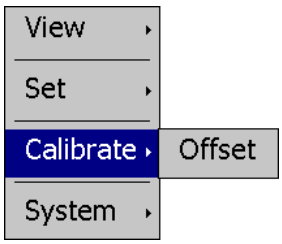
Text Based Offline Setup Menu



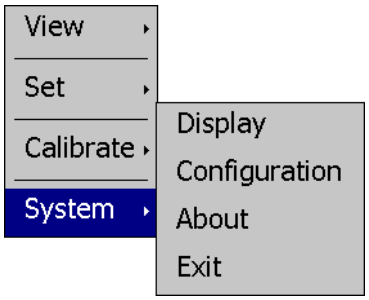
The **View** menu provides navigation back to the display device settings menu.



The **Set** menu provides access to the profile power Recovery options, temperature Units selection, NTS Clock, and Language settings.

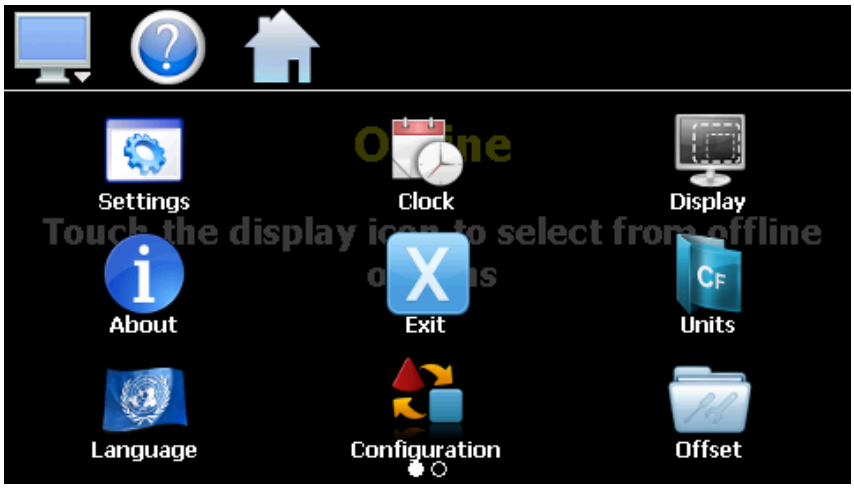


The **Calibrate** menu provides access to the user input Offset calibration for the control loop inputs.

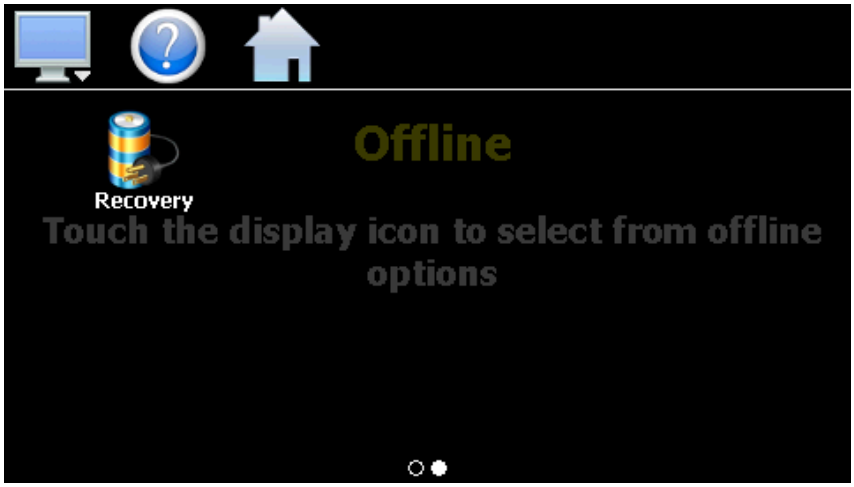


The **System** menu provides access to the display settings, import/export Configuration utility, About screen and Exit application screen.

Icon/Slide Page Based Offline Menu



Slide page 1 provides navigation back to the device Settings menu, Clock, Display settings, About the display and Exit application screens, temperature Units selection, Language, import/export Configuration utility and input Offset calibration.

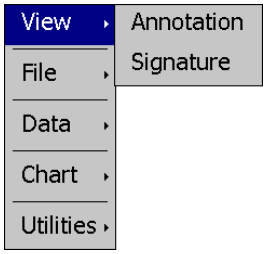


Slide page 2 provides access to the automated program power Recovery options.

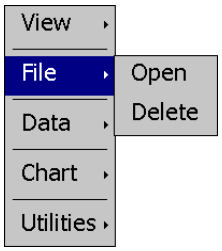
Data Menu

The data log menu is provided when the user selects “Data” from the main “Data” menu. See section 7 on Data Logging for information on these settings and their use.

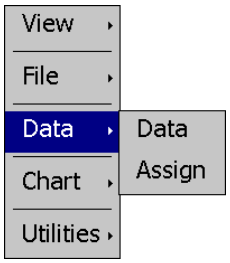
Text Based Data Logging Menu



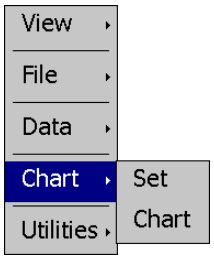
The **View** menu provides access to the data file Annotation and digital Signature screens.



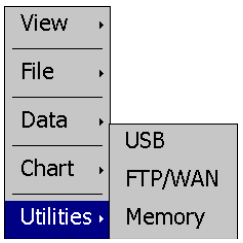
The **File** menu provides functions for opening and deleting historical data log files.



The **Data** menu provides access to the main Data screen for starting and stopping data logging and to the log point Assignment screen where the user can select which items are to be logged to the history file.

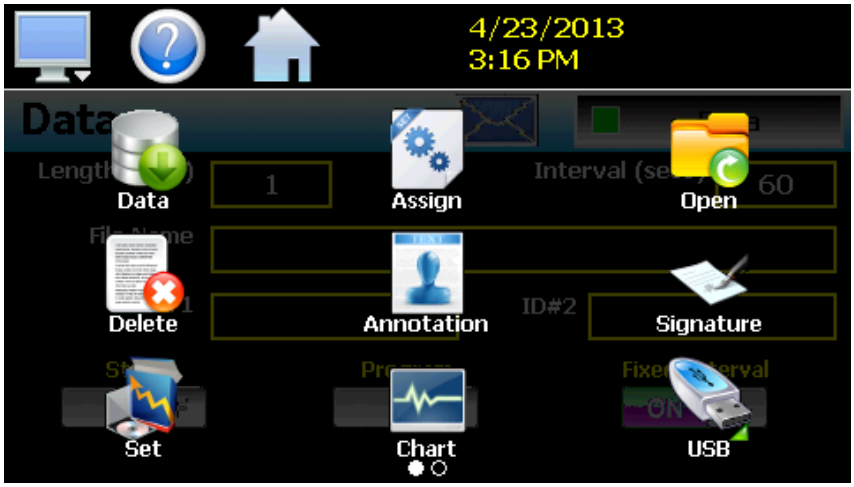


The **Chart** menu provides functions for viewing historical data files in graphical format.



The **Utilities** menu provides access to the display file management utilities including USB file transfer and FTP/WAN back-up.

Icon/Slide Page Based Log Menu



Slide page 1 provides access to the main Data log screen and to the log point Assignment screen where the user can select which items are to be logged.

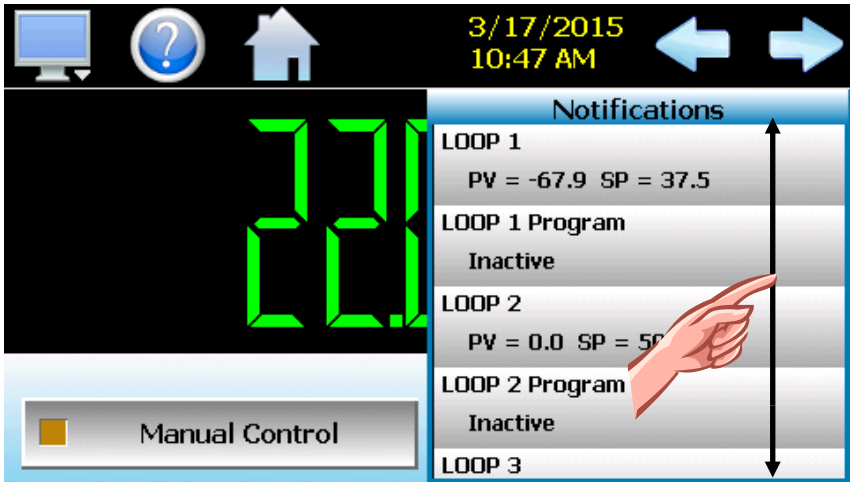
Historical data file functions are provided for Opening and Deleting historical files and viewing/setting data file Annotations and digital Signatures.

The plot Set and Chart icons provide access to the historical data viewer options.

Slide page 2 provides access to the FTP/WAN back-up settings and the memory check utility for viewing available system/storage memory space.

Notifications

The notification window is a feature that can be accessed by pressing the date/time field in the icon bar. This window provides a snapshot of current the display activity. The notification window can be closed by pressing the date/time field again, or is automatically closed if the Menu, Home or an arrow icon is pressed.



A user can view all notifications by touching the screen and dragging their finger up or down on the list to scroll through all items like other lists in the display. The notifications include the following:

- Loop PV and SP for each loop configured.
- Automatic program status including name of running profile.
- Active alarm status including the most recent alarm.
- Data logging status including active file name and the length and logging rate set.
- Security status including the current user.
- Audit trail active/inactive status.
- Web server active/inactive status.
- VNC server active/inactive status.
- the display IP address.
- Available SD storage memory remaining.

The appearance of the items is based on the configuration of the display. If data logging or security functions are disabled in the configuration for example, their status items will be removed from the list as well.

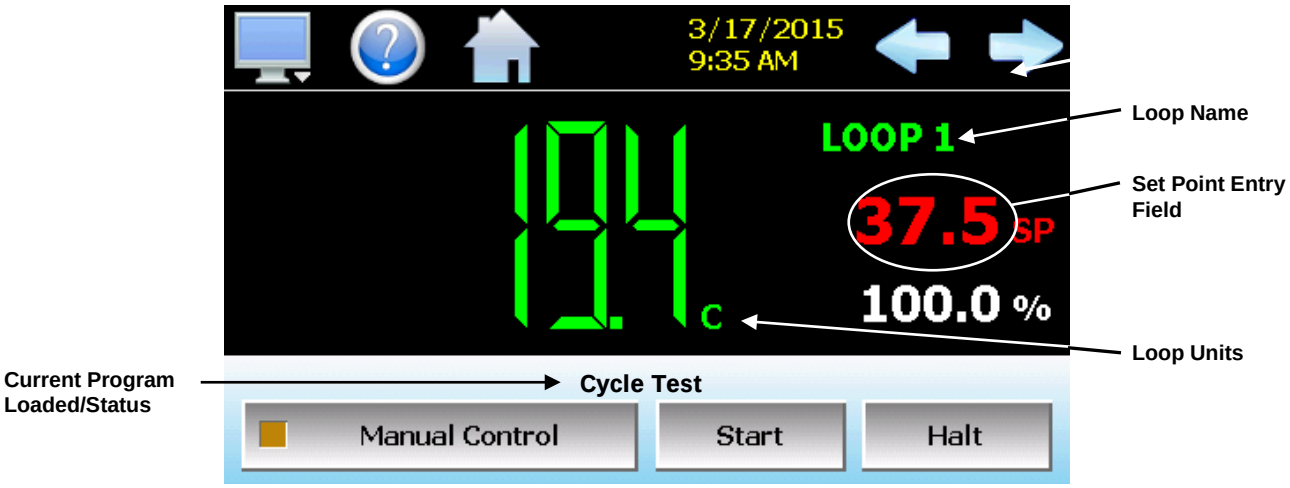
NOTE: *The notification items do not update while the list is shown. The information shown in the list is a snapshot of the data at the time the window was shown. Therefore, the PV or SP shown for a loop may not be the actual values for the loop if the notification window is left open for extended periods of time. The notification window is not available in the offline setup.*

Control Loops (Single Set point Operation)

The loop view screens provide direct viewing options for the control and monitoring of the display control loops. The loop screens allow the user to adjust the current loop set point (SP) and view the process variables (PV) and percentages of output (%) for each loop.

Single Loop View

The Single loop view display shows one control loop at a time. It is accessed from the home "View" menu. The screen provides loop control functions not available on the Overall view screen. These functions are accessed by the Manual Control, Start and Halt control buttons.



The **left** and **right arrow buttons** allow you to switch between each loop in the system if more than one loop is available. If the display is configured as a single loop system, the left and right arrow buttons will not be shown.

The **loop name**, shown at the top right of the loop view, will update as each loop is shown. The unit display field will update as well, in order to provide the user with the units of measurement for the selected loop.

The **set point entry field** is the area where the screen can be touched in order to bring up the keypad entry window. Using the numeric entry keypad, a new set point can be entered. Once entered, the new set point will be shown in the set point entry field. Adjustment of the set point is locked out if an automated ramp/soak program is running.

IMPORTANT: *When operating in single set point mode, the set point is saved in the loop control board's memory once every 5 minutes. If the set point is changed and power is removed prior to the 5 minute time period, when power is re-applied, the loop set point will return to the previous value. Make sure that power remains on the unit for 5 minutes after a set point change in order to have it power-up with the desired set point the next time power is applied.*

The loop control function buttons are used to define the mode of operation of the loop.

Manual Control - This button switches the loop mode between automatic and manual operation. When the loop is in automatic mode, the loop will automatically adjust its output based on its PID settings. When the loop is in manual operation, the percentage of output for the loop can then be set manually, to a fixed output percentage.

To switch the loop between auto and manual operation, press the button to place the loop in auto or manual mode. When in manual mode, the button's indicator will be on. To adjust the loop output percentage when in manual operation, touch the percent output display field and enter the desired percentage of output. If the loop is configured for heat/cool operation, enter a positive value for heating and negative value for cooling.

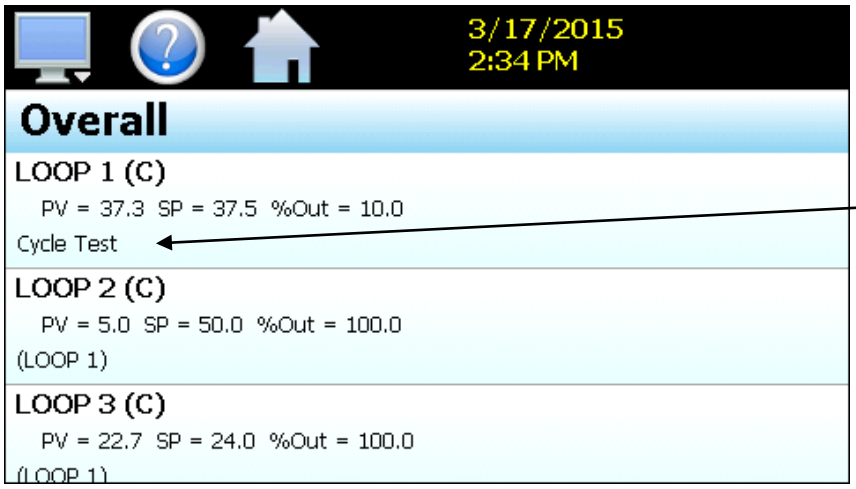
Start - This button starts the automatic ramp/soak program currently loaded in the loop control. During program operation, the button text will change to "Hold". Pressing the button will place the program in hold. Pressing the button again will resume the program.

Halt - This stops the automatic ramp/soak program running in the loop control. The loop will be places back into the single set point (static) mode of operation.

NOTE: *If the automatic ramp/soak program mode setting is set to "All", the current program loaded field and start/halt buttons will display and control the program loaded in the "primary" loop control. The program mode and primary loop are adjusted on the program Settings screen. See section 5, Automatic Ramp/Soak Program Operation for more information.*

Overall Loop View

The Overall loop view provides a list of all loops configured in the system. It is accessed from the home "View" menu. If the display is configured as a single loop system only loop one will be shown. The screen allows manual set point entry for each loop by touching the respective row.



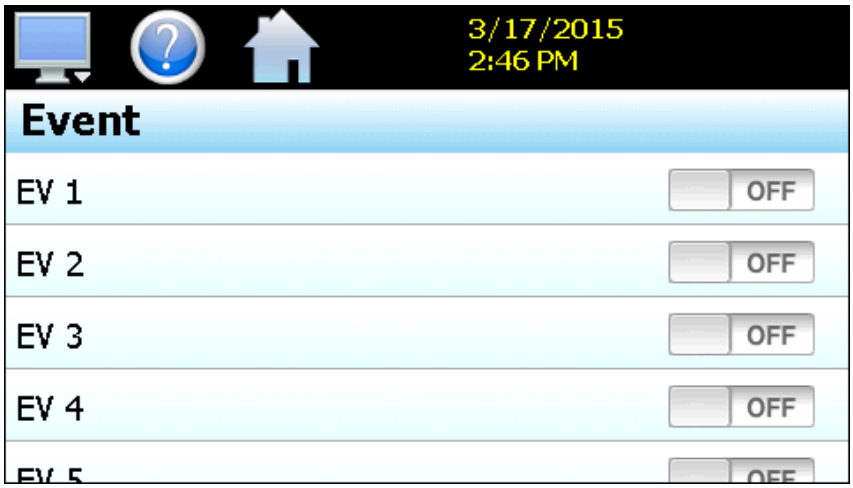
NOTE: *If the automatic ramp/soak program mode setting is set to "All", the current program loaded field for the primary loop will display the program information. All other "slave" loops will indicate that they are under set point control of the primary loop by displaying the name of the primary loop in parenthesis. See section 5, Automatic Ramp/Soak Program Operation for more information.*

Event Control

Events are the "switches" used to turn the digital outputs of the display loop controls on and off. These events can be manually turned on and off as well as programmed into automatic ramp/soak programs so that they can be turned on and off at set time intervals.

NOTE: *The display loop controls can provide up to 3 event outputs each (for a total of 30 events). Depending upon the configuration of the display, some outputs may perform specific control or alarm functions. The use of each output, and what it controls, is determined by the system designer. If there are questions or concerns about the configuration and operation of your the display controller, contact your OEM for further information. Only your OEM can address equipment related issues.*

The names of events are also determined by the system designer. The screen shot below is an example showing factory default event names. Consult section 8.3 on Event Names in order to see how to change the names of events.



To turn the events on and off, select "Events" from the home "View" menu. Press the switch for each event that you want to turn on or off to toggle the on/off state of the event. When an automatic ramp/soak program is running on the loop control that the event is tied to, the event cannot be manually controlled. During program operation, the event is controlled by the running program. The program must be stopped in order to control the event manually.

When running a program in the "All" mode, only the events tied to the primary loop are controlled by the program. All events tied to the individual "slave" loops can be manually controlled.

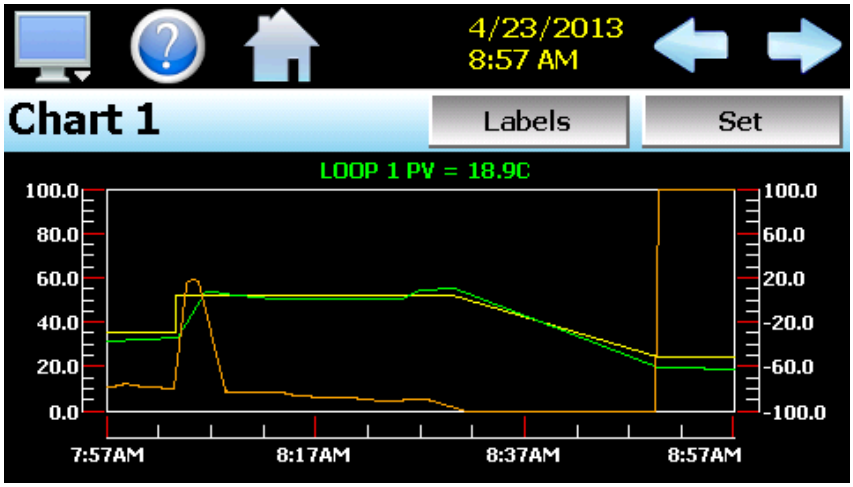
Process Monitoring

The loop view screens provide the current process values of the display. In order to view the process inputs over time, the display provides real-time charts. Four user configurable charts are provided with up to eight plot points per chart.

Charts

The Chart screen is accessed from the home "View" menu. The real-time charts can be configured to display the process variable (PV), set point (SP) and percentage of output (%) of each control loop over a selectable period of time. The vertical axis determines the range of displayed data while the horizontal axis determines the history period. The maximum time period that can be shown in a chart is 24 hours.

The rate at which the chart plots a new point is based on the time period to be shown. Each buffer can hold a total of 720 readings for each of the selected channels to plot. The update rate can be calculated by the formula: time period (in minutes) * 60 / 720. Note that for time periods less than 72 minutes, the update rate will be held to a minimum of 6 seconds. Thus, the update rate will vary from a minimum of 6 seconds (for time periods of 72 minutes or less) up to a maximum of 120 seconds for 1440 minutes (24 hours).



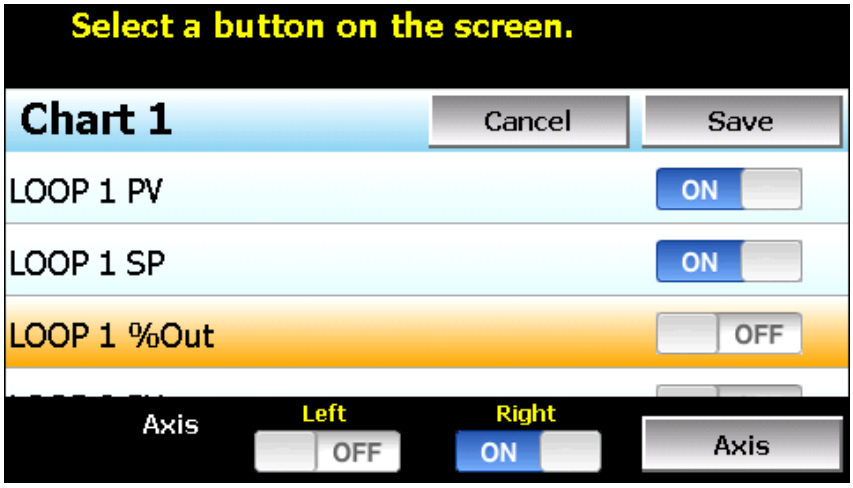
The **Labels** button allows the user to cycle through each of the configured plot channels to determine what each colored plot represents as well as view the current value without having to return to the Single or Dual view screens. The left and right scroll buttons at the upper right of the screen allow the user to cycle through each of the four available charts.

The charts also allow you to "zoom in" on a particular area to have a more detailed look at current data. By using your finger to select an area on the screen, the chart will zoom in on that area. To select a portion of the plot, touch and hold the screen with your finger. Drag your finger across the graph and a box will be drawn around the selected area. Removing your finger from the screen will cause the chart to redraw with only the selected plot area. To return to the normal view, touch the 'X' or 'Y' axis and select zoom out to return to the previous zoom setting or zoom normal to return to the full display.

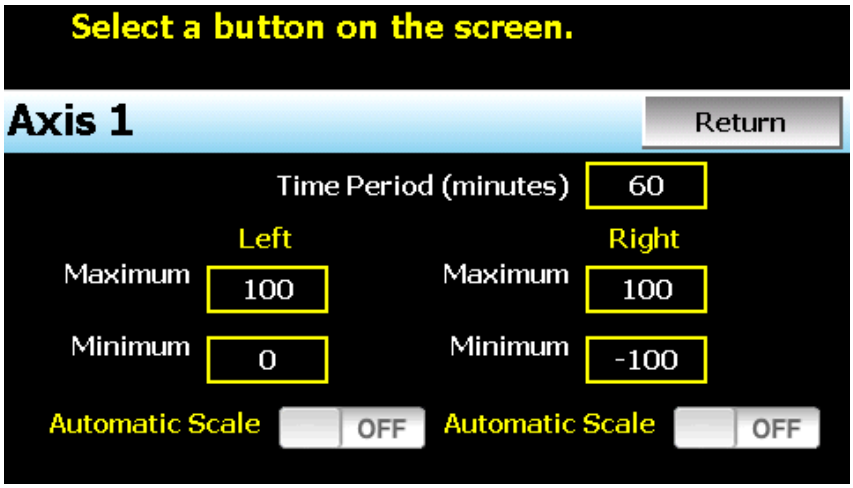
NOTE: *When a chart is zoomed in, it will not update with new information. The chart must be in normal view mode in order to update at each time interval. The chart will return to normal automatically when selecting a different screen to view.*

Chart Setup

To configure a chart, press the “Set” button in the upper right corner of the display. The setup screen will be shown. To assign channels to the chart, simply touch the on/off button for the desired items in the list to select them. Select the left or right vertical axis for each item by selecting the item in the list and press the button for the desired “Left” or “Right” axis. The left axis is the default axis selection. If none of the channels are assigned to the right axis, the axis will not be shown on the chart.



Once the channel selections have been made, press the “Axis” button to adjust the time period and vertical axis ranges of the graph.



Time Period - Adjusts the displayed time period for the graph. The allowable range is from 4 to 1440 minutes (24 hours).

Maximum - The maximum value sets the maximum range of the vertical access with a minimum value of -32,760 and a maximum of 32,760.

Minimum - The minimum value sets the minimum range of the vertical access with a minimum value of -32,760 and a maximum of 32,760.

Automatic Scale - When on, the vertical axis will automatically adjust its zero and span as needed to display the selected plot channels.

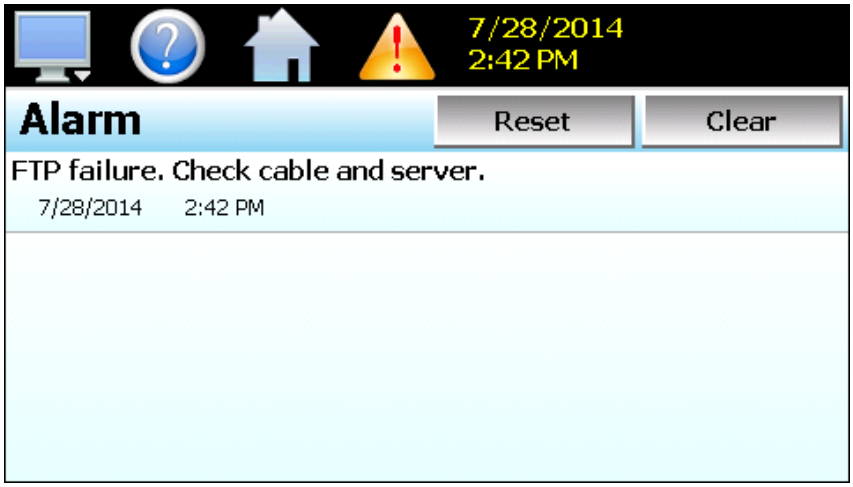
System Alarms

When an alarm condition occurs, the alarm icon flashes in the display icon bar, to provide a visual indication of an alarm condition. An audible alarm will also sound if the alarm requires immediate operator attention such as a loop communications failure or a process alarm set point has been exceeded. For more information on adjusting the audible alarm volume, see Section 9.12.3, Alarm Volume.

NOTE: *The display loop controls can provide up to 3 alarm outputs each (for a total of 30 alarms). Depending upon the configuration of the display, some outputs may perform specific control or event functions. The use of each output, and what it controls, is determined by the system designer. If there are questions or concerns about the configuration and operation of your the display controller, contact your OEM for further information. Only your OEM can address equipment related issues.*

Alarm Monitor

The Alarm screen is accessed from the home "View" menu. It can also be displayed by pressing the alarm icon whenever a new alarm occurs. It displays all current and/or previously acknowledged alarms according to time and date of occurrence. Once the alarm is reset, the alarm icon will be hidden; however, the alarm condition may still be present.



The alarm will be removed from the list when cleared by the operator by pressing the "Clear" button. Only alarms that are not currently active in the system can be cleared from the alarm list.

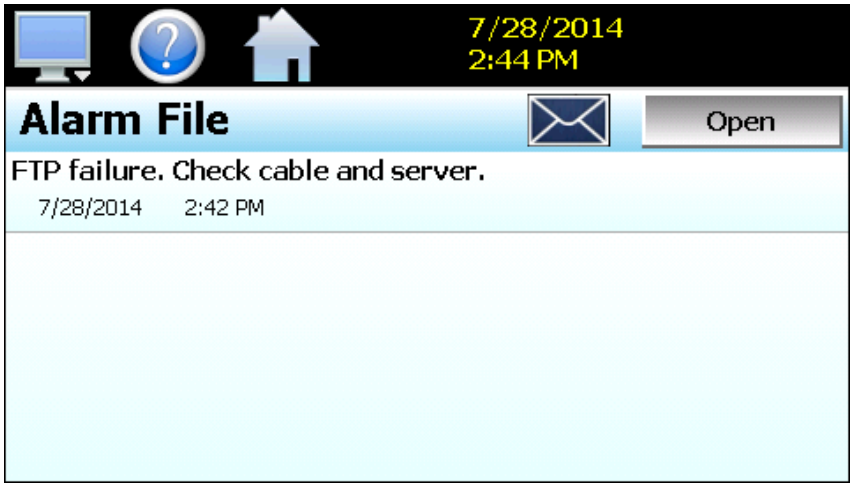
IMPORTANT: *If a control loop is in manual mode or in automatic tune and the reset button is preset, the alarm reset will terminate automatic tune or manual mode and place the loop back into normal operation.*

Upon alarm reset, if the process no longer exceeds the alarm set point, but the alarm output has not yet reset due to the alarm hysteresis, the alarm reset will ignore the alarm hysteresis and the alarm output will immediately go to the non-alarm output state.

Alarm File

The Alarm File screen is accessed from the home "View" menu. It displays all alarms for any given day. the display can store daily alarm files for a period of a year or longer (time based on storage usage for data history). Each time an alarm occurs on the display, the alarm is written to a file. Alarm file names are listed as month_day_year. The "Open" file button will display a dialog box where the user can select any alarm file to view.

NOTE: *If no alarms occurred on a given day, an alarm file will not be created for that day.*

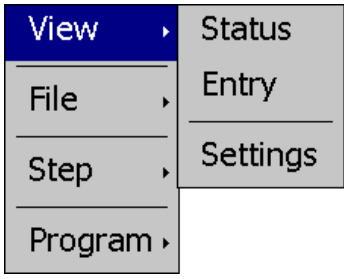


The send email icon allows the user to send a copy of the currently opened alarm file to any user configured in the display. When the email icon is pressed, an "Add Recipients" window will be displayed where the user can select recipients for the file from any of the email addresses configured under the display email settings.

Automatic Ramp/Soak Program Operation

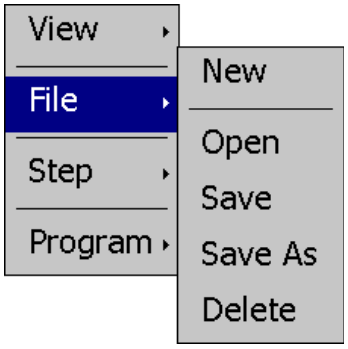
A ramp/soak program is a set of instructions (set points and events) programmed as a timed sequence of steps. When a program is run, the display executes each step of the program automatically, in sequence, based on the time duration and settings for each step. the display can store hundreds of automatic ram/soak programs (depending on storage usage for data history) with up to 64 steps in each program.

The menu provides navigation to the following functions:



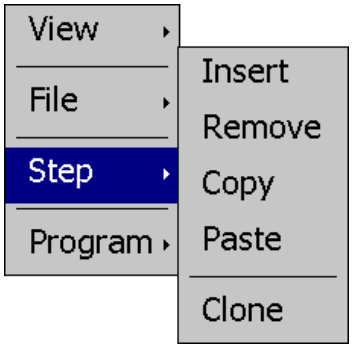
***View** menu*

Status: View program operation; step #, time remaining, etc.
Entry: Functions for creating/editing programs.
Settings: Set program operating mode and primary loop.



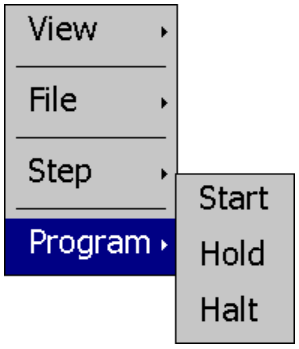
***File** menu*

New: Clears all current program entries.
Open: Provides file open dialog to select a program from memory.
Save: Saves the current program being edited.
Save As: Saves the program being edited under a new name.
Delete: Deletes the current program from internal memory.



***Step** menu*

Insert: Inserts a step into the program at the current step number.
Delete: Deletes the current step.
Copy: Copies current step data including events.
Paste: Pastes previously copied step data to the current step.
Clone: Copies and pastes current step events to all following steps.

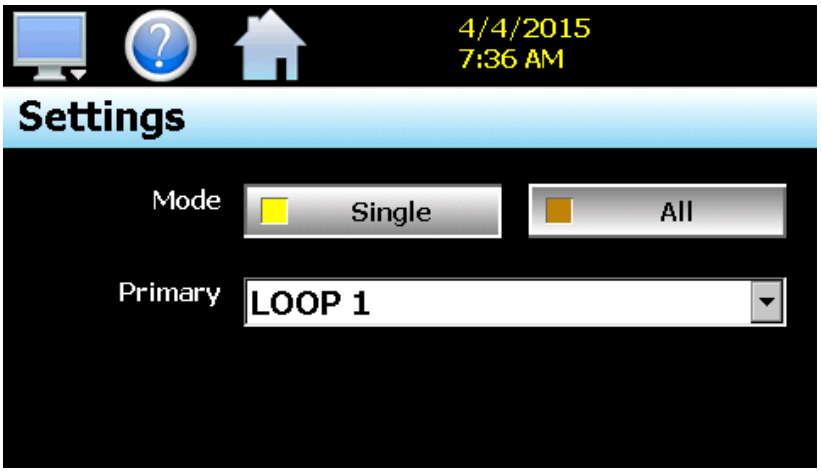


***Program** menu*

Start: Transfers current program to loop control(s) and starts it.
Hold: Places a running program in hold.
Halt: Stops a running program and returns the loop controls to single set point (static) operation.

Program Settings

The program settings are used to select the mode of operation for the automatic ramp/soak programs. The program Settings screen is accessed from the “Program” menu.



The **Single** mode selection button allows each control loop to run independently of the others. Programs are then downloaded separately to each loop control. The user can then individually start and stop the program in each loop control. Any combination of loop controls can then be operated in single set point (static) mode or automatically via the program at any given time.

The **All** mode selection button links all loop controls into a master/slave program operation. While in single set point (static) mode, each loop control operates independently from the others. However, when an automatic program is started, the loop defined as the “Primary” loop becomes the master and all other loops become set point slaves.

When the ramp/soak program is started in the primary loop, the display will automatically set the set point of all other (slave) loops to match the set point of the primary loop. The user will be unable to manually change the loop set points of the slave loops during program operation. However, any events tied to the slave loops can be manually turned on and off during program operation. Only events tied to the primary loop will be controlled via the automatic ramp/soak program.

The **Primary** loop selection is used to select which loop is to be used as the master loop when operating under the “All” program mode.

Entering a Ramp/Soak Program

Ramp/Soak programs are created and edited from the program Entry screen. The program Entry screen can also be accessed directly from the "Program" menu. To create an automatic ramp/soak program:

1.) From the File menu, select "New" to create a new program.

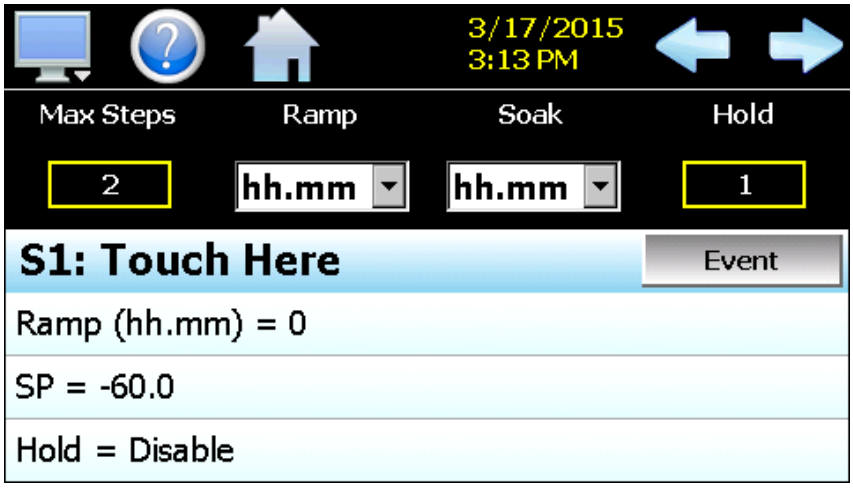
2.) Enter the number of steps that will be in the program you want to create. The default setting, and minimum number of steps is two. You can only adjust settings for step numbers within the range of 2 to the Max Steps entered (maximum of 64). Thus, to adjust settings for step 5, you must have the Max Steps set to a value of at least 5.

NOTE: *The number of steps can be changed at any time during the program entry to shorten or lengthen the program as required without affecting steps already programmed.*

3.) For each step, enter the step events, set point(s) and time duration or ramp rate (depending upon the ramp units selection). Example shown below with step time (HH:MM).

4.) From the File menu, select "Save" to save the program.

NOTE: *Programs can be saved with names of up to 16 characters long. However, the display only uses the first 14 characters of the program name for display updates and record keeping. When naming programs, try to keep the name limited to 14 characters in order to have the full program name shown, or use the first 14 characters as a means of more clearly identifying the program when more than 14 characters are used in the name.*



The **Ramp** units selection is a global selection that applies to all steps of the program. It allows the user to select the method of ramp step entry. Selections include ramp entry in units of time as either hours and minutes (hh.mm) or minutes and seconds (mm.ss) and entry in rate of change as units/hour or units/minute.

The **Soak** units selection is a global selection that applies to all steps of the program. It allows the user to select the method of soak step entry. Selections include units of time as either hours and minutes (hh.mm) or minutes and seconds (mm.ss).

The **Hold** band entry is global setting that apply to all steps of the program. If holdback is enabled on a ramp or soak step, this value will by applied to the current set point to determine if the process value is within the allowed deviation from set point. If outside of the allowed deviation, the program will be automatically placed into hold until the process value recovers within the band.

Setting Step Set Points and Time

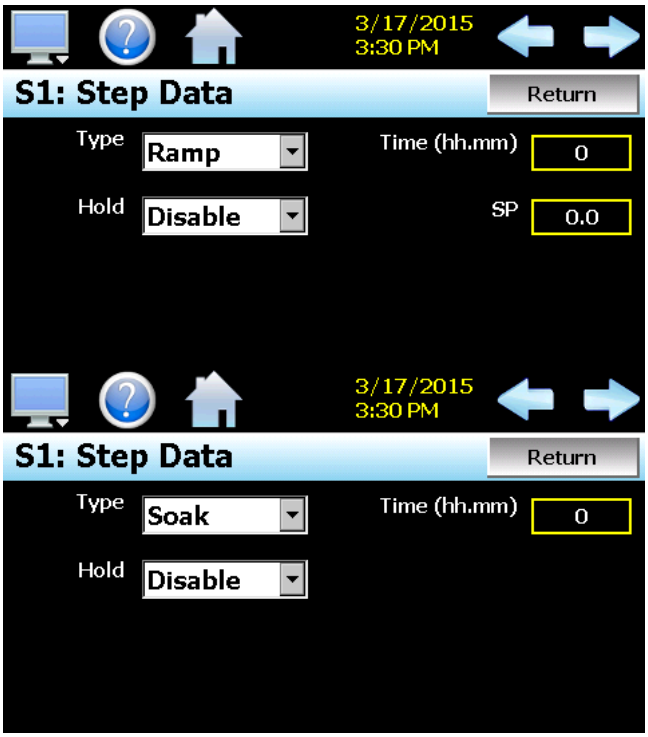
Programs are entered as a sequence of ramp and soak steps which define the set point and length of time that a loop should remain. The ramp and soak units can both be set for hours and minutes, minutes and seconds or one can be set for hours and minutes while the other is set for minutes and seconds.

Set point entry is only provided when entering a ramp step. If “soak” is selected for the step type, the loop will remain at the previous set point for the amount of time entered for the step. The set point entered is used as the target set point for the step, i.e., the set point the control loop will arrive at by the end of the step.

To enter the set point and/or time for a step, touch the time/set point list view at the bottom of the Entry screen. This will display the “Step Data” screen. Begin by selecting the desired ramp or soak step type (available selections are ramp, soak, jump and end). The jump and end step types are discussed in the following sections.

To enter the set point for the step, touch the set point field and enter the desired set point. To enter the step time, touch the time field to enter in the desired time duration. Time is entered as HH.MM or MM.SS depending upon the selection chosen on the entry screen. To make time entry easy, the entry will automatically be formatted into time as the number keys are pressed. To enter a time of 1 hour for example, you would enter a value of 100 for one hour and zero minutes. To enter a step time of 30 minutes, the time entry would be made as 30. If the time selection was in minutes and seconds, an entry of 1 minute and 30 seconds would be made as 130.

Since one minute and thirty seconds is also a time of 90 seconds, you can also enter a value of 90. Upon pressing the ‘Done’ button, the time will be formatted and displayed in the step data list view as 1.30 for 1 minute and 30 seconds.

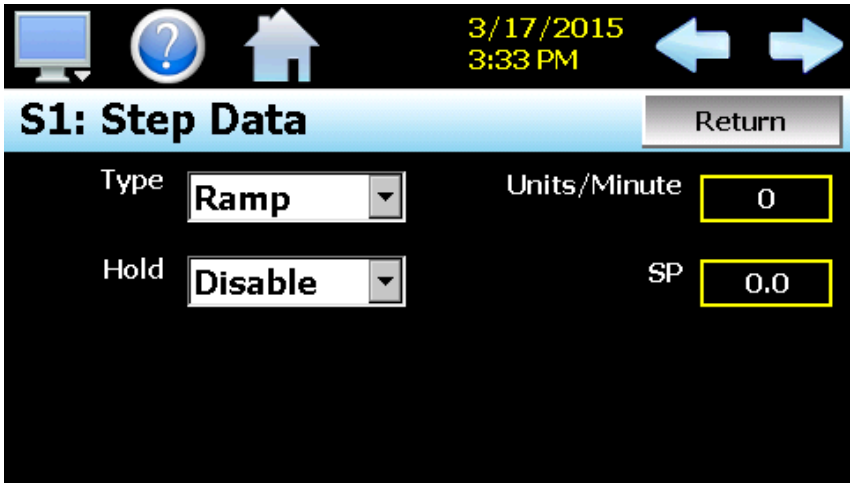


Ramp Step Entry
Soak Step Entry

NOTE: *A step time of zero can be entered for a step to implement an immediate set point change. When coupled with a hold back condition on the following step, there is no need to know the time it takes for the process to reach set point. The hold back condition can be used to trigger the next step, typically a soak, so that the desired soak time is achieved without having to determine what additional time may be needed in order to make sure that the process reaches set point before starting the soak time.*

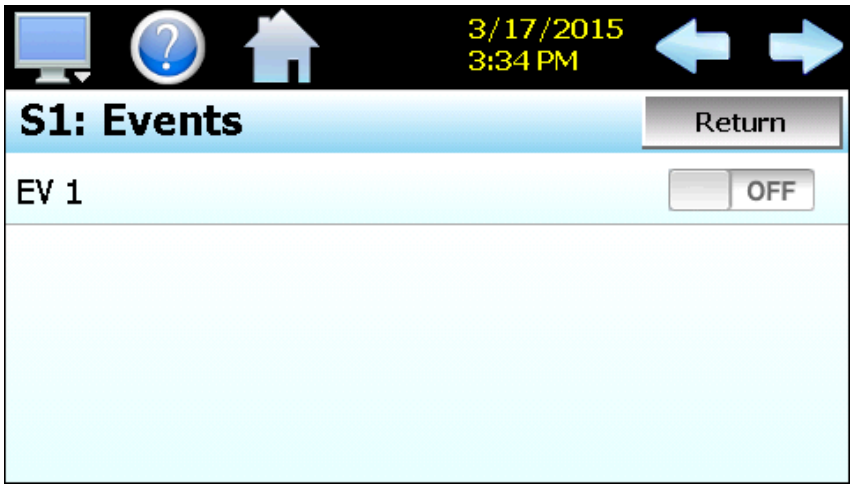
Setting Step Set Point and Ramp Rate

If the ramp units are set for units/hour or units/minute, ramp steps are entered in process units/time period. If the user enters a set point that matches the set point of the previous step, the step will be skipped since the loop is already at set point.



Setting Step Events

For each step of the program, the user can select which events are to be on during the step. To edit step events, press the “Events” button on the program Entry screen. This will display the step Events screen.



You can then select which events are to be on during the step by touching the on/off button for each event to toggle the events on or off. Pressing the left or right arrow button will allow you to scroll through each step of the program and not have to leave the step Events screen. To return to the Entry screen, press the "Return" button or select "Entry" from the View menu.

IMPORTANT: *The events displayed on the program entry events screen are those configured for the "primary" loop, whether the program mode is set to "Single" or "All". To view events for a specific loop, set the primary loop on the program settings screen to the desired loop you wish to create the program for. While a program can be downloaded and run on any loop in the system, if the event selections do not match the configuration of the loop (events assigned to different outputs), the event output will not turn on when the program is run.*

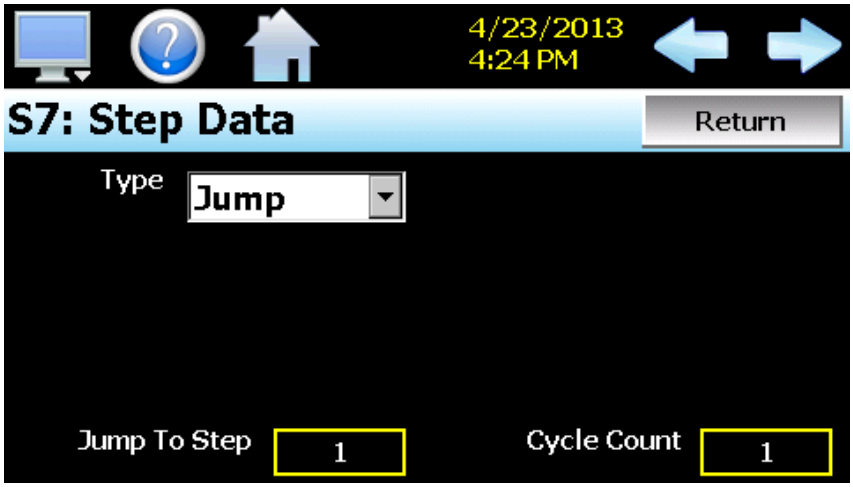
Events cannot be set for the End step. During program operation, when the End step is reached, the event outputs will return to their previous static setting (prior to starting program operation). If the loop controls are configured for "Final SetPoint" at end of program operation, the program will remain in the end step state and all event outputs will turn off and remain off until the user halts program operation. Upon stopping the program, the event outputs will then return to their static settings.

NOTE: *The step events must be set individually for each step. Even though a ramp/soak program may be in operation, if the events are not set, the associated loop control output will not turn on. To make setting step events quick and easy, the display provides the "Clone" function from the "Step" menu. When selected, all event selections of the current step will be copied to all following steps.*

This requires the user to only enter event selections for one step (step 1 for example), and if all following steps use the same event selections, selecting "Clone" from the "Step" menu will then copy the selections to all other steps of the program. This feature can be used on any step of the program, so if event selections then change on step 5, the function can be used again and all steps after step 5 will then have event selections of step 5 copied to them leaving steps 1-4 with the previous selections.

Setting Jump Steps

This feature allows the program to jump back to a previous step in order to repeat certain sections of a program. When a jump step is entered, the program will jump to the specified "jump step" rather than continuing on to the next step in the program. After all of the programmed jump cycles have been completed, the program will then continue to the next sequential step without making any further jumps.

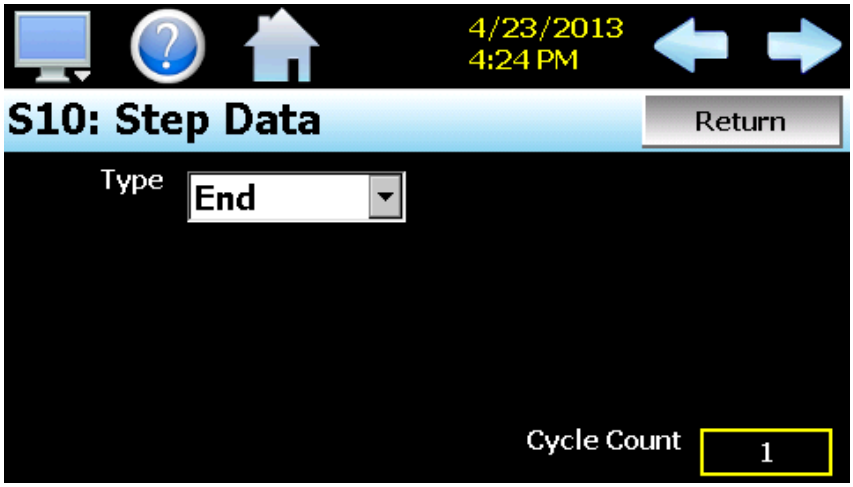


To program a jump step, select jump for the step type and enter the step number that you want the program to jump back to along with the total number of times the jump is to be made. A cycle count of one indicates that no jump will be made since one cycle is completed upon reaching the jump step.

NOTE: *the display has the ability to do nested looping by allowing multiple jump steps to be programmed throughout a program. The Status screen will provide the current cycle count; however, this is the cycle count of the current jump loop that the program is in. If nested jump loops are programmed, this can cause operator confusion if they do not know which jump loop the program is currently in based on the current step number.*

Setting the End Step

All programs require that the last step is entered as an "End" step type regardless of the length (2 to 64 steps) of the program. The end step type provides a cycle count entry which makes it easy for the operator to repeat an entire program without having to enter a jump step. The end step cycle count can be set from 1 to 9999 cycles. An entry of 10,000 can also be made which signifies infinite looping. If the user enters 10,000 for the cycle count, the program will repeat indefinitely until stopped by the user.



If the display is configured for automatic program final set point entry, the set point field will be present. When the program ends, the set point entered on the end step will be used as the loop set point. The loop control will then remain at that set point until the user halts the program. The loop control will then return to the previous static set point (prior to the start of the program) once the program is stopped.

The display configuration also provides the option for having the loop control return to the static mode of operation when the program is completed. When configured to use the last control set point, the loop controls will automatically return to the previous static set point (prior to the start of the program) when the program ends. If there are questions or concerns about the configuration and operation of your the display controller, contact your OEM for further information. Only your OEM can address equipment related issues.

NOTE: *When configured for* automatic program final set point entry, *the display will remain in the end step until the user manually stops the program. If any loop control outputs are configured as events, they will remain in the off state and cannot be turned back on until the program is stopped.*

Hold Back Operation

The hold back band setting on the Entry screen is used to set the control tolerance of the loop during the steps that have hold back enabled. When the loop process variable deviates from its set point by more than the band value, the program timer will stop until the process variable re-enters the hold back band. The entry applies to every step in the program and only needs to be set once.

To enable hold back on a step, select the hold back type to use. When the step executes, the program will automatically enter a hold condition if the loop's PV deviates from its set point by more than the hold back band setting. There are four available hold back modes to choose from:

Off Disables hold back so no action is taken.

Dev Lo Deviation low hold back places the program in hold when the process value deviates below the set point by more then the hold back band.

Dev Hi Deviation high hold back places the program in hold when the process value deviates above the set point by more then the hold back band.

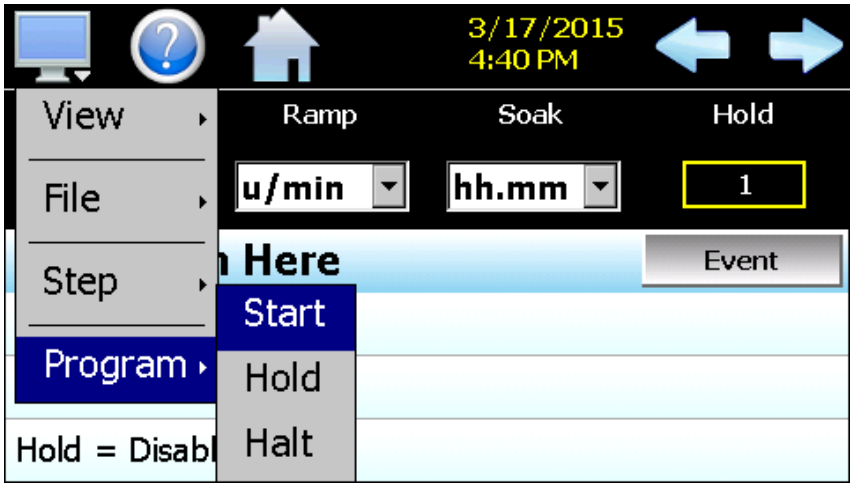
Band Deviation band hold back is a combination of both the deviation low and high hold back types. It places the program in hold when the process value deviates above or below the set point by more then the hold back band.

NOTE: *When running an automatic program in the "All" mode, only the primary loop is monitored for the holdback condition. All additional (slave) loops are not monitored for holdback. If there is a need to monitor the slave loops and place the program in hold if they deviate too far from set point, it will be necessary to configure the slave loops with deviation alarm outputs.*

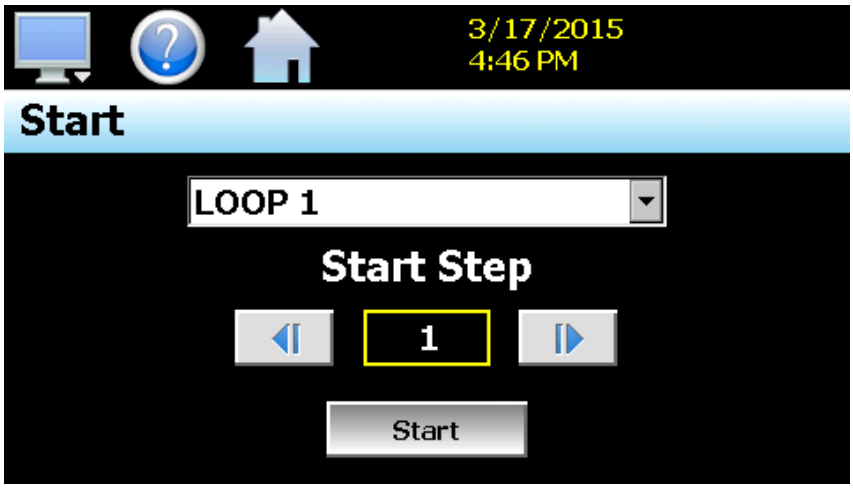
The deviation alarm outputs can then be wired into the event input of the primary loop. With the event input of the primary loop configured as an "automatic program hold" input, the program running in the primary loop will be placed in hold whenever a slave loop deviates too far from set point. When the deviation alarm deactivates, the program will then resume operation. Note that the deviation alarm set points for each loop will have to be manually entered to match the holdback band as set in the running program.

Starting an Automatic Ramp/Soak Program

In order to start an automatic ramp/soak program, it must first be loaded into the display control loop. In order to do this, you must select "Start" from the Program menu.



The screen will automatically change to the Start screen. By default, a program will always start on step 1. If you wish to start the program on a different step, press the start step field and enter the desired start step or use the left and right skip buttons to adjust the step number.



Select the desired loop to download and start the program on using the drop down selection. If only one loop is configured in the system, or the program mode is set to "All", the loop selection will not be visible. When the program mode is set to "All" on a multi loop system, program operation is automatically defaulted to the primary loop.

Once the desired loop has been selected and the start step number is entered, press the "Start" button. The program will then be transferred to the loop control and started once the transfer is complete. The Status screen will then be automatically displayed.

To stop a program, select "Stop" from the Program menu. When a program is stopped, the loop set points and events will revert back to the single set point (static mode) values that were entered prior to the program being started.

NOTE: *When the program operating mode is set to "Single" and more than one loop is configured in the system, the "Halt" menu selection will prompt the user to select a loop to perform the action on prior to stopping a program. If only one loop is configured, or the program mode is set to "All" on a multi loop system, the program will be stopped on the primary control loop.*

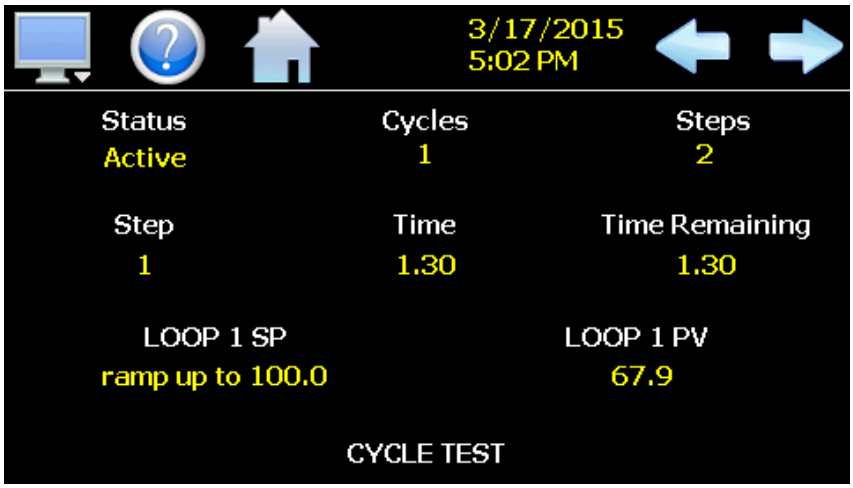
Hold/Resume Ramp/Soak Program Operation

At any time during the operation of a program, it can be manually placed into hold. This stops the program timer; however, the display continues operation under the current step settings at the time the program was put into hold. To pause a program, select "Hold" from the Program menu. To resume the program from the point in which it was paused, select "Start" from the Program menu.

NOTE: *When the program operating mode is set to "Single" and more than one loop is configured in the system, the "Hold" menu selection will prompt the user to select a loop to perform the action on prior to placing a program in hold. If only one loop is configured, or the program mode is set to "All" on a multi loop system, the program will be placed in hold on the primary control loop.*

Monitoring Automated Ramp/Soak Program Operation

The program Status view provides all information regarding the operation of a program for each control loop configured in the system. When a program is first started, the display automatically directs the user to this screen to observe program operation for the loop the program was started on.



The **Status** field indicates the current operating mode of the program, i.e., Active, In Hold and Inactive.

The **Cycles** field indicates the number of cycles left to be completed for the current jump loop.

The **Steps** field indicates the total number of steps in the current program.

The **Step** field indicates the step number currently being executed.

The **Time** field indicates the total length of time programmed for the current step.

Time Remaining is the time remaining in the current step.

The loop **SP** indicates the programmed set point for the loop that will be achieved by the end of the step. The field will indicate the current ramp or soak status for the loop based on the set point of the step. If the target set point of the step is greater than the loop set point, “ramp up to” will be displayed. If the set point is lower than the current loop set point, “ramping down to” will be displayed. If the step is a soak step or the target set point is the same as the current loop set point, “soak at” will be displayed.

The loop **PV** displays the current process value of the loop.

The name of the running program, or current program loaded to the the display loop control, will be shown at the bottom center of the screen. If no program has been loaded, the field will be empty.

IMPORTANT: *If the set point does not match the set point programmed for the step, check the lower and upper set point limits. The lower and upper limits define the allowed operating range. If a step set point exceeds a limit, it will be coerced to the lower or upper limit that it exceeds. This is done automatically without altering the original program.*

Common Questions About Ramp/Soak Program Operation

1. How do I start or run a ramp/soak program?

To select and start a program, you must be on the 'Entry' or 'Status' screen. Using the File menu, choose the 'Open' menu item to select from a list of all available programs stored on the display. Open the desired program from the list, and then select 'Start' from the Program menu. Enter the desired start step and select the loop to start the program on, then press the 'Start button.

2. How do I know which program is running?

When a program is running, the name is displayed on Status view screen as well as the Single and Overall loop view screens. the display will indicate that the program is running when it is in operation. If a program is not running, the display will display the name of the currently loaded program, i.e., present in memory and ready to be run.

3 Why is the program not running to the set point entered for the step?

Automatic ramp/soak program operation is limited by the lower and upper set point limits (see section 8.3 Setpoint Limits). If a program step has a set point that exceeds the lower or upper limit, the set point will be automatically coerced to the limit it exceeds. This prevents damage to equipment or product by insuring that the system only operates to the range entered by the user. If a program step has a set point of 100 for example, but the upper limit is 90, when the program is run the set point will be coerced to the maximum allowed upper limit of 90 during operation of the step.

The original program remains unaltered, so if the user then changes the lower and upper limits to match the range of set points within the program, the program will then operate to the programmed set points. This insures that the operating range of the system can not be exceeded even if a user accidentally copies a program from another system with a greater operating range.

6 Service Trouble Shooting

6.1 Replacing the heating plates or heating coil

Removal

- Remove the rear cover
- Disconnect the power wires to the heaters and the thermocouple wires at the terminal block
- Open the front door and remove the two screws on each side of the vertical stainless steel shelf lip
- From the rear, remove the entire heated chamber/insulation/element package
- Replace the entire heated chamber/insulation/element package as a unit

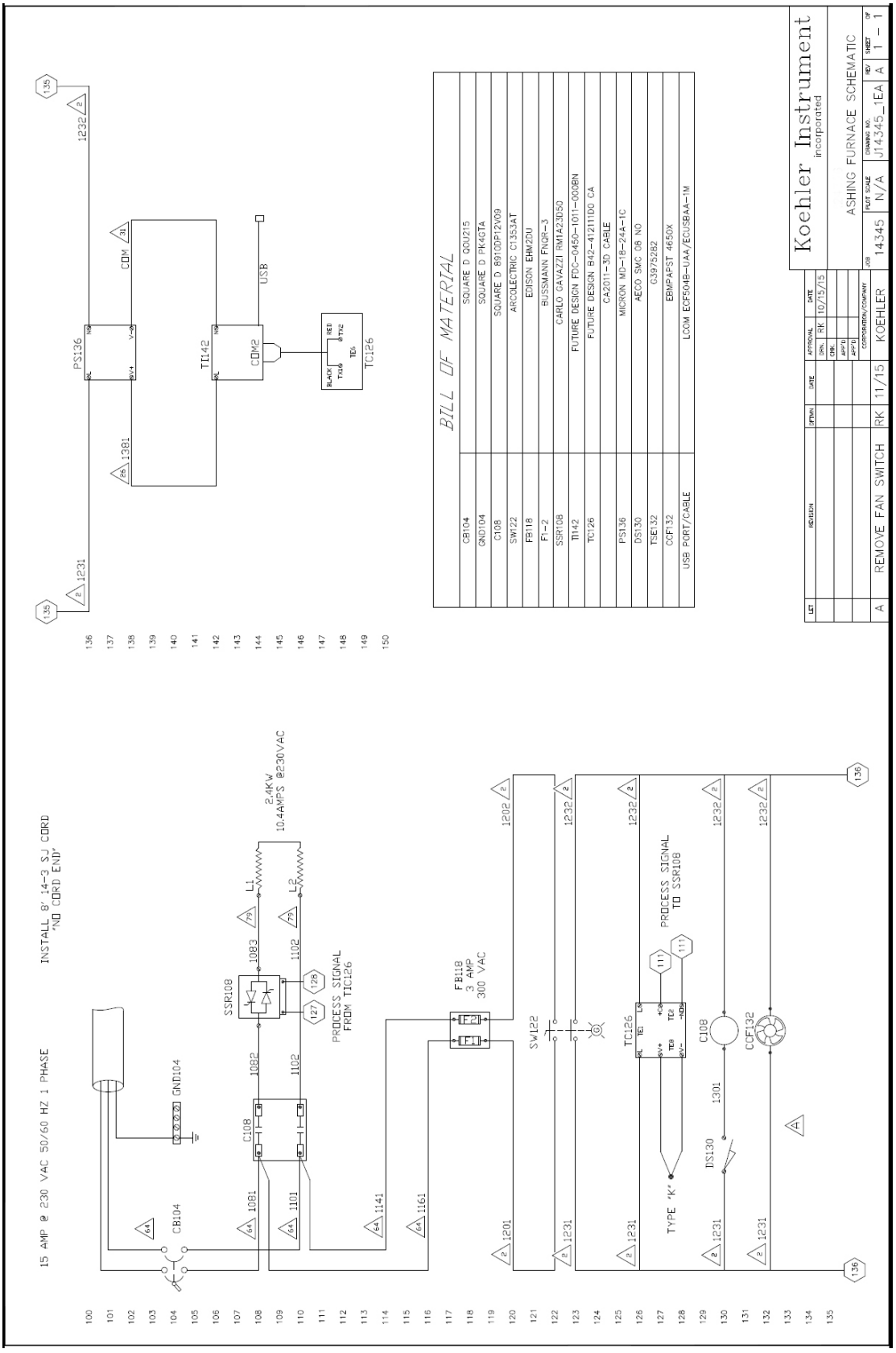
Insertion

- Clean furnace chamber and exhaust stack from residues
- Insert a new heated chamber/insulation/element package from the rear of the furnace
- Open the front door and install the two screws on each side of the vertical stainless steel shelf lip
- Re-connect the power wires to the heaters and the thermocouple wires at the terminal block
- Auto Tune the control system after installing the new heated chamber and perform the Initial heating procedure as outline in the beginning of this manual

Replacing the thermocouple

- Remove the rear cover
- Disconnect the thermocouple wires at the terminal block
- Loosen the compression fitting and remove the thermocouple. If the thermocouple was supplied with a new compression fitting, replace the old one with the new one
- Connect new thermocouple (observe correct polarity!)
- Install the rear cover

7 Wiring Diagram



8 Service

Under normal operating conditions and with routine maintenance, the K244XX, Ashing furnace should not require service. Any service problem can be quickly resolved by contacting Koehler's technical service department either by letter, phone, fax, or email. In order to assure the fastest possible service, please provide us with the following information.

Model Number: _____

Serial Number: _____

Date of Shipment: _____

9 Storage

This laboratory test instrument is equipped with electrical components. Storage facilities should be consistent with an indoor laboratory environment. This testing equipment should not be subjected to extremes of temperature and/or moisture.

This equipment was shipped from the factory in a corrugated cardboard container. If long term storage is anticipated, re-packing the instrument in a water-resistant container is recommended to ensure equipment safety and longevity.

10 Warranty

We, at Koehler, would like to thank you for your equipment purchase, which is protected by the following warranty. If within one (1) year from the date of receipt, but no longer than fifteen (15) months from the date of shipment, Koehler equipment fails to perform properly because of defects in materials or workmanship, Koehler Instrument Company, Inc. will repair or, at its sole discretion, replace the equipment without charge F.O.B. its plant, provided the equipment has been properly installed, operated, and maintained. Koehler Instrument Company must be advised in writing of the malfunction and authorize the return of the product to the factory. The sole responsibility of Koehler Instrument Company and the purchaser's exclusive remedy for any claim arising out of the purchase of any product is the repair or replacement of the product. In no event shall the cost of the purchaser's remedy exceed the purchase price, nor shall Koehler Instrument Company be liable for any special, indirect, incidental, consequential, or exemplary damages. KOEHLER INSTRUMENT COMPANY, INC. DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. Please save the shipping carton in the event the equipment needs to be returned to the factory for warranty repair. If the carton is discarded, it will be the purchaser's responsibility to provide an appropriate shipping carton.

10 Returned Goods Policy

To return products for credit or replacement, please contact Koehler Customer Service with your purchase order number, our packing list/invoice number, the item(s) to be returned and the reason for the return. You will be issued a Returned Authorization (RA) number, which must be prominently displayed on the shipping container when you return the material to our plant. Shipping containers without an RA number prominently displayed with will be returned to the sender. Goods must be returned freight prepaid. Returns will be subject to a restocking charge, the application of which will depend upon the circumstances necessitating the return. Some returns cannot be authorized, including certain products purchased from outside vendors for the convenience of the customer, products manufactured on special order, products shipped from the factory past ninety (90) days, and products which have been used or modified in such a way that they cannot be returned to stock for future sale.

Notes

Notes