Circuit Control

Supermarket Control Solutions

Installation Guide

ENGINEERING YOUR SUCCESS.

Bulletin 100-50-10.4/62017

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Introduction

The MT-700 Circuit Controller provides advanced, comprehensive control of refrigeration circuits.

Circuit Controller

The Circuit Controller is an advanced controller for regulating circuit pressure and managing defrost on up to 24 refrigeration circuits. The controller features a modular design, with selectable stepper-motor valve modules, relay output modules, and hybrid input/output modules. Inputs and outputs are user configurable to increase flexibility and maximize space utilization.

The Circuit Controller is a part of the Micro Thermo Technologies monitoring and controls platform, and integrates into the MT Alliance™ software. Together, the Alliance controls platform provides advanced control, reduced energy consumption, enhanced troubleshooting and diagnostics ability, and unparalleled visibility at any store.

Features

- Controls up to 24 circuits
- Up to 24 EEPR valves
- Up to 80 relays + up to 80 remote relays
- Configurable I/O
- Supports 2 Suction Groups
- Reduced board & space requirements
- Simplified user interface
- Improved overview of the circuits
- Compatible with TEVs and with Case Controllers

2 Circuit Controller Installation

Requirements

Hardware:
- MT-722F Module
- MT-700 Expansion Modules, as needed
- 4x #6 screws per module (for wall mounting)
- DIN Rail with #6 screws for mounting (if not wall mounted)
- 18 AWG 7/26 stranded, unshielded twisted pair network cable (Belden 8461 or equivalent)

Software:
- MT Alliance, Version 7.4 or higher

Tools:
- Phillips and Flat screwdrivers
- Small Flat screwdriver for terminal connections
- Wire cutters / strippers

Hardware Installation

Mounting

The MT-700 Series Controllers should be installed only by a qualified professional. The only user serviceable part of the MT-700 series are the relay fuses. To ensure safety and proper operation, the case should remain closed at all times, unless a fuse replacement is required.

The MT-700 Series Controllers have two mounting options: DIN rail; or Direct Mounting by the eight screw holes (four per controller module).

For DIN Rail Mounting:

Mount the DIN rail, either horizontally or vertically, in the desired location. Attach the controller modules to the rail separately, with the MT-722F to the left. Attach expansion modules in order to the right of the brain. Ensure the controllers' communication ports are correctly aligned, and gently slide the units together until the plastic housings are flush. Attach additional modules as needed to complete the controller train.

For Direct Mounting:

The controller modules must be mounted one at a time. Start by securing the MT-722F Controller module in place using four #6 screws. Place the first expansion module to the right of the MT-722F; align the controllers' communication ports, and gently push the units together until the plastic housings are flush. Secure the second module in place using four #6 screws. Continue attaching additional modules as needed to the existing controller train.

Wiring

For proper operation, the MT-700 Circuit Controller requires the power supply and LonWorks® network be connected. Up to (24) stepper motor refrigeration valves or up to (80) relay outputs can be wired to the controller. Refer to the wiring diagram and instructions supplied with the equipment for proper wiring connections.

Note: All connections should be made with the controller powered off.

Wiring *(cont.)*

Micro Thermo Technologies™ supplied equipment should be connected as follows:

- **Sporlan Valves:**
  Connect the four colored leads (Red, Green, White, Black) to the removable terminal connector of the desired MT-708V valve output. Make sure the leads are in the correct order, and correspond to the R, G, W, B markings on the module once connected.
- **Temperature Sensors:**
  Connect one lead to Signal Common; connect the other lead to the desired Universal Input (UI). *Temperature sensors are not polarized.*
- **Pressure Transducers:**
  Connect the Red lead to controller's five volt supply (5V); connect the Black lead to Signal Common; connect the Green lead to the desired Universal Input (UI).
- **Switch:**
  Connect one lead to Signal Common; connect the other lead to the desired Universal Input (UI). *Switches are not polarized.*

Micro Thermo Technologies and the Alliance Platform support a wide array of 3rd party sensors and valves. For installation of all other components, refer to the instructions supplied with the equipment.

- Next, connect the network cables to the LON terminals. The A and B connections are not polarized.
- Finally, connect the 24VAC supply from the transformer to the controller.

Observe all local electrical codes. Use caution when working around high voltage components.

Remote Satellite

Remote satellite controllers should be installed in the same manner as the main Circuit Controller train. Follow the Mounting and Wiring instructions above. Stepper-motor valve expansion modules are not supported; electronic evaporator pressure regulating valves should never be wired to a remote satellite. If EEPR valves are located remotely and wiring back to the primary Circuit Controller is not practical, the DT-EEPR controller can be used for valve control.

Basic Setup

Initial Circuit Control Setup

Getting Started

> Note: In order to begin the software setup, the installer will need proper credentials to access the Configuration Mode in Alliance.

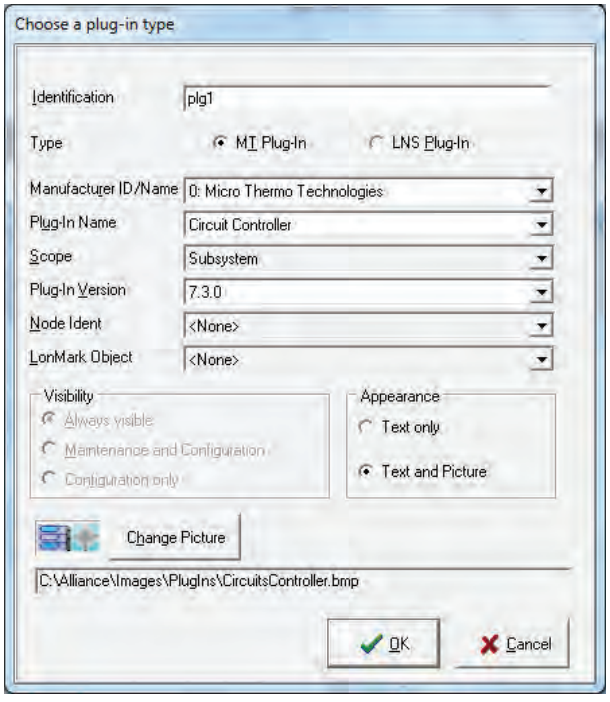
The MT-700 Circuit Controller is set up through the MT Alliance software. Installation requires creating a Circuit Controller plug-in, installing the node firmware, and setting up the operational parameters.

Each Circuit Controller supports up to two satellite relay nodes. A satellite node is an additional controller train whose relays are actuated remotely by the Circuit Controller via the LonWorks network. All installation, configuration and settings for the entire Circuit Controller, including satellites, are made through a single plug-in.

Creating the Circuit Controller

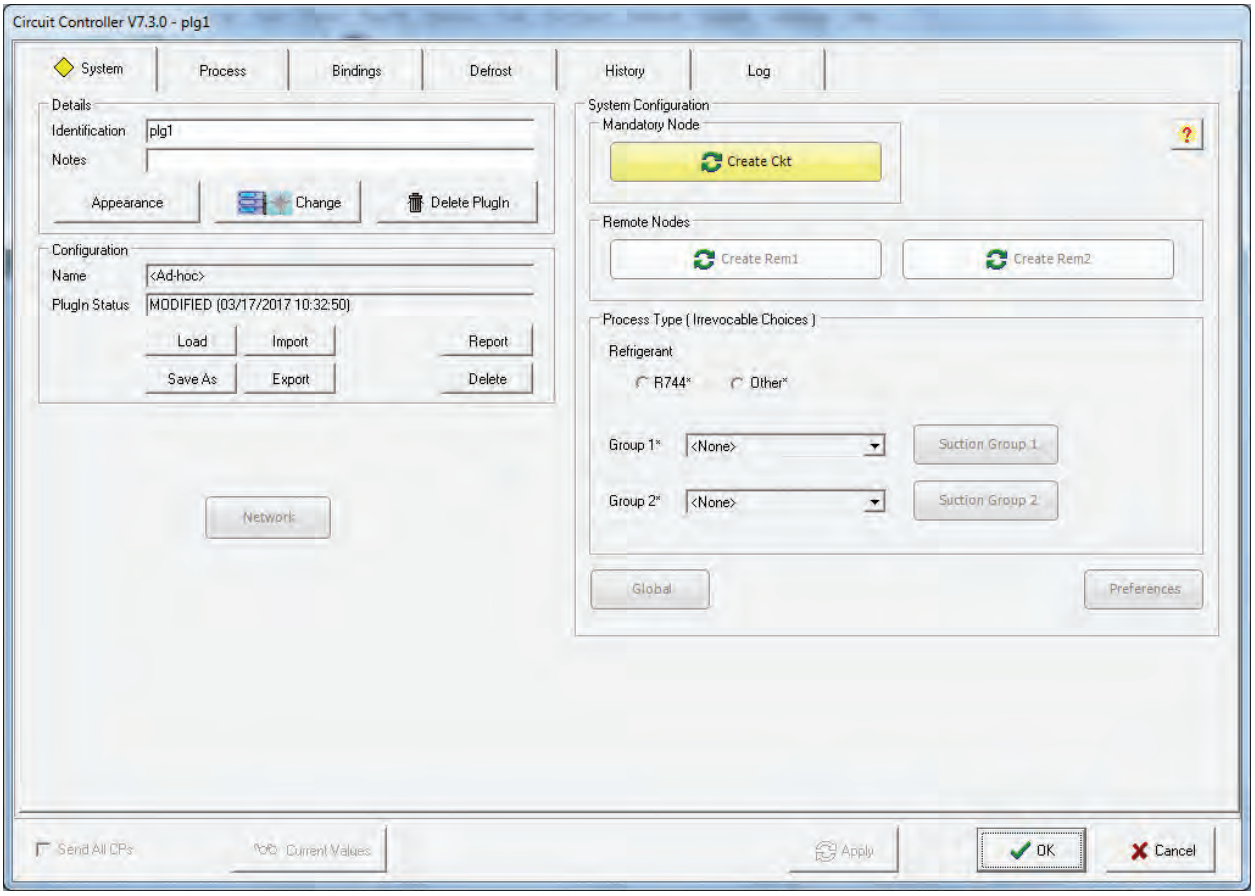
After logging in to Alliance, select the Refrigeration System and Configuration Mode. Select the appropriate view, based upon the location of the Circuit Controller node.

To begin, the Alliance plug-in must be created and configured. Click-and-Drag the "Plug-In" component and drop it on the view as desired. In the *Choose a plug-in type* window, select the "Circuit Controller" plug-in and confirm the most recent Plug-In Version is selected. Change the Identification field to a unique, easy to understand name, and press the OK button.



Installing the Circuit Node

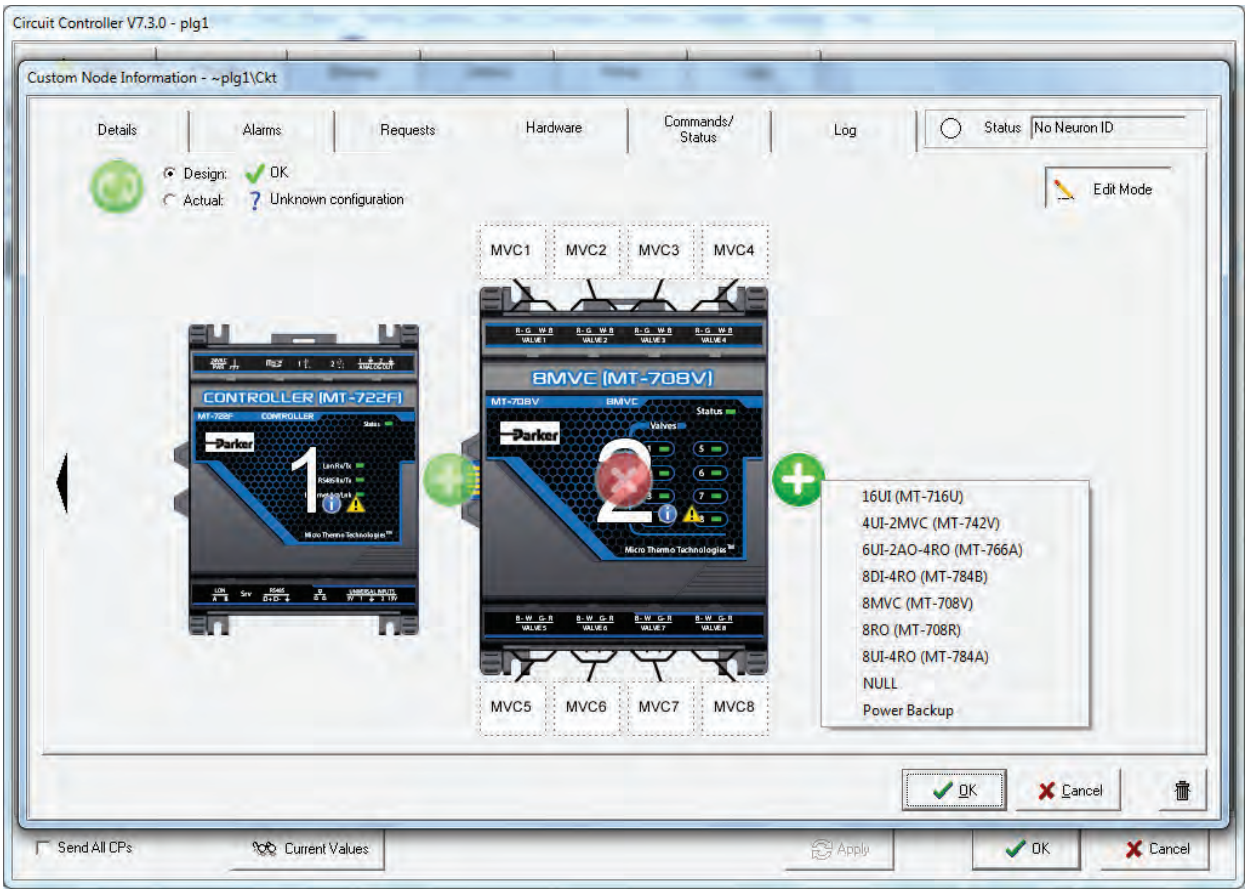
Click on the new plug-in created in the previous step. The plug-in will open to the System Tab. In the System Configuration section, click the “Create Ckt” button. Select the appropriate network channel and click OK. Alliance will generate the node internally, which now must be configured and installed on the controller.



Basic Setup

Installing the Circuit Node *(cont.)*

The Create Ckt button is now replaced with the button to access the Node. Click the "Ckt" button. On the Details tab in the new window, the node can be renamed if desired. Next, the hardware modules must be specified. Select the "Hardware" tab and click the "Edit Mode" button. Click on the green Add Module icon beside the MT-722F controller, and select the module in the 2nd position in the controller train. Repeat this process, specifying each module in the train. If a module is mistakenly added on screen, clicking the red Delete Module icon will remove the module. Modules can also be added in the middle of a train by selecting the Add Module icon between two modules. Installations that only require the MT-722F module do not require any modification on the Hardware tab.



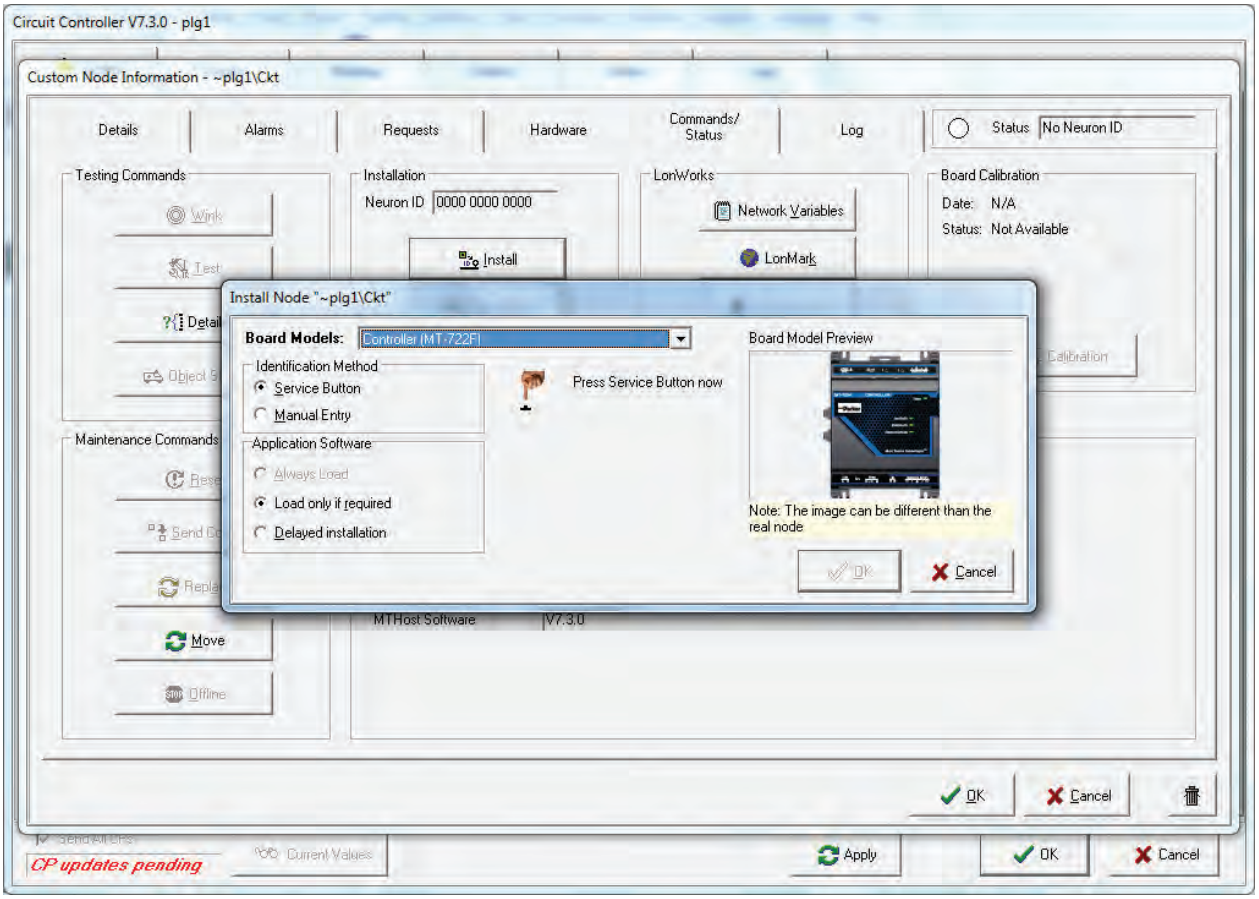
(cont.)

To install the program on the controller, select the “Commands/Status” tab and click the “Install” button. A second window will appear. Alliance now requires the unique network identification number (known as Neuron ID) for the controller that is being installed.

By default, Alliance waits for the controller to transmit its own Neuron ID. This is accomplished by pressing the Service button on the board. Alternatively, the installer can choose to manually enter the 12-digit, alpha-numeric ID and then continue by pressing “Ok”. The Neuron ID can be found on the identification sticker adhered to the controller.

> Micro Thermo recommends using the Service Button method. This eliminates the possibility of an input error and confirms network communication, both of which may be difficult to diagnose later.

Alliance is now installing the node. This may take several minutes. Once complete, click the “Ok” button on the node window to return the Alliance main view. If prompted, click “Yes” to save changes.



Basic Setup

Creating the Satellite Node

Satellite Nodes are integrated into the Circuit Controller plug-in, and are installed similar to main controller firmware. Up to two satellite nodes can be used per Circuit Controller.

On the System tab, in the System Configuration section, click the "Create Rem1" button. Select the appropriate network channel and click OK. Alliance will generate the node internally, which now must be configured and installed on the controller. "Create Rem1" is now replaced with the button to access the Node. Click the "Rem1" button. Follow the same process used to Install the Circuit Node to Edit the hardware modules and Install the firmware to the controller.

Repeat this process for the second remote satellite, "Rem2", if needed.

Configuration

Configuring the Circuit Controller

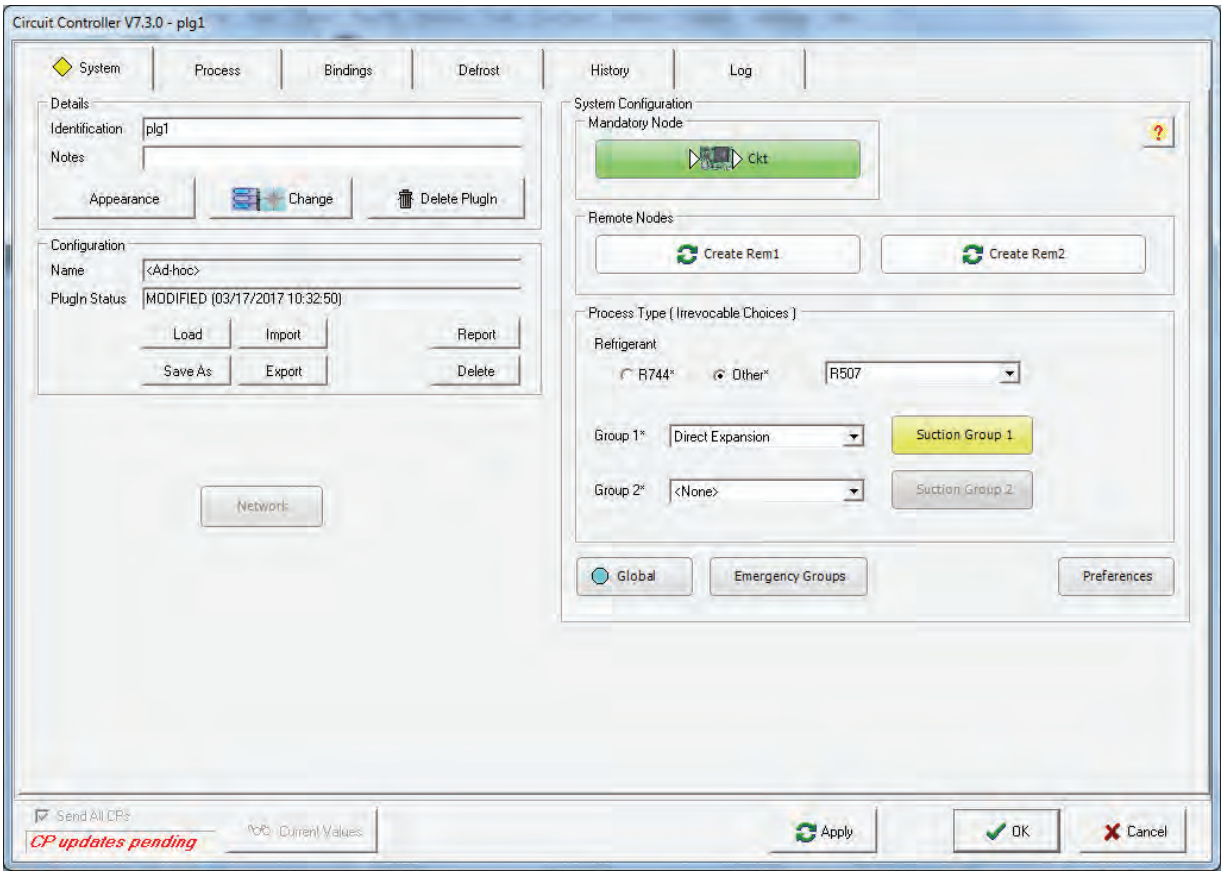
> Note: Given the number of possible configurations, this document will guide the user through the process of configuring the Circuit Controller. Not all applications or configurations can be addressed in this scope. All required parameters will be highlighted in yellow in the plug-in. Yellow buttons indicate required parameters on another window.

The configuration for the Circuit Controller is done through the plug-in. Click the plug-in icon created during the previous step to open the configuration window.

The plug-in features comprehensive help buttons. The question mark on each page provides detailed descriptions and suggestions for each page.

System Tab

Begin the configuration by selecting the Process Type settings. Select the Refrigerant and at least one Group type. These choices cannot be changed once applied. Modifications require the plug-in to be deleted and the setup process repeated from *Creating the Plug-in*.

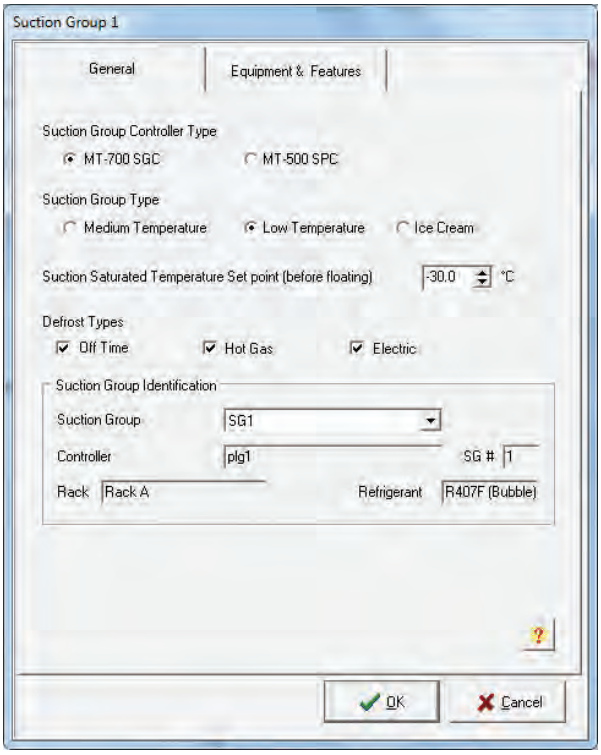


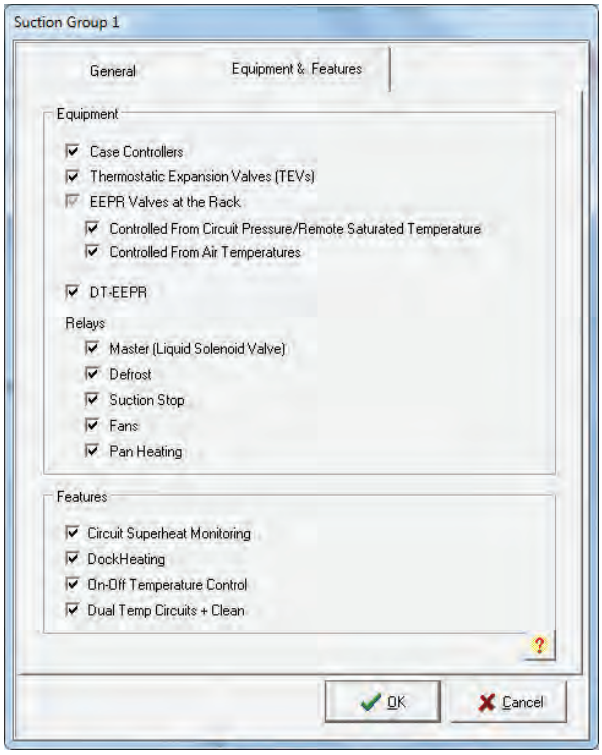
Configuration

System Tab *(cont.)*

Click the yellow Suction Group button to complete configuration for each group. On the General tab, select the defrost type(s) and set the Suction Saturated Temperature Set Point. The Suction Saturated Temperature Set Point is a key setting, and should be accurately set before configuring the rest of the Circuit Controller.

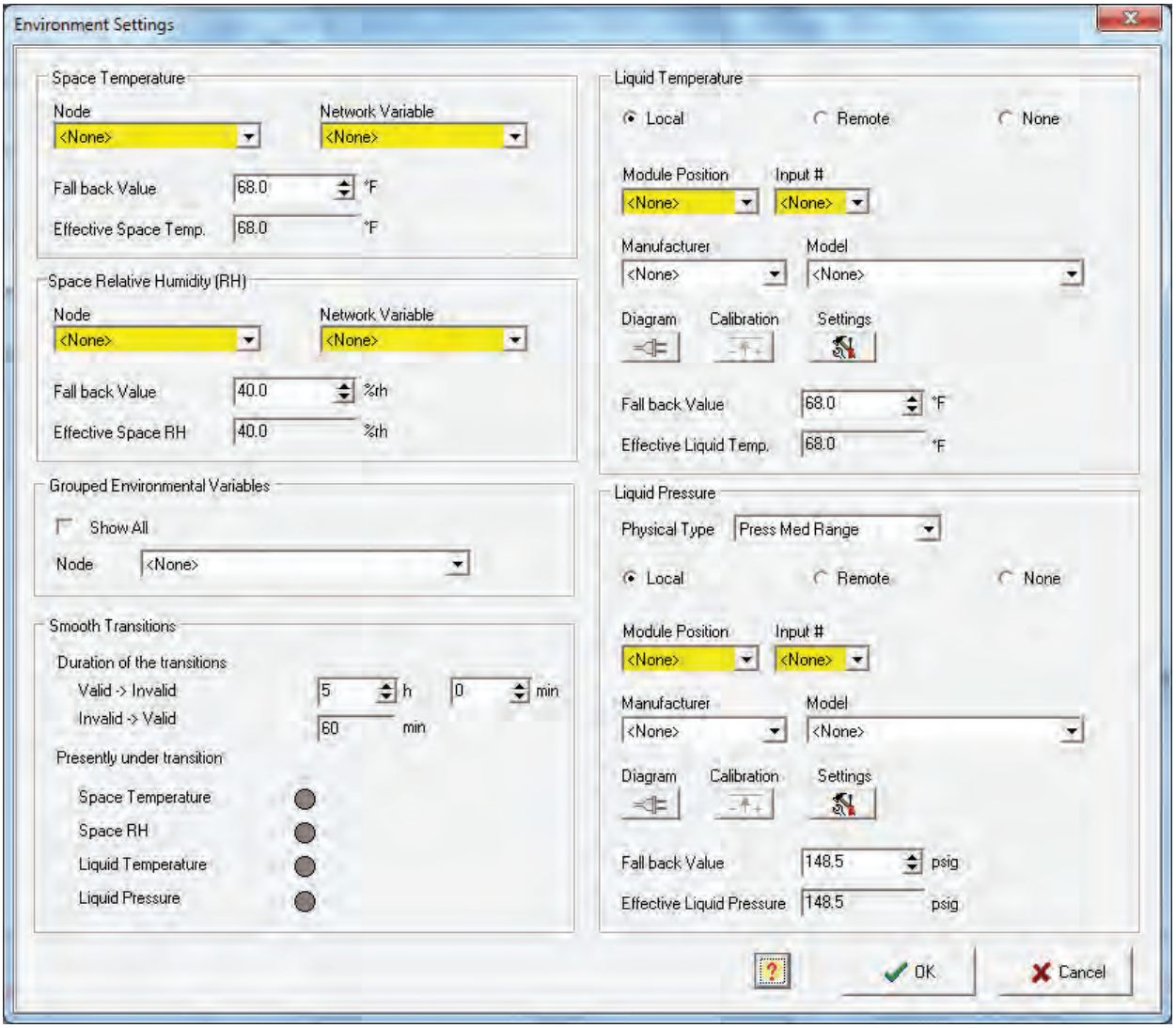
The Suction Group Controller Type and Identification needs to be selected; however, can be completed at a later time, if the Suction Group is not yet configured. On the Equipment & Features tab, select all items that are required for these circuits. Equipment and Features can be added, and unused items removed, at a later time. Once complete, click the OK button to return to the System tab.





(cont.)

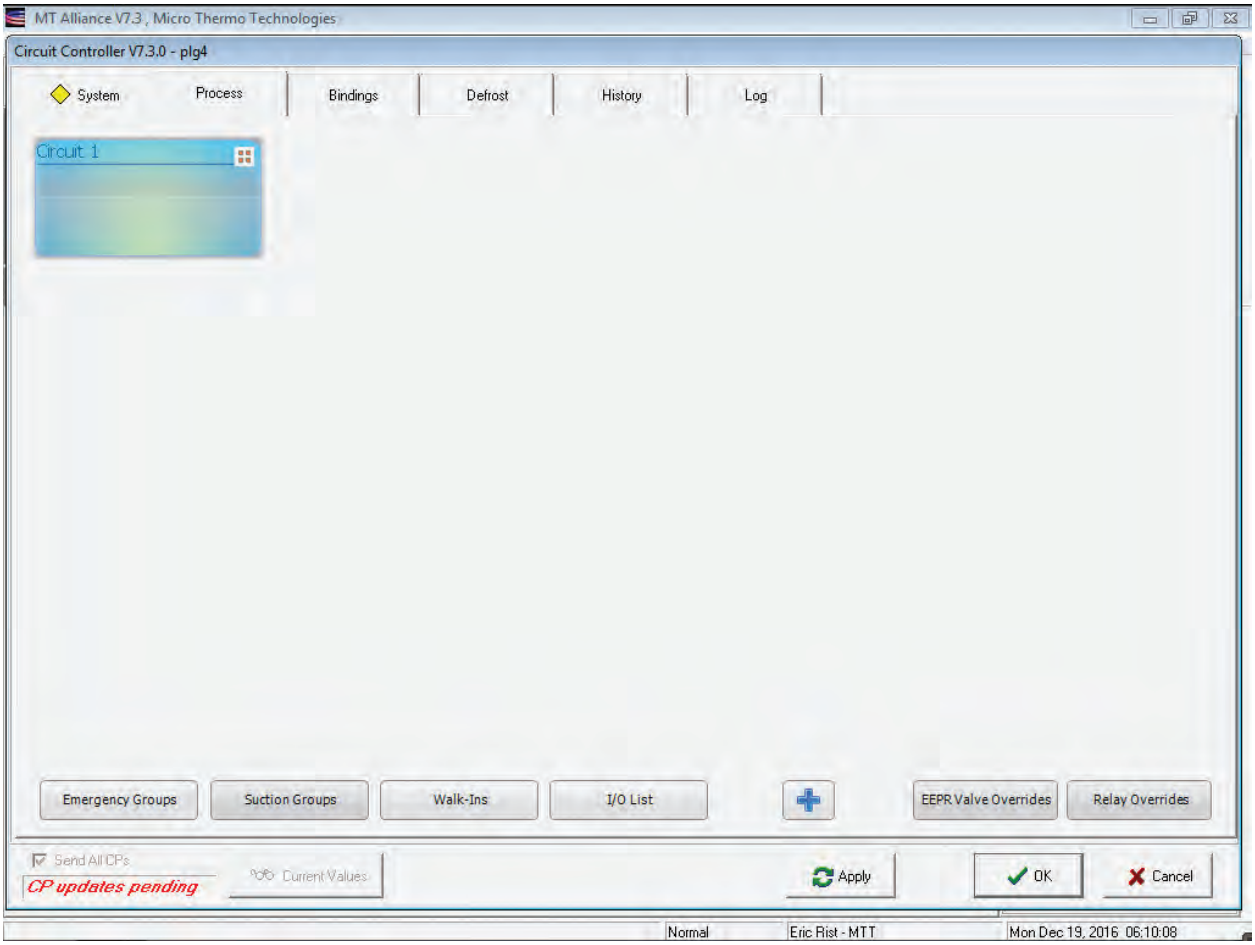
Once the Suction Groups are configured, the Environment button will become available. Open the Environment window to configure the required settings. The environmental correction settings are exceedingly important to the precise operation of the Circuit Controller; as such, many of the settings are required during setup. However, all inputs should be carefully reviewed before proceeding.



Configuration

Process Tab

The Process tab is the primary screen for circuit configuration, and also for viewing status during operation. At least one circuit will always be present in the Process view. By default, an empty circuit is automatically populated.

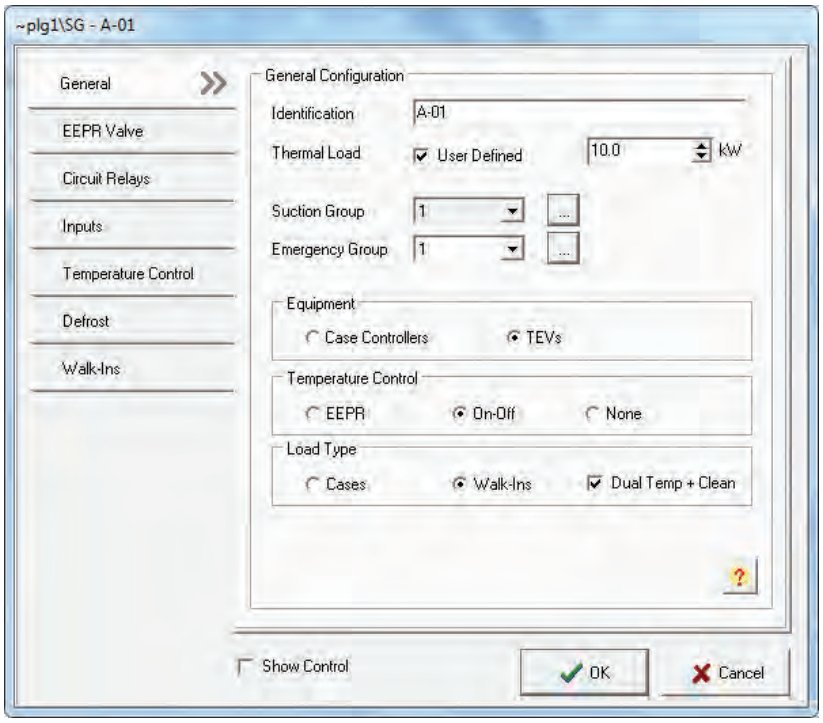


Configuring a Circuit

Settings for the Circuit operation are divided into two categories: *Config* and *Control*. Configuration settings are normally set during initial setup; control settings are generally viewed and modified during operation. Control and Config settings pages will open independently. To view both pages side-by-side, open either view and select the check box at the bottom to show the second view.

To begin configuring the circuit, click on the icon in the top right corner and select Config. A new window opens to the General settings for the circuit. Click the Show Control check box at the bottom of the window to display all settings simultaneously.

(cont.)



Provide a unique, meaningful name for the circuit and complete the settings below. If known, the Thermal Load for the circuit should be specified; otherwise, this setting will be calculated during operation by the controller. Next, select the Equipment, Temperature Control method, and the Load Type. Selecting Walk-in enables additional settings, including leak detector and door ajar, as well as additional relay outputs for the circuit.

The Dual Temp + Clean option allows the entire circuit to operate as dual temp. Individual dual temp cases controlled by an EEPR normally use the DT-EEPR application. Selecting Dual Temp + Clean instead enables a Dual Use Switch (DUS) from one of the circuit's RefUnits or Case Controllers to select between two Circuit set points.

Once all selections are complete, the remaining configuration tabs will be unlocked.

> Note: Depending on the Equipment and Features selected for the suction group, only applicable settings will be shown on the Configuration and Control pages.

Continue through the remaining tabs to setup:

EEPR Valve
Specify the EEPR valve and the output location

Circuit Relays
Specify the output location for circuit relays

Inputs
Specify the input type and location for circuit pressure and temperature

Pressure Regulation
Confirm the pressure configuration

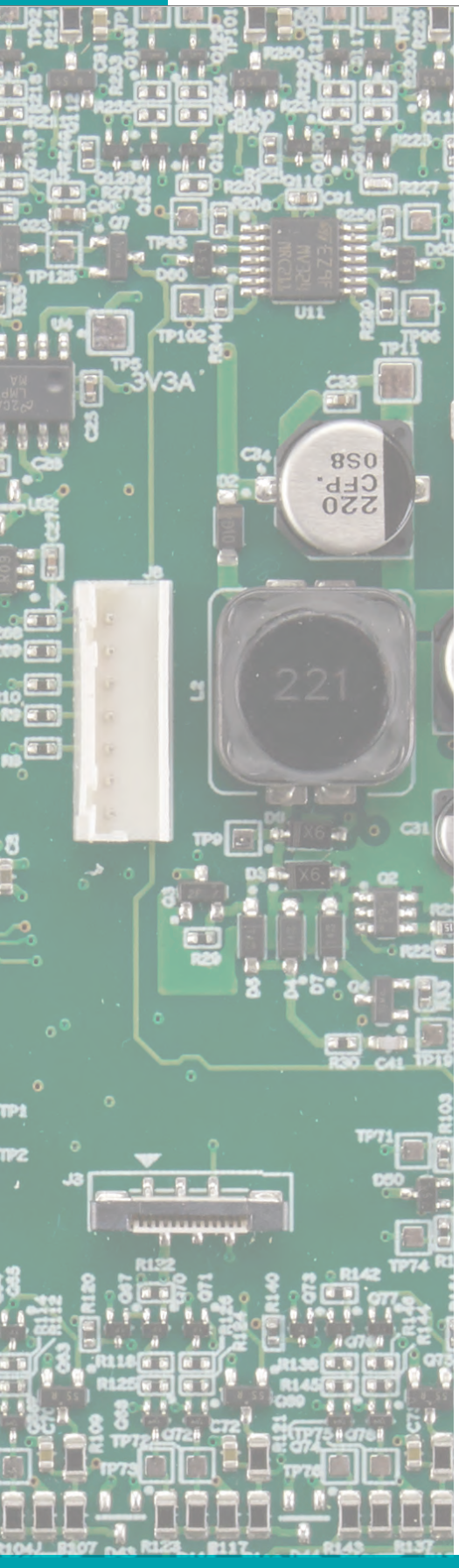
Defrost
Specify defrost type and settings for the circuit

Walk-Ins
(If selected) Add walk-ins to the circuit, and assign Leak Detectors, Door Ajar Sensors, and Output Relays for each walk-in.

IMPORTANT: All network bindings are made automatically by the Circuit Controller. Air Temperatures for each circuit can be assigned manually on the Inputs tab, and bindings will be made when settings are saved. However, if the "Create Automatic bindings with this Circuit's Case Ctrls" option is selected, the Case Controllers must be configured and **then the Circuit Controller plug-in must be re-opened**. Upon opening, the Circuit Controller will recognize the Case Controllers assigned to its circuits and automatically create the necessary network bindings. For circuits using thermostatic expansion valves, the Circuit Controller will automatically bind sensors defined within the associated RefUnits.

Once all settings are set as desired for the first circuit, click OK to save and apply.

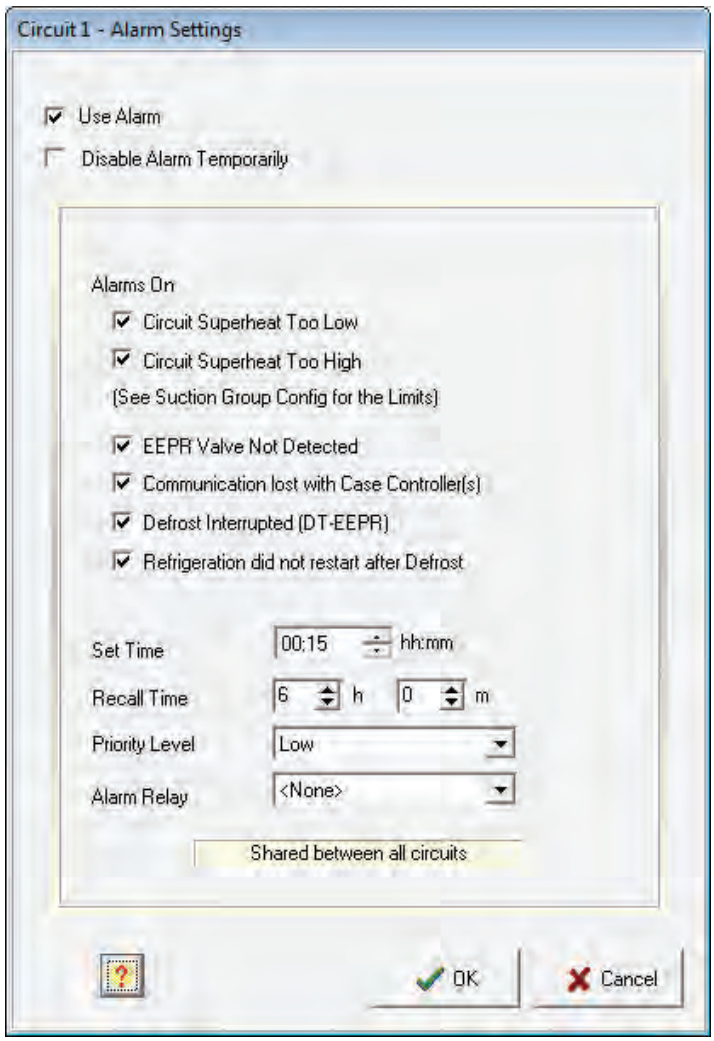
Configuration



Circuit Alarm Settings

There are a number of alarms available on the Circuit Controller. Many of these alarms are global to the controller or suction group. For ease of setup, these global alarm settings are logically grouped with similar settings. For example, walk-in alarm settings are available on the Walk-In settings window.

However, circuit specific alarms can be configured independently for each circuit in the Process view. Once a circuit is configured, these settings should be confirmed or changed as needed. From the Process view, click the icon in the top right corner of the circuit and select *Alarms*. Select the to set alarm priority, assign the alarm relay, and enable the following alarms:



Each circuit also has a Defrost Alarm, which is used to indicate that a defrost lasted for the maximum time allowed. By default, this alarm is disabled on each circuit. The alarm can be enabled from the Process tab, by clicking on the icon in the top right corner and select *Alarms*. Select the *Defrost Alarms* to enable and configure.

Adding Circuits

There are two ways to add circuits to the controller. Click the at the bottom of the Process window to add a new, blank circuit. All settings will need to be entered/verified when creating a blank circuit.

To simplify the setup, an existing circuit can be duplicated. Click on the icon in the top right corner of a circuit and select *Duplicate*. Duplicating a circuit will copy all common settings. The new circuit will only require the circuit be named, and the input/output assignments be set for the EEPR, relays, and inputs (if applicable). **All other settings should be confirmed before proceeding.**

Circuit displays can be moved within the Process screen, to create a custom view as desired. Click and hold near the top of any circuit display (above the blue line, where the name is displayed). Drag and drop the rectangle in the desired location.

Global Settings

There are four command buttons located at the bottom of the Process screen. Each opens a separate window. The details in these windows are global settings that apply to the Circuit Controller. The first three, *Emergency Groups, Suction Groups*, and *Walk-Ins*, contain settings that can be edited. The fourth, *I/O List*, displays all input and output assignments for this controller.

The Emergency Group settings specify how the controller should react if an Emergency signal is received via the network. The settings also allow you to define what the controller should do in the event it loses communication with the group emergency signal or Case Controller(s). If neither Emergency Group is enabled from the System tab, the Emergency Group button will be hidden on the Process tab.

The Suction Groups settings specify further configuration to the operation of the suction group, including floating suction pressure, floating circuit pressures, overflow detection, and more.

The Walk-Ins window provide additional settings that apply to circuits whose load type is specified as walk-in. This includes settings for how the controller should react during door ajar and leak detection events.

Configuration

Overrides

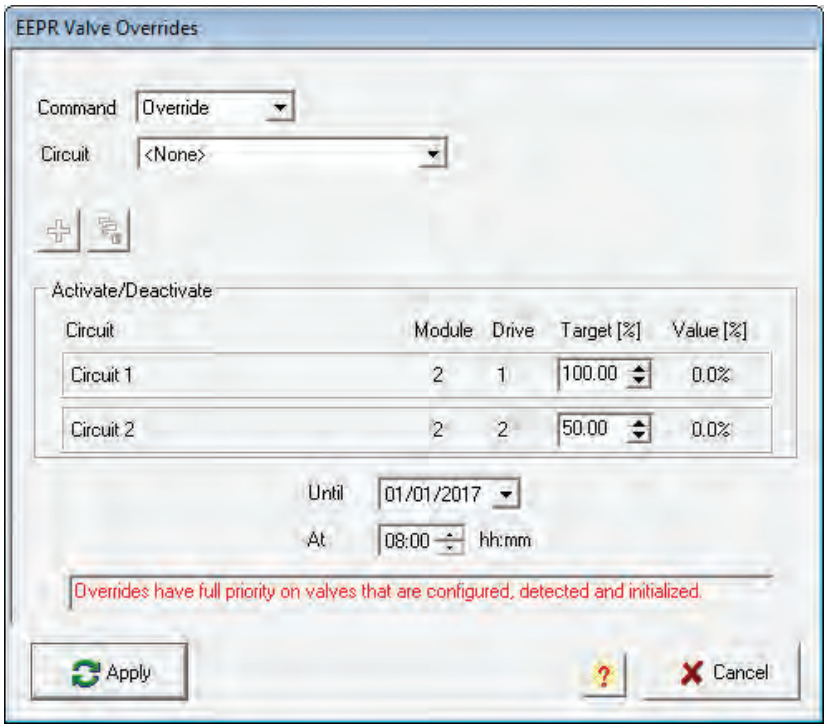
All EEPR Valves and Relays can be overridden from the Process screen. To override an EEPR or view active overrides, click the *EEPR Overrides* button. If the command displays "No Override", there are no active overrides.

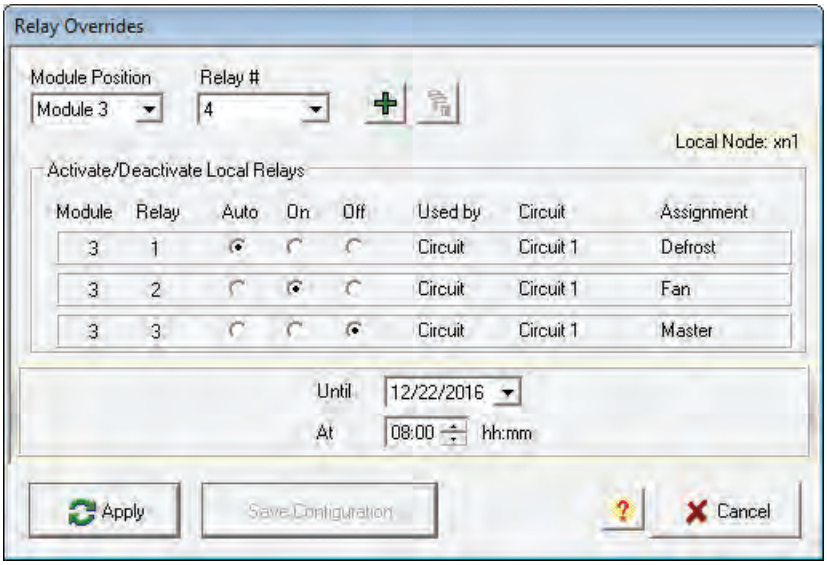
To add an override, select "Override" from the drop-down menu. Select the desired circuit from the Circuit drop-down and click the Add button (green plus symbol). Set the *Target [%]* value to the desired valve position. Finally, set the expiration date and time for the override below the circuit list.

Multiple valves can be overridden simultaneously. Select an additional circuit from the Circuits drop-down menu and click the Add button. Set the desired *Target [%]* for each circuit. **NOTE: All EEPR overrides will expire at the same time.**

To remove one or more EEPR circuits from override, hold the ALT key and click on the Circuits. Selected circuits will be outlined in magenta. Click the Delete button beside the Add button.

To override a Relay or view active overrides, click the Relay Overrides button from the Process screen. Relays that are not listed or are in Auto mode are not in override.





To add an override, select the *Module Position* and *Relay #* from the drop-down menus and click the Add button (green plus symbol). The relay can be set to Auto, On, or Off. Relays set to Auto can be left in the list, but will continue operating normally. Finally, set the expiration date and time for the override below the relay list.

(cont.)

Relays on Satellites can also be overridden from this window. To access them, click the "Show Remote" option, which appears at the bottom of the screen if a remote satellite has been created.

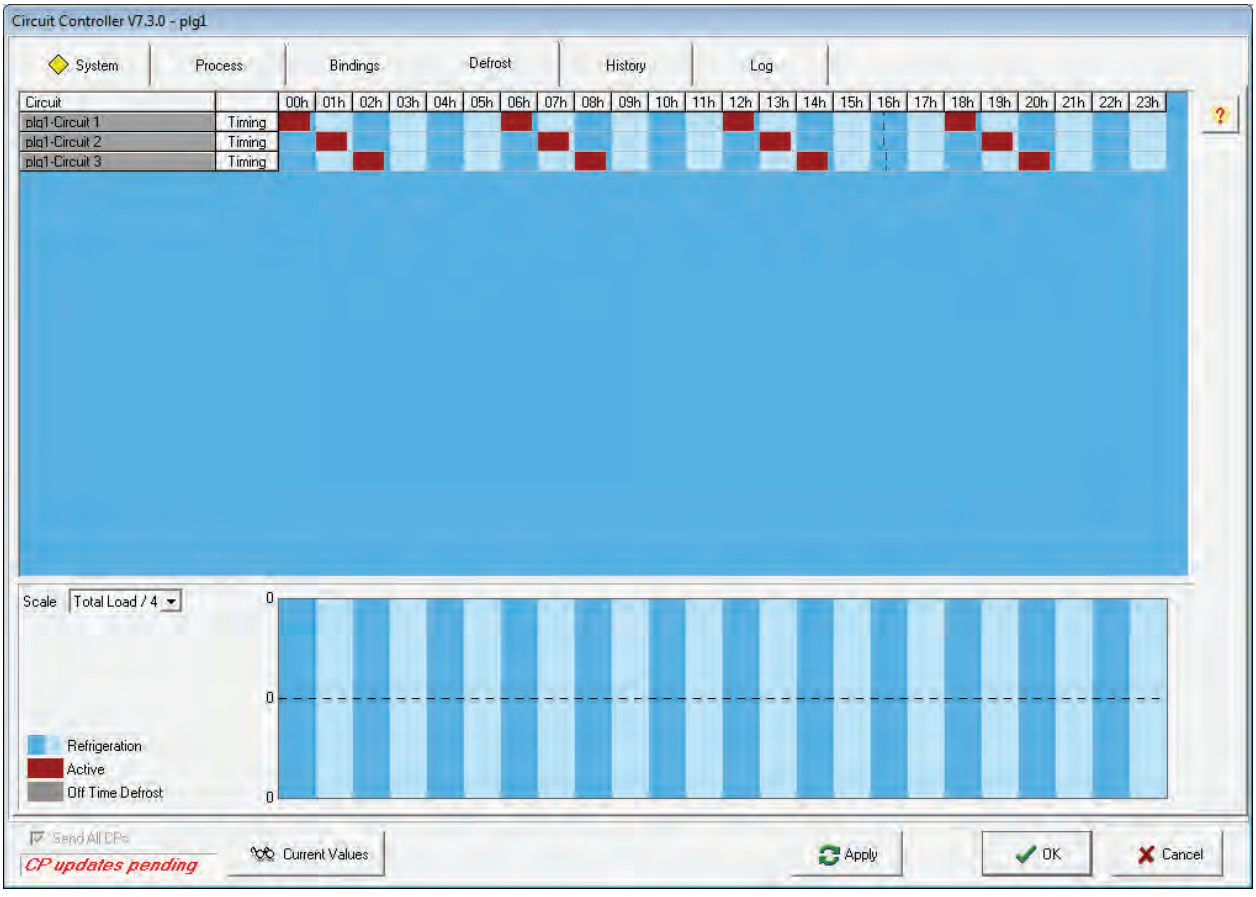
Multiple relays can be overridden simultaneously. Select additional relays and click the Add button. Select Auto, On, or Off.

NOTE: All relay overrides will expire at the same time.

To remove one or more relays from override, hold the ALT key and click on the Circuits. Selected circuits will be outlined in magenta. Click the Delete button beside the Add button.

Defrost Tab

The defrost for each circuit can be configured from the Defrost tab. All configured circuits will be displayed on the grid. From the Defrost tab, it is possible to select the Racks or Suction Groups that will appear in the list.

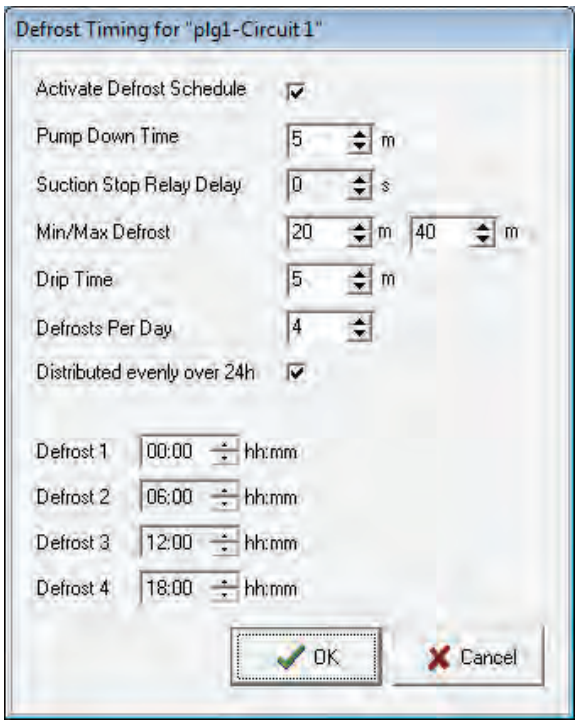


Configuration

Defrost Tab *(cont.)*

Click the *Timing* button next the first circuit. The Defrost Timing window will open. Set the defrost parameters as desired for the circuit, and press "OK". Repeat the defrost configuration for each circuit.

De-selecting the "Activate Defrost Schedule" option makes it possible to define the defrost schedule immediately, but to activate it for this circuit at a later time.



The defrost schedule will be displayed on the time graph. The times can be changed for each circuit to avoid simultaneous defrosts. The red (active) and gray (off-time) boxes indicate when the circuit will be in defrost. Click-and-drag any of the boxes to adjust the defrost time earlier or later. If the "Distribute evenly over 24h" option was selected in the Defrost Timing window, all defrosts for the given circuit will move together. The Total Load will be displayed in the lower grid to show total effect on the rack load.

History Tab

The History Tab allows select values from the Circuit Controller to be saved in the historical data in Alliance for future analysis. By default, the Circuit Refrigeration status for each circuit is selected. Additional variables can be selected.

> NOTE: Additional values should be selected only when necessary. Selecting additional values will increase LonWorks network traffic, which can negatively affect network performance.

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1. **Terms and Conditions.** Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is expressly conditioned on Buyer's assent to these Terms and Conditions and to the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional term or condition of Buyer's order or any other document issued by Buyer.

2. **Price Adjustments; Payments.** Prices stated on the reverse side or preceding pages of this document are valid for 30 days. After 30 days, Seller may change prices to reflect any increase in its costs resulting from state, federal or local legislation, price increases from its suppliers, or any change in the rate, charge, or classification of any carrier. The prices stated on the reverse or preceding pages of this document do not include any sales, use, or other taxes unless so stated specifically. Unless otherwise specified by Seller, all prices are F.O.B. Seller's facility, and payment is due 30 days from the date of invoice. After 30 days, Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. **Delivery Dates; Title and Risk; Shipment.** All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon tender to the carrier at Seller's facility (i.e., when it's on the truck, it's yours). Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's changes in shipping, product specifications or in accordance with Section 13, herein.

4. **Warranty.** Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of five years from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. This warranty is made only to Buyer and does not extend to anyone to whom Products are sold after purchased from Seller. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. **Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 60 days after delivery or, in the case of an alleged breach of warranty, within 30 days after the date within the warranty period on which the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for any amount due to Seller from Buyer) must be commenced within thirteen months from the date of tender of delivery by Seller or, for a cause of action based upon an alleged breach of warranty, within thirteen months from the date within the warranty period on which the defect is or should have been discovered by Buyer.

6. **LIMITATION OF LIABILITY.** UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. **Contingencies.** Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.

8. **User Responsibility.** The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

9. **Loss to Buyer's Property.** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

10. **Special Tooling.** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

11. **Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.

12. **Improper use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

13. **Cancellations and Changes.** Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

14. **Limitation on Assignment.** Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

15. **Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

16. **Waiver and Severability.** Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

17. **Termination.** This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement (b) the appointment of a trustee, receiver or custodian for all or any part of Buyer's property (c) the filing of a petition for relief in bankruptcy of the other Party on its own behalf, or by a third party (d) an assignment for the benefit of creditors, or (e) the dissolution or liquidation of the Buyer.

18. **Governing Law.** This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Disputes between the parties shall not be settled by arbitration unless, after a dispute has arisen, both parties expressly agree in writing to arbitrate the dispute.

19. **Indemnity for Infringement of Intellectual Property Rights.** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

20. **Taxes.** Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.

21. **Equal Opportunity Clause.** For the performance of government contracts and where dollar value of the Products exceed $10,000, the equal employment opportunity clauses in Executive Order 11246, VEVRAA, and 41 C.F.R. §§ 60-1.4(a), 60-741.5(a), and 60-250.4, are hereby incorporated.

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