
# Case Controller

## Supermarket Control Solutions

**Installation Guide**

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Case Controller

# Introduction

The MT Case Controller is an all-in-one controller for display cases and cold rooms, providing a single point of control for all aspects of the unit.


## Case Controller

The Case Controller manages the electric expansion valve, fan, defrost cycles, lights and antisweat. This simplifies wiring, reduces components, and concentrates all aspects of case management in one location.

The Case Controller is part of the Micro Thermo Platform of refrigeration and supermarket controls, and integrates with the MT Alliance software (version 7.1 and higher). Through Alliance, the Case Controller provides real-time monitoring and alarms, comprehensive configuration parameters for customizing operation, and historical data logging to track precise operation of the system.

This document contains installation instructions for mounting and wiring, integrating the controller into the Micro Thermo system, and configuring the controller through MT Alliance. This document also includes operating details, including controller specifications.

## $CO_2$

The Case Controller is compatible with many of today's most common refrigerants, including R-744 ($CO_2$). The controller has several built in features specifically designed for optimal control of $CO_2$ systems. These control features will be denoted in the Installation and Operation sections.

Please ensure all valves, pressure transducers, and other system components are rated correctly for the system application.

# Introduction


## System Integration

The Case Controller is one piece of the Alliance Platform, sharing and receiving data across the system to optimize control. While the Case Controller will maintain basic functionality during temporary network outages, the full operation is dependent on the complete Alliance System.

The Case Controller's algorithms have been designed to optimize system control. This includes utilizing sensor data from other controllers, shared across the LonWorks® network. The controller improves efficiency of the expansion valve by incorporating ambient air conditions and liquid temperature/pressure into the refrigeration calculations.

Most importantly, the defrost scheduling and coordination is handled for the entire circuit by a separate controller operating Alliance's "DTSecCool" plug-in. Each Case Controller has an onboard relay for localized electric defrost control, and can terminate defrost based on a dedicated temperature sensor. However, the additional controller (most often an MT-504 Control Board) can be used to: schedule the defrost timing and details, call for the start of a defrost cycle, recognize when all Case Controllers in a circuit have completed their individual defrosts, and call for all the start of refrigeration. Without this additional controller, the Case Controller will maintain temperature control but cannot initiate defrost.

## Features

The Micro Thermo Case Controller offers advanced control functionality combined with MT Alliance's easy to use graphical interface. Together, they offer features that help streamline installation, improve system efficiency and reduce operating costs, simplify monitoring and oversight, and more.

The Case Controller's **Dual Temp Setting** allows multipurpose cases to be configured with two separate and complete operational settings. With the click of a button, the Case Controller will toggle between modes, minimizing setup time and reducing the potential for errors during changeover periods. Micro Thermo has also simplified the setup for similar cases in a lineup. The new **Create A Lineup** option allows up to 16 Case Controllers to be automatically linked together in the Alliance software. During installation, all configurations done for one controller will be copied to the other controllers created in the lineup. This drastically reduces installation time by eliminating redundant programming. Need to customize one setting? Simply disconnect an individual parameter so

that modifications don't affect other controllers, and all other parameters remain shared.

Micro Thermo stands behind the principle that better control means better temperature; better temperature increases refrigeration efficiency and reduces food loss. Micro Thermo controllers feature the **Temperature Control with Superheat Limit** option that offer many advantages of standard superheat only control. In addition to adding flexibility applications, this setting stabilizes the case temperature and refrigerant flow to optimize the system.

To utilize the full refrigeration capacity, the Case Controller also features a **Smart Fan Control** scheme. During defrost, turning the evaporator fans off while the coil is still cold wastes potential cooling. Following defrost, turning the fans on while the coil is warmer than the air puts unnecessary heat into the case. The Case Controller monitors coil temperature and switches the fans to maximize refrigeration, which also reduces temperature variations in the case during defrost periods.

From the Alliance software, **Cleaning Mode** can be activated with two clicks of a mouse. During cleaning, the Case Controller stops refrigeration, closing the valve and turning off the fans. This allows maintenance to be performed on the case, easily and safely.

One of the most important features of a refrigeration control system is system monitoring and alarming. All Micro Thermo controllers feature **Advanced Alarming** schemes that provide added protection against food loss and predictive alarming for potential equipment failures. The Case Controller has two alarm sets that can be configured with different alarm priorities. Set correctly, this tiered alarm can be used to indicate imminent food loss or a dirty case that is having difficulty maintaining temperature. In addition to the two alarm sets, the Case Controller features cumulative alarming. Based on the HACCP standards for food safety, the cumulative alarm monitors long-term temperature variations from the optimal temperature and alarms when the case cannot maintain the correct temperature range.

# Installing the Case Controller

## Requirements

**Hardware:**

- Case Controller
- Temperature Sensors (1 to 4)
- Pressure Transducer (1)
- Four #6 screws for wall mounting
- DIN Rail or SnapTrack with two #6 screws for mounting (if not wall mounted)
- 18 AWG 7/26 stranded, unshielded twisted pair network cable (Belden 8461 or equivalent)
- Solid State Relay for Anti-Sweat element (if present)

**Software:**

- MT Alliance, Version 7.1 or higher

**Tools:**

- Philips and Flat screwdrivers
- Small Flat screwdriver for terminal connections
- Wire cutters / strippers

# Hardware Installation

## Mounting the Case Controller

The Case Controller should be mounted in a non-condensing location, away from excess debris, water, and vibration. Options include atop a display case, inside the mechanical space of a case, an outside wall of a cold room, inside an electrical panel, etc. The Case Controller can be independently mounted for Panel Mounting (unit model without metal case) or Independently Mounted for Surface Mounting (unit model with metal case). The front of the controller needs to be easily accessible to complete the setup process on site.

The controller can be wall mounted directly in place, or can be mounted using a SnapTrack or DIN rail. To begin, locate an open space for mounting:

**For Screw Mounting:**

Holding the Case Controller in the desired location, mark the top of each screw hole (one at each corner). Drill holes for each marked location. Insert #6 screws to the top two holes, and tighten halfway. Hang the controller on the two screws, and tighten each. Insert and secure the two remaining screws.

**For SnapTrack Mounting:**

Holding the track in the desired location, mark the two screw holes. Drill holes for each marked locations. Reposition the track, and insert and tighten the two screws. Place the bottom edge of the controller's feet into the SnapTrack and apply gentle pressure to the top edge of the controller. The top feet should snap into the track easily.

**For DIN Rail Mounting:**

Holding the DIN rail in the desired location, mark the two screw holes. Drill holes for each marked locations. Reposition the DIN rail, and insert and tighten the two screws. Align the grooved track on back of the controller with the DIN rail. Position the lower edge securely to the bottom of the DIN rail, and apply gentle pressure to the top edge of the controller. The top should snap onto the rail easily.

## Wiring the Case Controller

Following the wiring diagram shown on next page, make all the connections. If not specified, connections are not polarized. For all wiring use copper conductors only.

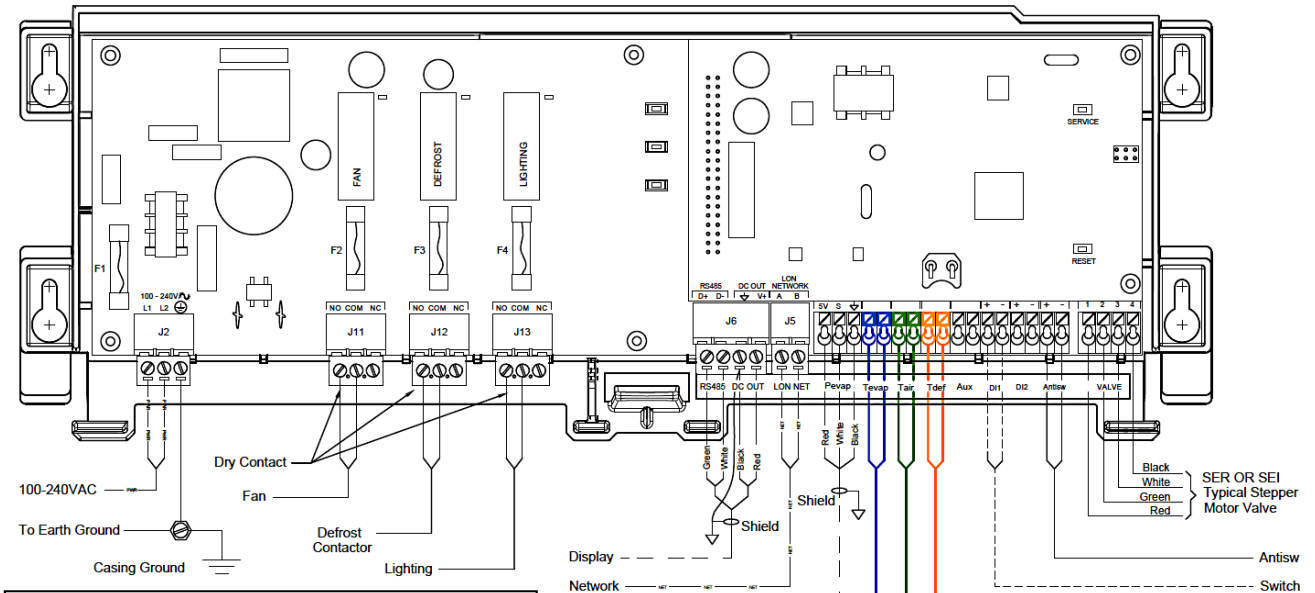
If more than 4 amps are required for the fans, lights, or defrost heaters, the Case Controller relays can be used as the control signal for external relays. Use SPDT relays with the coil voltage matched to the supply voltage (120VAC or 240VAC) and a contact rating above the required current. Make sure the metal enclosure has appropriate grounding connection. See metal enclosure installation guidelines in Appendice D.

## Wiring the Case Controller *(cont.)*

In this case, the connections described below will be made to the external relay instead of the on-board relay. The Case Controller's relays will be connected from the NO contact to the external relay as depicted on the following page.

**Note: See Technical Specifications (page 33) for relay ratings, wire and output details.**

- Connect the fan to Relay #1. Connect L1 to the relay COM terminal. Connect L2 to one terminal on the fan. Connect an additional wire from the relay NC terminal to the other terminal on the fan.
- Connect the defrost element to Relay #2. Connect L1 to the relay COM terminal. Connect L2 to one terminal on the defrost element. Connect an additional wire from the relay NO terminal to the other terminal on the defrost element.
- Connect the lighting to Relay #3. Connect L1 to the relay COM terminal. Connect L2 to one terminal on the lights. Connect an additional wire from the relay NC terminal to the other terminal on the lights.
- Connect the network cable to the "Network" terminals on the controller. Connect the other end to the network terminals on the nearest Micro Thermo controller.
- Connect the pressure transducer cable to "Pevap." The three colored wires must be connected as shown.
- Connect the evaporator temperature sensor to "Tevap."
- Connect the air temperature (or control temperature) sensor to "Tair."
- Connect the defrost termination sensor to "Tdef."
- Connect the optional auxiliary input temperature sensor to "Taux."
- Connect the external anti-sweat relay to the "Antisw" connection.
- Connect dry-contact or switch to digital inputs "DI1" and/or "DI2."
- Connect the stepper motor valve to the "Valve" terminals. The four colored wires must be connected as shown in diagram.




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

Class 2 wiring section

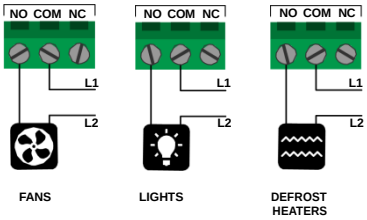
# Installing the Case Controller

## Wiring the Case Controller *(cont.)*

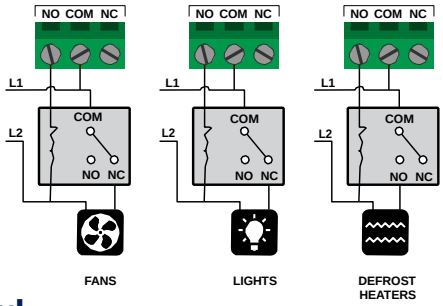
When routing wires, please follow good wiring practices to avoid undesired interference on the network cable. High voltage wires should be routed at least 12" away from the communication cable, and the two should never be run through the same conduit. If a communication cable needs to cross a high voltage cable, make sure the two wires cross and are secured perpendicular to each other to reduce noise. Finally, connect the 120/240V to the power input's removable terminal connector, and plug in to the board. Make sure leads are connected as shown.

After all connections are made and the protective covers of the controller are installed, apply power to the controller.

### On-Board Relay Connections




### External Relay Connections




## Mounting / Wiring the MT-504 Board

The MT-504 control board should be mounted in an electrical panel, and can be located anywhere on the LonWorks® network.

Connect the 18AWG network cable to the network terminals on the controller. The connections are not polarized. Connect the other end of the cable to the network terminal on another controller in the electrical panel.

Connect 24VAC to the power input's removable terminal block, and plug in to the board. After all connections are made, apply power to the controller.

# Configuring the Defrost Scheduler From Alliance

## Getting Started

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

The DTSecCool installation requires setting up a 'Node' to program the controller, and a 'Plug-In' to configure the settings used by the controller.

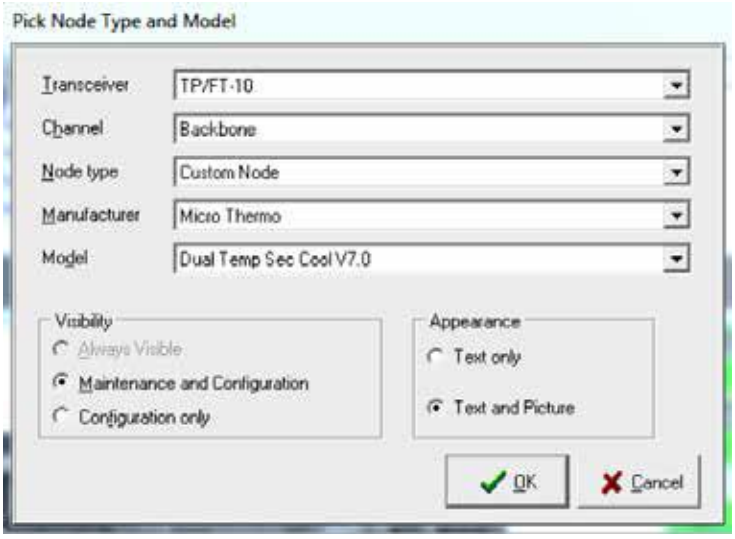
After logging into Alliance, select the Refrigeration System and Configuration Mode. Select the appropriate view, based upon the location of the DTSecCool node. Click-and-Drag the "Node" component from the list and drop it in the desired location on the active view. The icon can be moved at any time by holding the "CTRL" key and dragging the node to the new desired location.

In the "Pick Node Type and Model" dialog box, select the communications channel that the node is connected to. For node type, select "Custom Node." For manufacturer, select "Micro Thermo." And for model, select "Dual Temp Sec Cool V7.0."

## Installing the Node:

Click on the new node icon. On the Details tab, the node can be renamed if desired. 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.

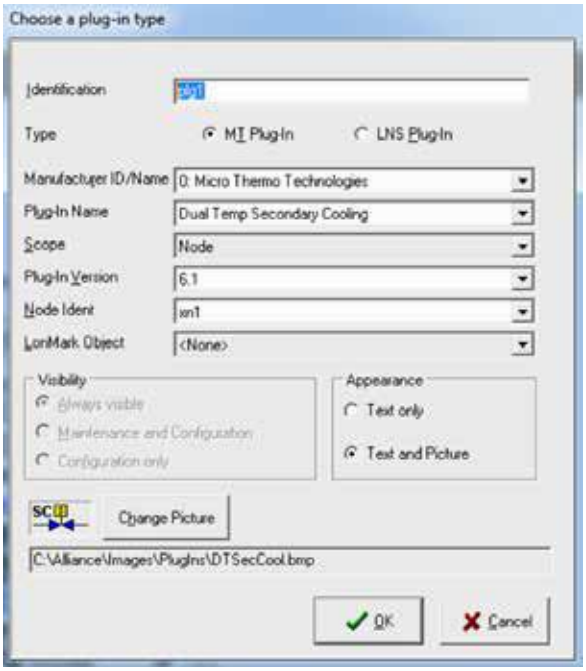



Alliance is now installing the node. This may take several minutes. Once complete, click the "OK" button on the node window to return the Alliance main view. If prompted, click "Yes" to save changes.

> 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.

## Creating the Plug-In

With the node created and installed, an Alliance plug-in must be configured. Click-and-Drag the "Plug-In" component and drop it adjacent to the newly created node. In the "Choose a plug-in type" box, select the "Dual Temp Secondary Cooling" plug-in, version "6.1," and select the name of the recently created node from the Node Ident drop-down box. Change the Identification field to a unique, easy to understand name.

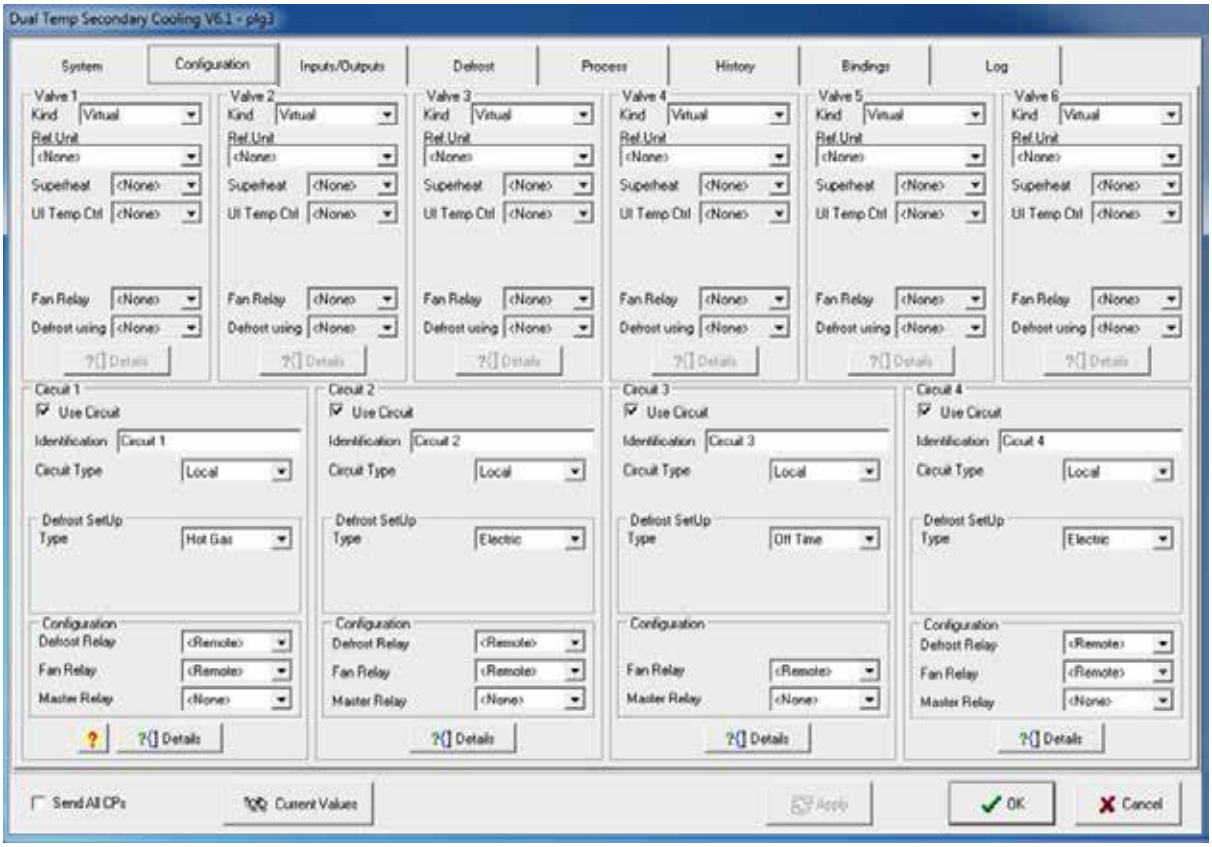


# Installing the Case Controller

## Configuring Defrost Schedules *(cont.)*

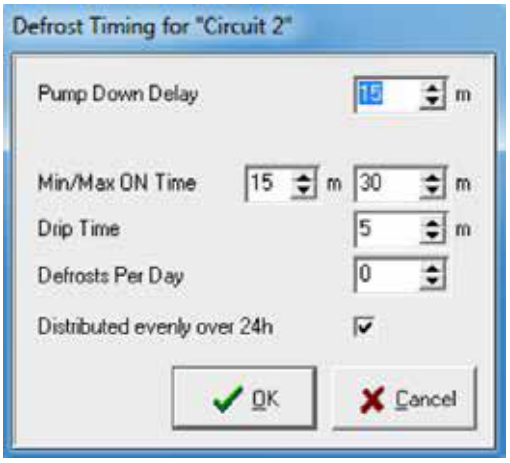
The DTSecCool plug-in is now created. Open the plug-in and go to the Configuration tab. Each DTSecCool node can support up to four circuits with defrost schedules. For each circuit to be controlled, complete the following:

- Select the "Use Circuit" checkbox
- Give the circuit a unique, easily identifiable name
- Select the Defrost Type: Hot Gas, Electric, or Off Time
- Since the Case Controllers will be controlling individual fans, select "<Remote>" for Fan Relay.
- Select the output for the Defrost Relay: select "<Remote>" if the Case Controller will be controlling an individual element, or the appropriate relay if the MT-504 controller will be controlling defrost for the circuit.



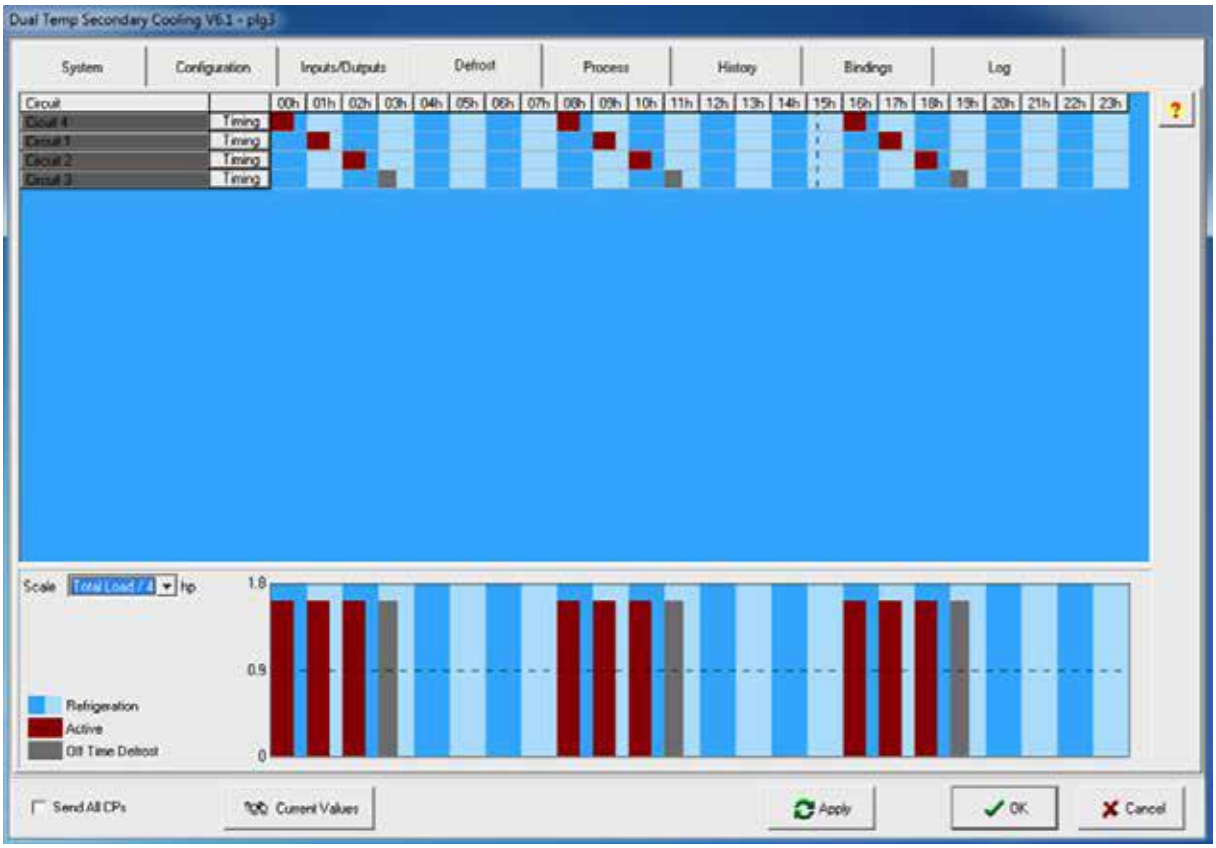
*(cont.)*

Next, set the defrost schedule for each circuit. Select the Defrost tab, and click the "Timing" button next to the first circuit. The Defrost Timing Window appears. Set the defrost parameters as desired for the circuit, and press "OK." Repeat the Defrost Timing configuration for each circuit.




The defrost time can be changed for each circuit individually to avoid simultaneous defrosts.
The red/gray boxes on the time graph indicate when each circuit will be in defrost. Click-and-Drag any of the red/gray boxes to adjust the defrost time earlier or later. If the "Distributed evenly over 24h" option was selected in the previous step, all defrosts for a given circuit will move together to maintain spacing.

After the timing has been set up, the DTSecCool set up is complete. Press "OK" to save the settings and update the controller.



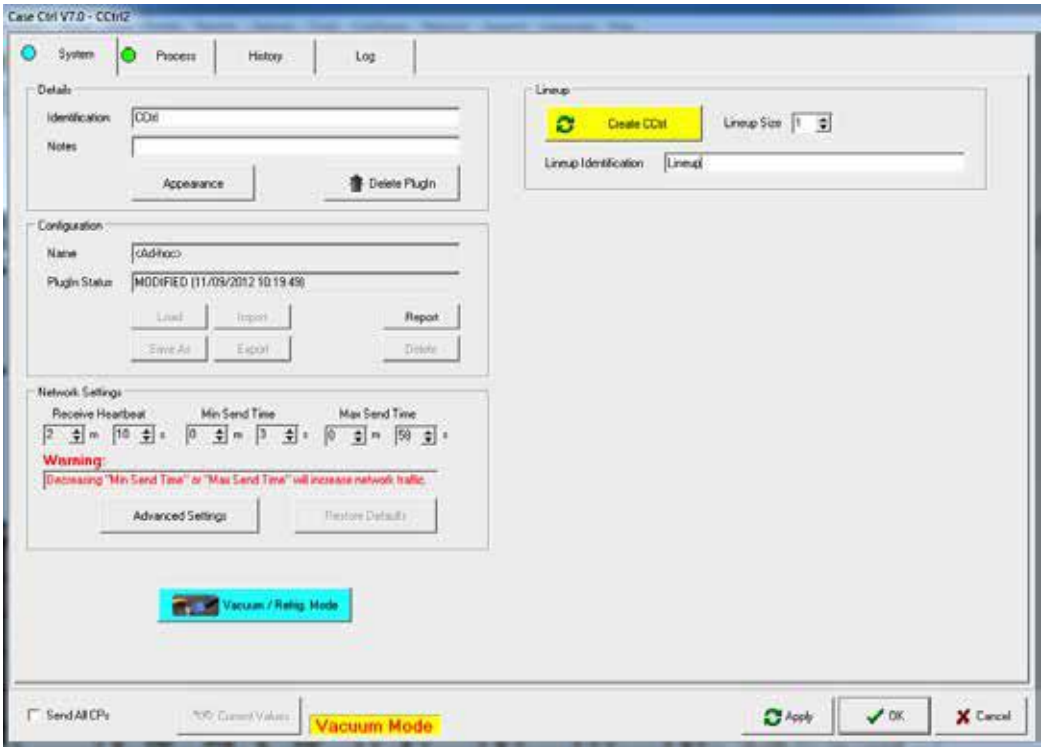
# Configuring the Case Controller From MT Alliance

## Getting Started

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

Click-and-Drag the "Case Ctrl" component from the list and drop it in the desired location on the active view. The icon can be moved within the current view at any time. While holding the "CTRL" key, click-and-drag the Case Controller icon to the new desired location.

Click on the new Case Controller icon to begin the installation process. The Case Controller Configuration Window, shown below, will open.




The Case Controller Configuration Window before creating the Case Controller Lineup.

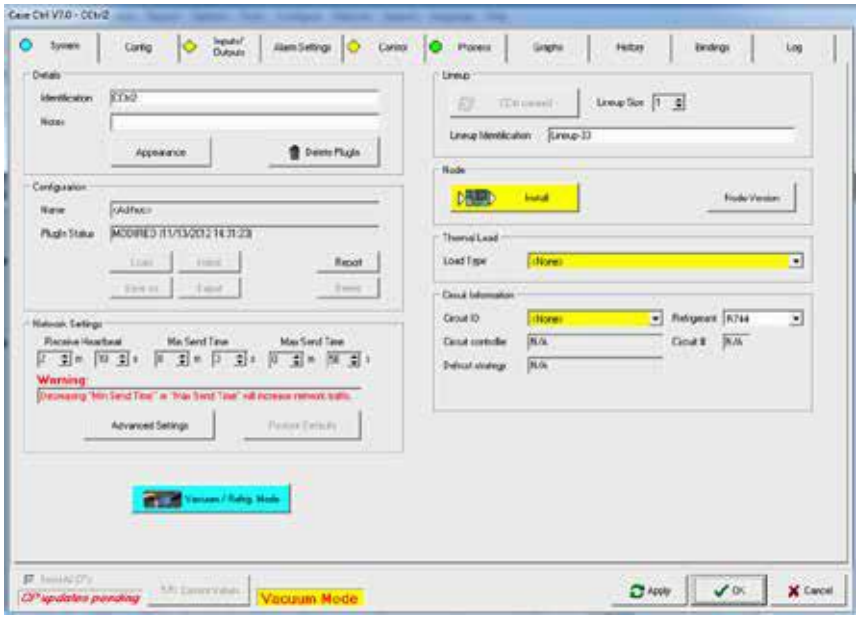
## Creating a Lineup

Before configuring, Alliance must first create the nodes that will be installed to the Case Controller. To simplify installation and future configuration changes, multiple Case Controllers can be created as a Lineup.

A lineup can include up to 16 Case Controllers, which will share many or all configuration parameters. This feature streamlines installation and reduces time on future modifications. Configurations made to one controller will be automatically propagated to all controllers in the lineup.

Give the Case Controller and Lineup unique names in the "Identification" and "Lineup Identification" fields, respectively. Select the Lineup Size.

To create the node(s) that will later be downloaded to the Case Controller(s), click "Create CCtrl." A new window will appear asking to specify the network channel. After clicking OK, Alliance will create additional Case Controller icons according the lineup size specified, and the Configuration window will expand with additional parameters.




The Case Controller Configuration Window after creating the Case Controller Lineup.

## Shared Parameters can be in one of three states:

### Permanently Shared

Some basic settings are permanently shared and cannot be disconnected. Changes made to any Case Controller in the lineup will always be applied to the entire lineup. These settings include: network configuration, circuit specifications, lighting settings, and others.

### Currently Shared

The majority of settings are initially shared throughout the lineup, but can be disconnected at any time. Changes made to any Case Controller in the lineup will be applied to the entire lineup. Single clicking on this icon offers two options. Clicking "Highlight group parameters" highlights all of the parameters that will be affected if this group is disconnected. Clicking "Shared" will disconnect the group of parameters within the lineup.

### Disconnected

Settings are no longer shared across the lineup. Only non-permanently shared parameters can be disconnected; and once disconnected, **these settings cannot be shared again.** The current values stored at the time of disconnecting will remain saved. However, all future changes made to a Case Controller will affect only that specific device.

# Installing the Case Controller

## Programming the Case Controller occurs in two steps:

1. Installing the Node
2. Sending Configuration Parameters *(Abbreviated CPs)*

## Installing the Node:

- This step can be completed at any point before, during, or after the setpoint parameters are configured.
- These steps must be repeated for each individual Case Controller being added to the system.

Installing the node entails several internal processes that setup both Alliance and the new controller for proper operation, including transmitting the Case Controller program to the hardware. This occurs one time during initial setup, and must be completed for each Case Controller added to the system. Configuration parameters (discussed later in this section) assign the controller's inputs and outputs, set system information, and update all setpoints. These parameters can be either shared among multiple controllers or configured independently, and are automatically retransmitted whenever settings are saved in Alliance.

To install the Case Controller program to the controller, click on the highlighted "Install" button. After the new window appears, select the "Commands/Status" tab. Next, click the "Install" button. A third window will appear. Alliance now requires the unique network identification number (known as Neuron ID) for the Case Controller that is being installed.

By default, Alliance waits for the Case Controller to transmit its own Neuron ID. This is accomplished by pressing the Service button on the controller. 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 by removing the Case Controller's cover and locating the identification sticker on the raised printed circuit board.

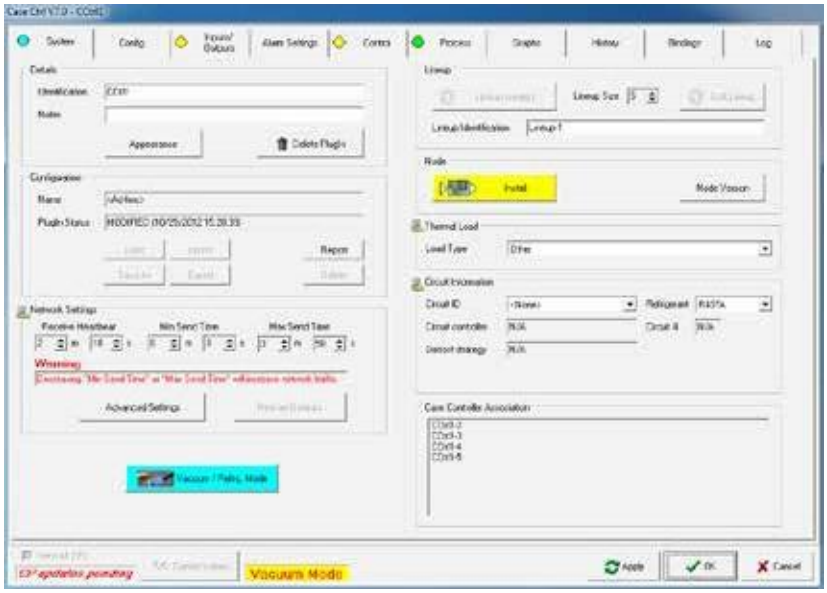
> Micro Thermo recommends using the Service Button method. This eliminates the possibility of an input error and confirms network communication, both of which may be difficult to diagnose later.

Alliance is now installing the node. Once complete, click the "OK" button on the second window to return to the Case Controller configuration window.

**Reminder: You must repeat the previous steps to install the node on each individual Case Controller being added to the system.**

# Configuration Parameters

> Upon initial setup, the Case Controller starts in "Vacuum Mode." The controller does not begin normal operation until the installer activates "Refrigeration Mode."




The Case Controller or lineup parameters can now be modified to achieve the desired operation. Across the top, the Configuration Window is divided into 10 tabs. The contents of the first five tabs are detailed below. The remaining tabs are explained in more detail in *Section 3 – Case Control Operation.*

Many of the parameters available will only be used for advanced configurations or to achieve unique behavior on some systems. Common parameters used during installation are listed below. For a complete list of parameter definitions, see Appendix A.

Alliance highlights certain fields in yellow to indicate key settings that need to be set (or confirmed) before operation can begin. A tab marked by a yellow diamond indicates the presence of highlighted fields. Other fields may be grayed-out, indicating values which cannot be changed at this time.

The Configuration Window is dynamic. As certain selections are made, other options will become available or be removed from the configuration window.

## System Tab

The System tab provides an overview of the refrigeration system to which the Case Controller is connected. Many settings are built into the system and cannot be changed.

### Load Type

Specify the type of case being controlled; this determines certain preset parameter control values and may disable parameters that do not apply.

### Circuit ID

Specify the circuit for the Case Controller; this configures some shared network data and determines the defrost scheme. To add/edit circuits in the dropdown list, see "Configuring DTSecCool Node for Defrosts."

### Refrigerant

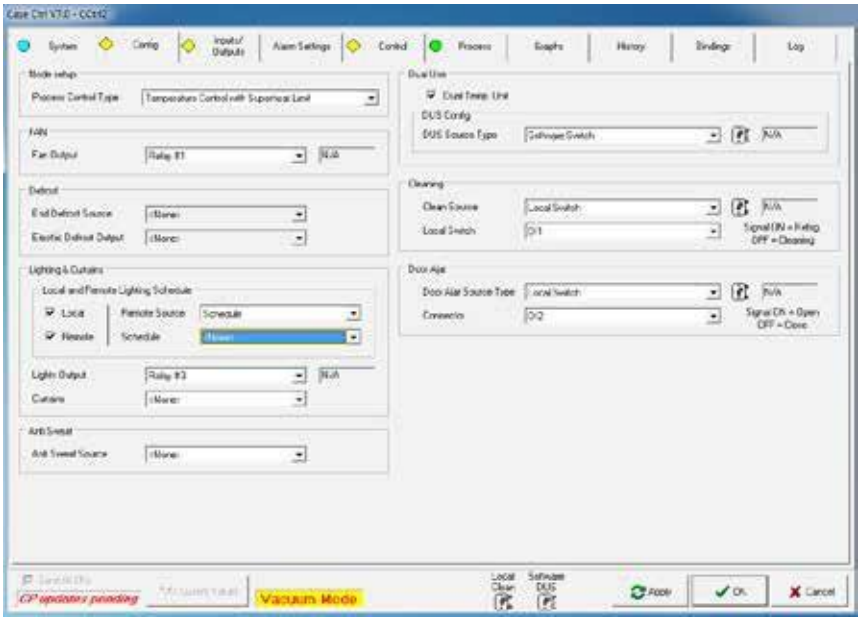
Specify the refrigerant being used.

# Installing the Case Controller

## Config Tab

The Config tab provides detailed settings for how the Case Controller is being used. Many of these settings impact other parameters and set-points later in the configuration process.

If any changes are made, all settings on Inputs / Outputs tab and Control tab must verified.




### Process Control Type

Specify the control scheme desired:

**Temperature Control with Superheat Limit** controls the expansion valve to optimize case temperature, as long as the superheat is at an acceptable level. If superheat falls to the specified threshold, the controller will begin closing the valve. Once superheat returns above the threshold, the controller will resume maintaining case temperature.

**Superheat Control Only** controls the expansion valve to maintain the specified superheat.

**Temperature Control Only** controls the expansion valve to maintain a specified case temperature.

### End Defrost Source

Specify the temperature input that will trigger the controller to end defrost. By default, the controller uses the dedicated defrost termination sensor.

## Config Tab *(cont.)*

### Light & Curtains

Specify whether the lighting schedule will be configured on the controller (locally), over the network from the main scheduler (remotely), or neither. If selecting Remote, specify the source and schedule the Case Controller should use.

### Anti-Sweat

If anti-sweat heaters are present, specify whether the Case Controller will be controlling based upon a constant pulse method or based upon the dew point provided from the Anti-Sweat board.

### Dual Use

If the case is used at two different temperatures, a switch can be used to quickly change between two configured setpoints. Select "Dual Temp. Unit" and specify the DUS source that will select the temperature:

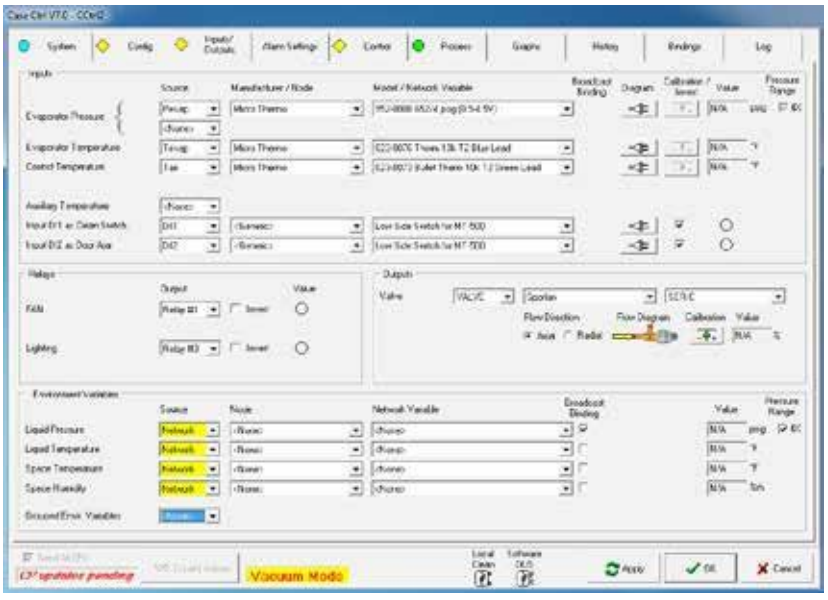
**Software Switch** will enable an icon on the Process tab for switching between temperatures.

**Local Switch** will select temperature based upon the position of a physical switch connected to one of the digital inputs.

**Remote Switch** will select temperature based upon a signal from another device on the network.

### Door Ajar

If a door ajar switch is present, select the type of switch (local or remote) and then specify the location where the Case Controller should monitor.




## Inputs / Outputs Tab

> The Inputs / Outputs tab provides the controller with the necessary details to accurately interact with all sensors, switches, network connections, and the electric valve.

**Evaporator Pressure** Select the Manufacturer and Model for the pressure transducer installed on the suction line.

### Temperature Sensors

Select the Manufacturer and Models for each temperature sensor listed; select "None" for any input that is not connected.

# Installing the Case Controller

## Inputs / Outputs Tab *(cont.)*

### Digital Inputs

Verify the digital input settings (or absence) based upon selections made on the Config tab.

### Outputs

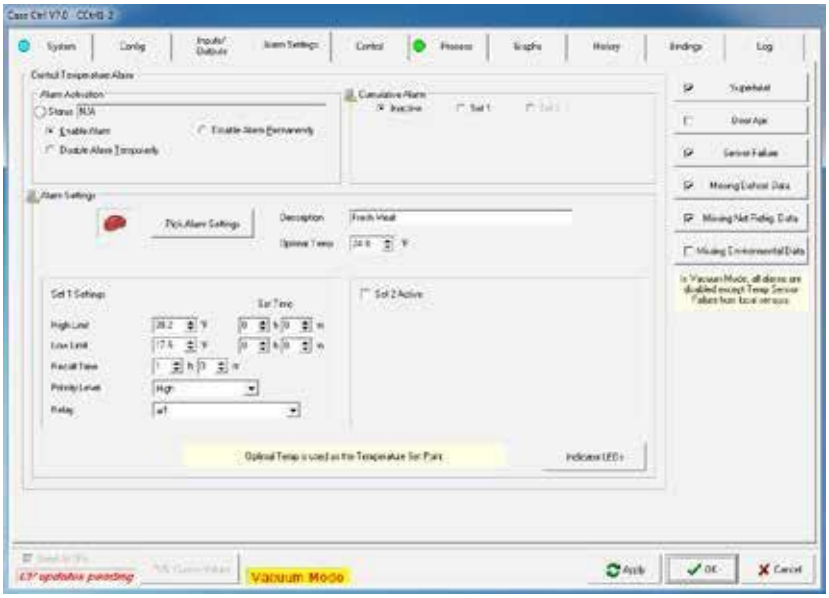
Select the valve output, Manufacturer, and Model for the connected valve from the drop-down lists.

### Environmental Variables

The Case Controller factors in environmental/system parameters to optimize valve control. Select the network locations for any/all of the four variables (if present). Once the first Case Controller's Environmental Variables are configured, this group of settings will be shared across the network. All future Case Controller setups can be expedited by selecting the grouped environmental variable, and these settings will automatically be replicated.

## Alarm Settings Tab

Alarm settings can be fully customized to meet the operational needs of the case and its contents. A list of commonly used, pre-set alarm settings are available to use as a starting point. To begin, click the "Pick Alarm Settings" button. Choose one that closely meets the needs for this Case Controller; or if none apply, press "Cancel" to return to the previous screen.



## Alarm Settings Tab *(cont.)*

### Alarm Settings

Specify the case temperature set point in the Optimal Temperature field.

### Set 1 Settings

Specify the operation of the primary alarm:

**High/Low Limits:** the temperature thresholds which constitute an alarm condition.

**Set Time:** the time delay during which the temperature must remain outside of the high/low limit before the alarm signal is activated.

**Recall Time:** if an alarm is Acknowledged in Alliance but the alarm condition persists, the alarm signal will be reactivated after the delay specified by the recall time. This feature ensures alarm conditions are not dismissed or forgotten without being resolved.

**Priority Level:** the severity indicated in the alarm message. Temperature alarms should be considered high priority.

**Relay:** the external output relay to activate when the alarm is triggered, if desired.

### Set 2 Settings

Select the "Set 2 Active" checkbox to activate the secondary alarm. Follow the same convention as Set 1 Settings.

### Cumulative Alarm

To activate the cumulative alarm, select which alarm set to use as boundary threshold. Next, specify the time outside of range that will activate the alarm and the cumulative period over which to monitor.

> Note: If the Case Controller is configured for Dual Temperature, then Alarm Set 1 is the alarm thresholds for Temperature Set 1; Alarm Set 2 is the alarm thresholds for Temperature Set 2; and the Cumulative alarm is disabled.

## Control Tab

The Control tab provides settings that precisely configure the controller operation. Default values have been calculated for optimal control in most system configurations. For most installations, the "Basic View" will provide all of the necessary settings. Should more control options become needed, select the "Advanced View" button.

The Control tab is divided into additional tabs, itemized down the left side of the window. The following parameters should be configured or verified to meet the system needs.

## The Case Controller provides three alarm options for each case:

**Set 1 - Primary**

Set 1 is the primary alarm setting, usually used to alert when the case reaches a temperature at which food loss/damage is imminent.

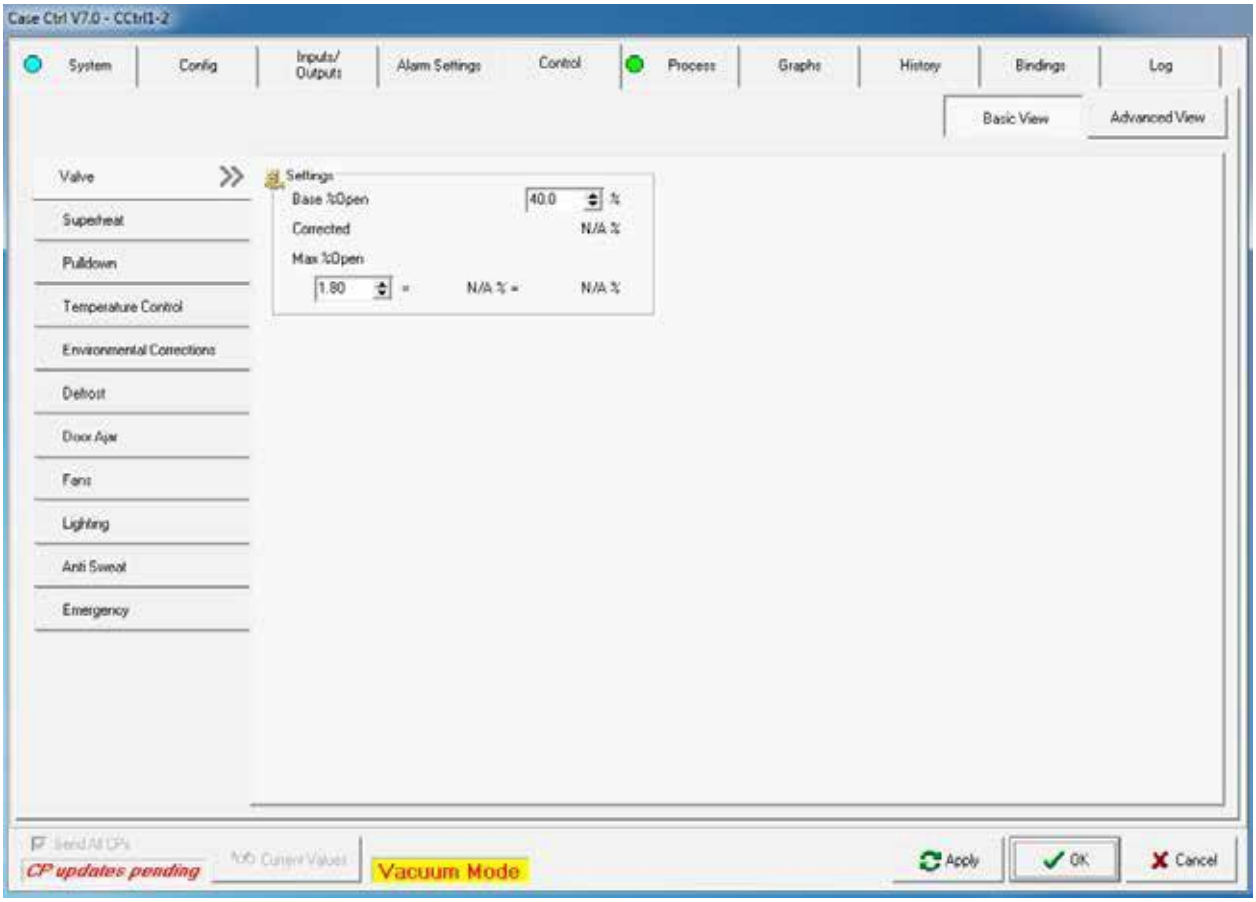
**Set 2 - Secondary**

Set 2 allows for a second temperature range to be set and is usually used to alert when the case reaches a temperature that will decrease product quality or shelf life. Set 2 is often set with a narrower high/low limit, but a longer delay than Set 1.

**Cumulative Alarm**

On occasion, the case temperature may exceed the alarm boundaries (e.g., during defrost). Delays are built in to most refrigeration controllers to avoid nuisance alarms, while still ensuring that temperatures return to normal within an acceptable time. However, frequent temperature variations can still have a negative impact on the product quality over time. Micro Thermo's Cumulative Alarm is based on the HACCP standard for food safety and tracks the total time that a case temperature exceeds the alarm boundaries.

# Installing the Case Controller




## Control Tab *(cont.)*

### Valve

**Base %Open** is the approximate position of the valve under steady state condition with a normal load. This value is used in many calculations. Improving the accuracy of this value will improve the efficiency of the control scheme and reduce valve hunting.

**Max %Open** is the maximum position the controller will place the valve. Specify the position as a multiple of Base %Open, and confirm the percentage value.

### Superheat

While controlling case temperature, the controller disregards the current superheat as long as it remains above the "Threshold."

**Cut Off** is the minimum allowable superheat. At this temperature, the valve will be positioned at the minimum valve position, in order to protect the compressor.

## Control Tab *(cont.)*

**Band** is the temperature range over which the controller will progressively close the valve, in attempt to raise the superheat. The "Threshold" value is the sum of the cut off temperature and the band.

### Pulldown

**Initial %Open** specifies the initial placement of the valve when refrigeration resumes after defrost. The standard control scheme is ignored until temperature returns to an acceptable range.

### Temperature Control

Allows for advanced configuration of temperature response. PID settings should only be changed by experienced professionals.

**Minimum %Open** located in the "Advanced View," is the minimum position the controller will place the valve.

### Defrost

**%Open in Defrost** specifies the position of the valve during defrost.

**End Defrost Temperature** specifies the temperature at which defrost will be ended for this controller. This setting will not terminate defrost on any other Case Controller.

**%Open on End Defrost** specifies the position of the valve after defrost. The controller will hold this position while it awaits signal that all other controllers on the circuit have completed defrost.

**%Open in Pumpdown** specifies the valve position during pumpdown.

**%Open in Drip** specifies the valve position after the circuit has completed defrost, before refrigeration mode is activated.

### Door Ajar

Allows the controller to stop refrigeration when the door ajar switch is activated.

**%Open on Door Ajar** specifies the position of the valve while the door ajar switch is activated.

### Fans

**Stop Fans on Door Ajar** specifies when to stop fans if the door ajar switch is activated.

**Stop Fans on Defrost** intelligently starts/stops the evaporator fan to maximize the residual cooling effect of refrigerant in the evaporator.

# Installing the Case Controller

## Control Tab *(cont.)*

**Stop Fans on Defrost** *(cont.)*

The controller will leave the fans running until the case temperature begins to rise (or for the maximum duration specified by *Timeout*). The Controller will leave the fans off after defrost until the evaporator temperature has been pulled down (or for the maximum duration specified by *Timeout*).

### Lighting

Specifies a basic lighting schedule for this case, if *Local* was selected on the Config tab.

### Anti-Sweat

Specifies the function of the Anti-Sweat pulsed output.

**Default Anti-Sweat** specifies the percentage of time the heaters will be on, if *Constant Pulse Method* was selected on the Config Tab.

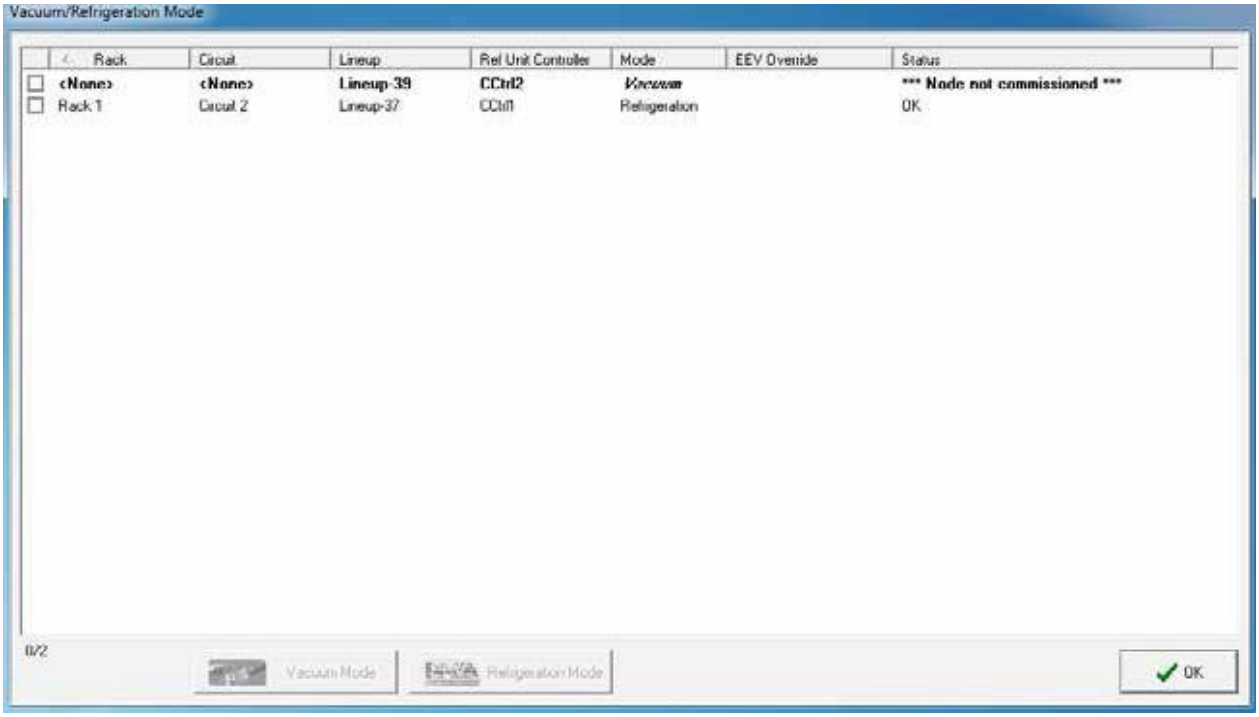
## Saving Changes

At any point during the configuration, the current progress can be saved and resumed at a later time. Press the "Apply" button to save without closing the current window; press the "OK" button to save and exit the configuration. Clicking either button will cause the Configuration Parameters to download to the controller. This may take a few minutes.

# Starting Refrigeration Mode

After all settings have been configured, the Case Controller is ready for operation. However, the controller will remain in Vacuum Mode until activated.

If the steps for "Installing the Node" were skipped earlier, this must be completed before activating Refrigeration Mode.




When the system is ready to be started and the controllers are ready to begin Refrigeration mode, open any Case Controller Configuration Window. On the System tab, select the blue "Vacuum / Refrig. Mode" button. A second dialog window will open with a list of Case Controllers on the network. Select the Case Controllers on the system that are still in Vacuum Mode and are ready to be activated. Click the Refrigeration Mode button to begin normal operation.

# Case Control Operation

## Overview

The Case Controller and Alliance software offer historical and

comprehensive real-time information about the device's operation. Alliance's graphical user interface allows an approved user, from technician

to corporate executive, access to the information they need to keep equipment running correctly and efficiently. The controller also features ten LED indicators for a visual status update.


## Controller Status

**Status Key:** Off On Flashing

### RS485 Rx/Tx

Unused at this time.

### LON Rx/Tx

Indicates activity on the LonWorks network; the controller is either sending or receiving data.

### Status

During normal operation, the status indicator will flash twice followed by a one second delay.

In wink mode, the status indicator will flash quickly. After one minute, wink mode will automatically end, and the indicator will return to normal.

### Air Temp

The Control Temperature input is set to <None>, and the controller is not monitoring this input.

Case temperature is currently 4.5° (or more) above set point.*

Case temperature is currently between 2.5° and 4.5° above set point.*

Case temperature is currently within 2.5° of set point.*

Case temperature is currently 2.5° (or more) below set point.*

*These temperature thresholds can be changed in Case Controller plug-in by clicking the "Indicator" button on the Alarm tab.

## Temp Alarm

No alarm present.

The Case Temperature alarm is active. This light will remain lit until the alarm is acknowledged in Alliance.

## Other Alarm

No alarm present.

An alarm, other than case temperature, is currently active. This light will remain lit until the alarm is acknowledged in Alliance.

## Valve

The valve is not connected, or is connected incorrectly.

The valve is connected and idle.

The controller is currently moving the valve.

## Defrost

The controller is in refrigeration mode.

The controller is waiting for pumpdown or drip time to complete.

The controller is in defrost mode.

## Fan

The fan is currently off.

The fan is currently on.

## Lights

The lights are currently off.

The lights are currently on.

## Anti-Sweat

The Anti-Sweat output is off.

The Anti-Sweat output is on.

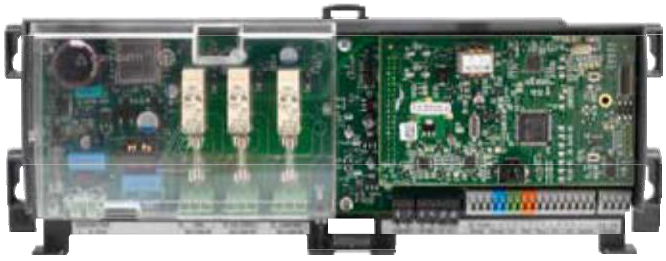
# Case Control Operation

## MT Alliance

### The three modes in the Alliance software provide different levels of access to controller data and configuration.

After logging in to the Alliance software, all users will have access to the Overview mode. Based on assigned credentials, some users will have access to the Maintenance mode. And a few select users will have the highest level privileges with Configuration mode.

After logging in to the Alliance software, locate the Case Controller on the building floor plan and select the icon. The Case Controller plug-in window will open. Depending on the current mode, some tabs will not be accessible.




**In Overview mode:**

The user will be able to view alarm settings, view details of current state of the controller, view historical graphs, and view the change log for the controller.

**In Maintenance mode:**

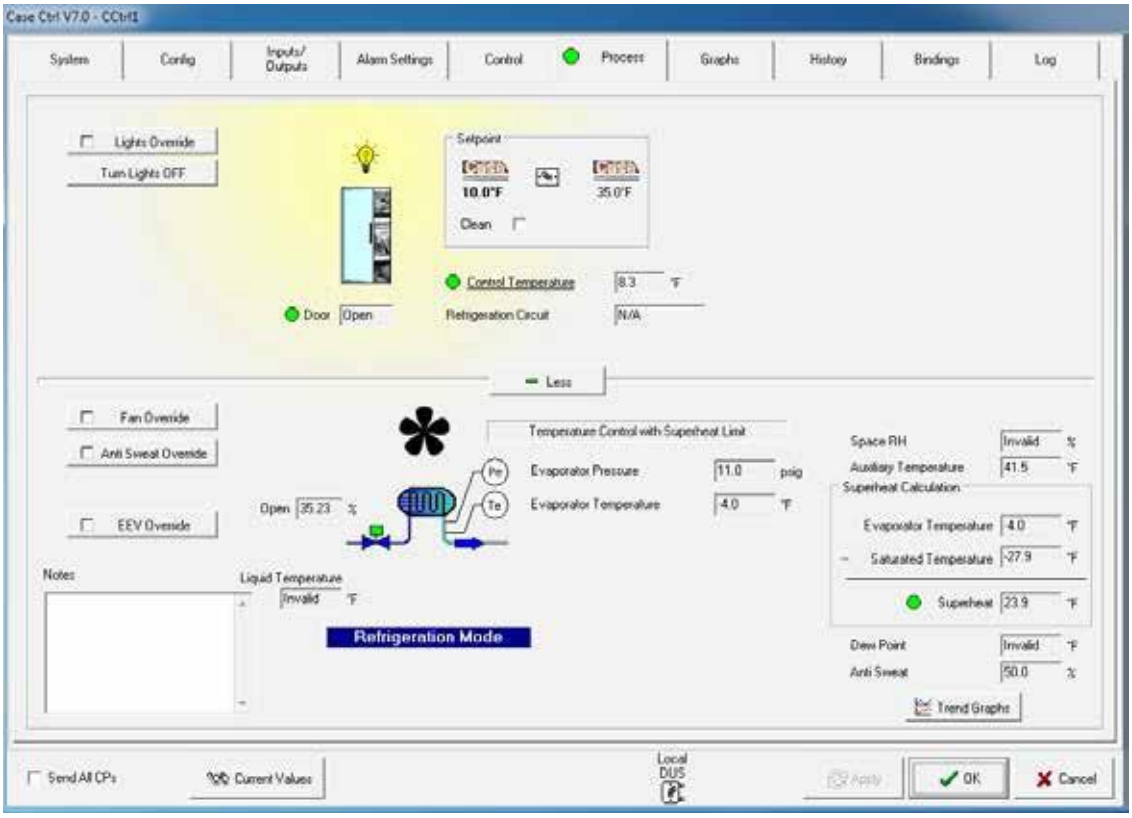
The plug-in will show an additional five tabs that allow the user to view configuration settings. The alarm settings can also be modified in Maintenance mode.

**In Configuration mode:**

All tabs will be shown and configuration parameters can be modified to customize the operation of the controller.

## Viewing Detailed Status

Details of the controller's operation can be viewed in any mode. After opening the Case Controller plug-in, select the Process tab.




If the Case Controller is configured for Dual Temperature, the Setpoint section at the top will show both temperature setpoints. Further, if the temperature is selected by Software Switch, a light switch icon will be shown between the two setpoints. The position of the switch in the image indicates the current setpoint selected; clicking the icon will toggle between the two setpoints.

If the bottom half of the window is blank, click the "More" button to expand the view. The Process tab shows all real-time data reported from the controller. This includes temperature set point, input readings (including door ajar and environmental variables, if present), all outputs, and system mode. Alliance incorporates a graphical display, representing the components of the system, in addition to the numerical readings:

### Lights

The light bulb icon at the top is illuminated yellow when the lights are on; the yellow disappears when the lights are off.

### Door Ajar

The door icon will show an open or closed door, to match the reading of the door ajar switch.

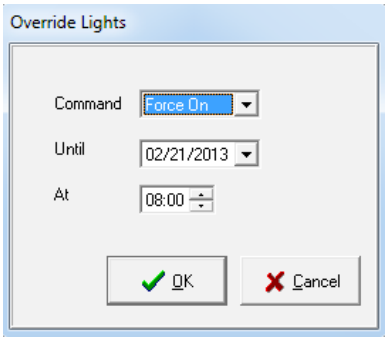
### Fans

The fan blade icon spins while the fan is turned on, and remains stationary while the fan is off.

# Case Control Operation

## Viewing Detailed Status *(cont.)*

During normal operation, a green circle beside an input indicates the value is within the alarm limits and functioning as expected. If any values trigger an alarm, this icon will change to red and easily identify the source of the alarm. After acknowledging the alarm condition, the icon changes to yellow to indicate the recall period. After the recall time has passed, if no alarm is present, the icon will return to green. A blue icon indicates the alarm is temporarily disabled. This includes the superheat alarm automatically being disabled during defrost.




Click Ok to close the window.

## Overriding Outputs

From the Process tab, the user can manually override each of the outputs. **Use caution when overriding outputs. If not done correctly, serious system damage can occur.** Overriding outputs requires either Maintenance mode or Configuration mode be selected. Locate the button on the left edge of the Process tab to override a specific output. Clicking the button will open a new window. Activate the override from the drop down box and select the end time when the controller will resume normal operation. For EEV override, fill in the percent open to position the valve.

Reminder: The override will not take effect until the settings are downloaded to the controller. Click Apply to activate the override.

## View / Modify Alarms

From the Alarm tab, all alarm thresholds can be viewed. If Maintenance or Configuration mode is selected, these values can also be modified. **For definitions of Set 1, Set 2, and Cumulative alarms, see the "Alarm Tab" section under Installation.** To disable all alarms on the controller, select "Disable Alarm Permanently" or "Disable Alarm Temporarily." Fill in the reason and the end time for the alarms to be automatically reactivated (for temporary).

Individual alarms can be configured through the buttons along the right edge. To activate/deactivate, temporarily disable, and customize the settings, click on the button for the appropriate alarm. A new window will open. Fill in the fields, as desired.

**Use Alarm:** permanently enable/disable the alarm.

**Set Time:** the time delay during which the alarm condition must remain before the alarm signal is activated.

**Recall Time:** if an alarm is Acknowledged in Alliance but the alarm condition persists, the alarm signal will be reactivated after the delay specified by the recall time. This feature ensures alarm conditions are not dismissed or forgotten without being resolved.

**Priority Level:** the severity indicated in the alarm message. The superheat alarm should be considered high priority.

**Relay:** the external output relay to activate when the alarm is triggered, if desired.

**Disable Alarms Temporarily:** temporarily disable the alarm. The alarm will be automatically reactivated at the time specified. Provide a reason to be recorded in the controller's log.

The superheat alarm contains two additional parameters that specify when the alarm is activated. The superheat alarm is cumulative. The Case Controller keeps a "Time in Overflow" timer for the time superheat is below the low limit. Rising above the low limit will not "reset" the timer. Instead, the timer counts up while superheat is below the low limit and counts down while superheat is above the low limit. When "Time in

## View / Modify Alarms *(cont.)*

Overflow" exceeds the set time, the alarm is activated.

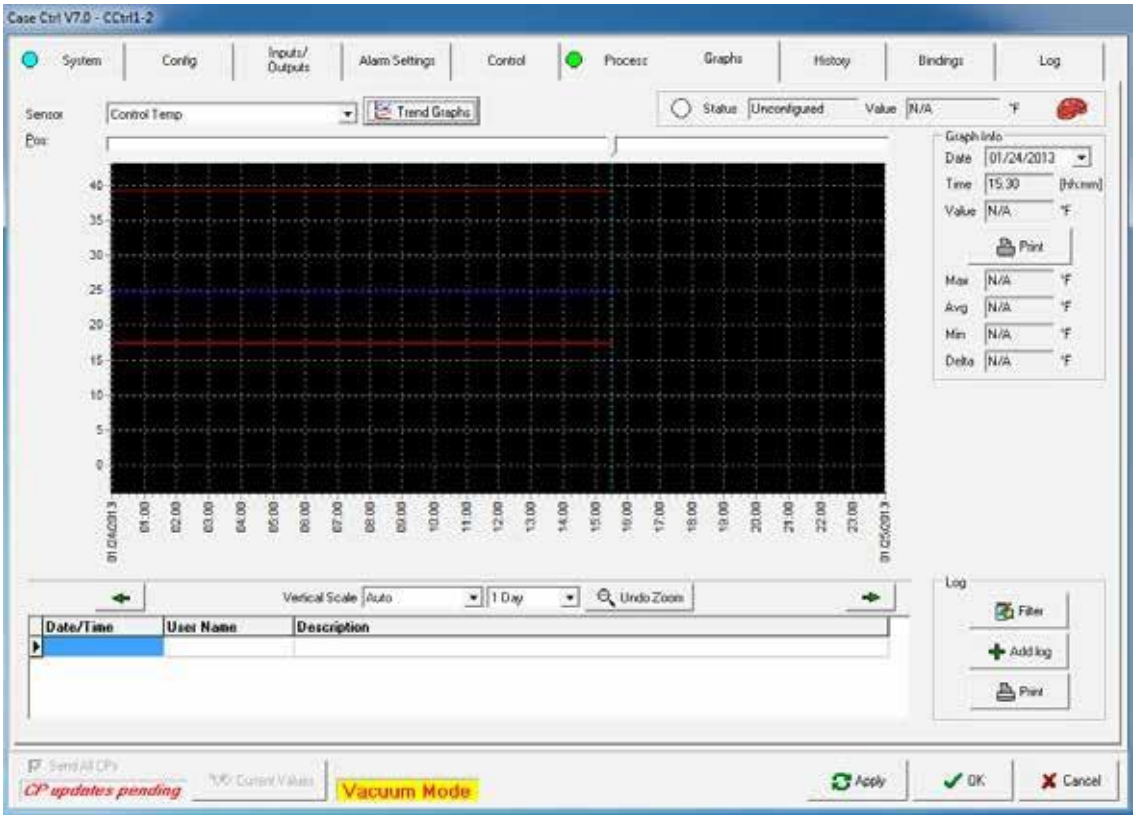
**Low Limit:** the superheat threshold that constitutes an alarm condition.

**Overflow Tolerance:**
Overflow tolerance is the rate at which time is subtracted from the alarm timer. For example: with the default 25%, every 4 seconds above the low limit decreases the timer by 1 second (25%). This value can be set between 1% and 50%. The higher the value, the faster the alarm timer will reset; the lower the value, the slower the timer will reset.

The Air Temp indicator on the Case Controller can be customized from the Alarm tab. Click the "Indicator LEDs" button. In the new window that opens, the thresholds for the color/flash pattern on the controller's face can be set. Select the temperature error that causes the red LED to flash, indicating very high temperature; the temperature error that causes the red LED to stay lit, indicating high temperature; and the temperature error that causes the green LED to flash, indicating low temperature.

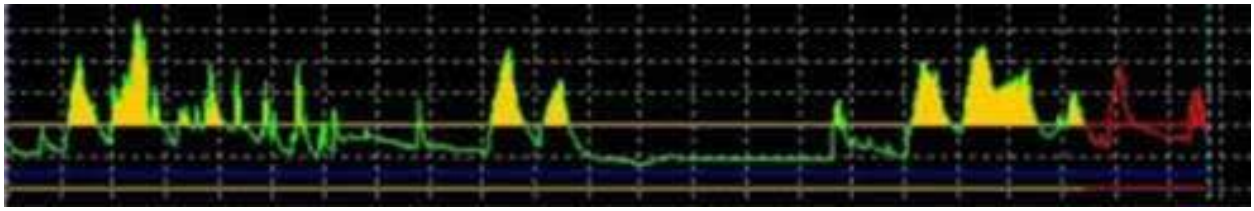
## View Historical Graphs

The Graphs tab provides access to all historical data saved on the data logger. By default, Alliance shows the Control Temp graph, which includes the alarm thresholds in red and the optimal temperature in blue. Graphs can be viewed for Alarm Set 1, Alarm Set 2, or both simultaneously by selecting the desired option located to the right of the graph.



# Case Control Operation

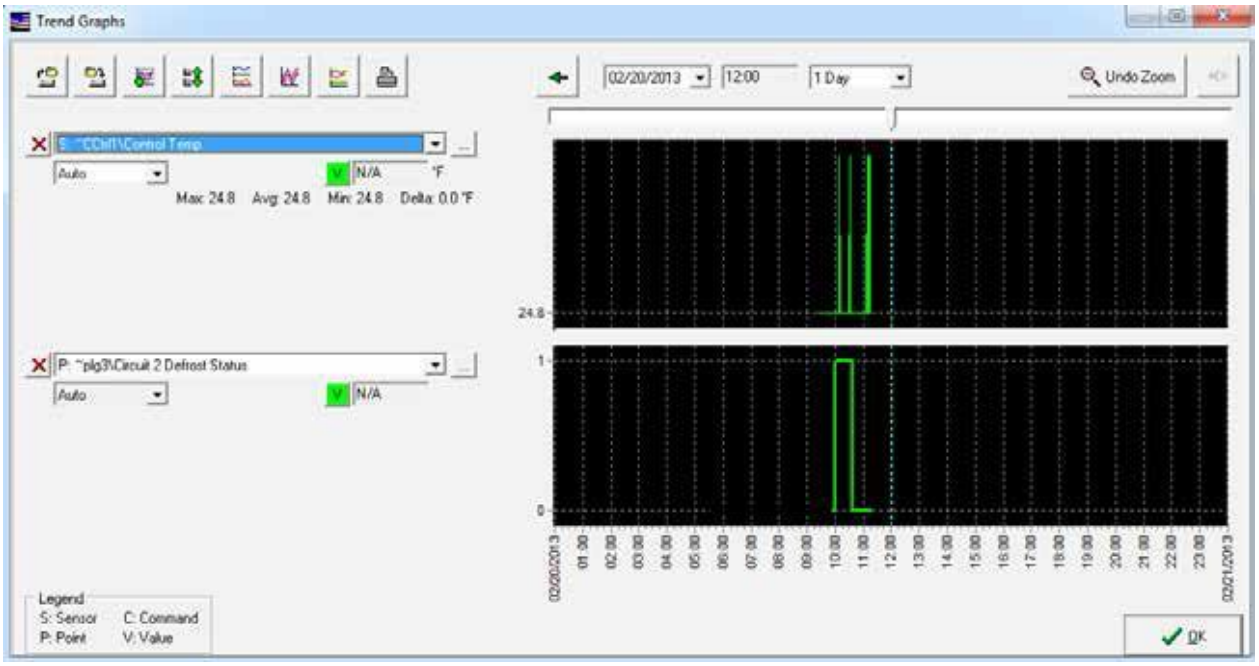
## View Historical Graphs *(cont.)*



The graph will indicate in red the time when the alarm for this sensor was active. Also, if the Cumulative alarm is set, Alliance will highlight the graph where the temperature is outside of range.

Using "Sensor" drop down box at the top, you can view the history for any other stored variable. The two drop down boxes below the graph can be used to adjust the vertical scale and the horizontal time frame of graph. The Graph Info along the right edge provides specific values for the point in time marked by the blue vertical line. This vertical line can be moved, either by clicking on another location on the graph or by dragging the gray slider above the graph. All events corresponding to the selected variable appear in the table below the graph. The log can be filtered or printed using the buttons along the ridge edge. New notes can also be added for future reference.

Multiple variables can be viewed on side by side graphs, for instance to assist in system troubleshooting. First, click the "Trend Graphs" button near the top of the Graphs tab. In the new window, up to seven stored variables can be plotted separately, or combined onto one graph for easy viewing. Click the Ellipsis button beside the variable name to select a different variable, from any node connected to Alliance. Graphs can be added, removed, reordered on the screen, printed, and saved for quick viewing in the future.



## View Change Log

The Alliance software records every change made to any setting in every plug-in. This information can be particularly valuable later when diagnosing a recent problem or to find details of a change to the system.

The log for each device is saved separately, and can be accessed through the plug-in window. From any mode, simply select the Log tab at the top. The table includes every change made to this Case Controller since its installation.

To filter the list, simply select a start and end date and the type of change made from the options below the table. Notes can be added to the log for future reference by using the Add button. And the Print Log button allows the user to print the filtered list, if desired.

When Maintenance mode is selected, the Case Controller plug-in window allows access to the System tab, Config tab, Inputs/Outputs tab, Control tab, and History tab. All configuration settings for the Case Controller can be viewed through the plug-in. However, the settings on these tabs cannot be modified.

To change any configuration settings on these tabs, the user must have the proper credentials to access the Configuration mode. When Configuration mode is selected, the Case Controller plug-in window allows these settings to be modified. For details on these settings, see *Configuring the Case Controller in Alliance* section in Chapter 2 or a complete list of parameters in *Appendix C*.

# Replacing a Case Controller

Under certain circumstances, it may become necessary to replace a faulty controller. Bringing a new controller online involves:

1. **Installing the new hardware**
2. **Sending the configuration settings from the Alliance interface**

## Replacing Original Hardware

To remove the original controller, first disconnect power from the unit. The power leads do not need to be disconnected from the terminal block. The extractable connector can be lifted off of the board, and later be reapplied to the new controller.

Next, disconnect the remaining wire connections on the Case Controller. Carefully label each wire, noting the specific location from which it was removed. Detach the controller from its mounting:

**If the controller is wall mounted:**

With the cover off, loosen the two screws on each side of the controller. Gently slide the controller upwards, aligning the screw heads with the lower opening, and lift the controller free.

**If the controller is DIN Rail mounted:**

With the cover off, insert a flat screwdriver into the slotted tab at the top of the controller. Gently lift the tab upwards while pulling the top of the controller away from the mounting surface. Once the top is free from the DIN rail, lift the controller free.

**If the controller is SnapTrack mounted:**

If space permits, the Case Controller can be slid off one end of the SnapTrack. The controller can also be pulled directly off the track. Starting at one corner of the controller, gently pull the lip of the SnapTrack away from the controller. The mounting leg will come free easily. Repeat this for each remaining mounting leg.

Mount the new Case Controller, reversing the previous steps taken to remove the original device. See Section 2 for complete installation instructions.

## Configuring Alliance

The Alliance software saves the program and settings for all configured hardware, and will send the existing configuration to the new controller in a few steps. From the Refrigeration view in Alliance, click on the icon for Case Controller that is being replaced. Go to the "System" tab and click the "Install" button. On the new window that opens, select the "Commands/Status" tab and click the "Replace" button. A third window will appear. Alliance now requires the unique network identification number (known as Neuron ID) for the Case Controller that is being installed.

By default, Alliance waits for the Case Controller to transmit its own Neuron ID. This is accomplished by pressing the Service button on the controller. 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 by removing the Case Controller's cover and locating the identification sticker on the raised printed circuit board.

> 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 program on the new controller, and sending existing configuration parameters. This may take several minutes. Once complete, click the "OK" button on the second window to return to the Case Controller configuration window.
If no further changes are desired, click the "OK" button to return to Alliance.

# 5 Decommissioning a Case Controller

Under certain circumstances, it may be desirable to remove a Case Controller from the refrigeration system. In order to prevent nuisance alarms, the controller must be removed from the Alliance software.

**Removing the controller from Alliance will also remove all historical data associated with this device.**

From the Refrigeration view, click on the icon of the Case Controller that is being removed. On the "System" tab, click the "Delete PlugIn" button. Click "OK" to confirm deleting the Case Controller.

Once the controller has been removed from Alliance, the hardware can be removed from the system. First, turn power off to the device. It is now safe to remove all connections from the controller. If the controller will be reinstalled in the future, label each wire with the terminal from which it was removed. Else, all remaining devices can be uninstalled (probes, wiring, etc).

## Detach the controller from its mounting:

**If the controller is wall mounted:**

With the cover off, loosen the two screws on each side of the controller. Gently slide the controller upwards, aligning the screw heads with the lower opening, and lift the controller free.

**If the controller is DIN Rail mounted:**

With the cover off, insert a flat screwdriver into the slotted tab at the top of the controller. Gently lift the tab upwards while pulling the top of the controller away from the mounting surface. Once the top is free from the DIN rail, lift the controller free.

**If the controller is SnapTrack mounted:**

If space permits, the Case Controller can be slid off one end of the SnapTrack. The controller can also be pulled directly off the track. Starting at one corner of the controller, gently pull the lip of the SnapTrack away from the controller. The mounting leg will come free easily. Repeat this for each remaining mounting leg.

# Technical Specifications

## Electrical

**For: All models**
**Analog Inputs:**
(4) Temperature Sensors,
10KΩ NTC probes no polarity sensitive
(1) Pressure Transducer,
0.5-4.5V ratiometric

**Digital Inputs:**
(2) 0-5VDC max range, to interface with dry contacts

Wire: For above use 22 AWG stranded tinned copper 105°C Insulated

**For: 963-651G *, CC0R models**
**Supply Voltage:**
100-240VAC, 50/60Hz

**Fuses F1:** 5 x 20mm, 250V, 2A Fast Blow Fuse

**Digital Outputs:**
(1) Bipolar Stepper Motor Output, 180mA 30V max (for EEV control)
(1) 5VDC Pulsed Anti-Sweat Output, 15mA max (for Solid State Relay)
(1) Fan Relay N.C.: 5A res., N.O.: 4.9 FLA @240 VAC, Not suitable for ECM fans
(1) Defrost Relay N.C.: 5A res. @240 VAC, N.O. 1.9A @240 VAC or 2.8A @120VAC Pilot Duty
(1) Lighting Relay N.C.: 5A res. @240 VAC, N.O. 2.4A @240V or 3.6A @120V Std. Ballast

**Fuses F2, F3, F4:** GMC 5 x 20mm, 250V, 5A Slow Blow Fuse

**For: 963-CC1A, 963-CC2R models**
**Supply Voltage:**
115-230VAC, 50/60Hz

**Relay Outputs:**
Note: Power supplied to load comes from the power supplied to the relay card
(1) Anti-Sweat Solid State Relay Output, 115-230 V ac, 12 A Resistive
(1) Fan Output: ½ HP @115-230 VAC, and 12AResistive @115-230 VAC. Not suitable for ECM fans
(1) Curtain Closing: 115-230 V ac, ½ HP and 115-230 V ac, 12A Resistive
(1) Curtain Opening + Schedule Output: ½ HP @115-230 VAC, and 12A Resistive @115-230 VAC,

**Fuses F5, F6, F7:** 3AG/MDA 12A/250V 1/4 x 1 1/4" Time-Delay

**Network Connections:**
(1) LonWorks TP/FT-10 Network @ 78kbps

Wire: 18 AWG 7/26 stranded, unshielded twisted pair (Belden 8461 or equivalent)

## Mechanical

**Operating Temperature:**
**963-651G *, CC0R models** -13°F to 140°F (-25°C to 60°C)
**963-CC1A, CC2R models** -13°F to 104°F (-25°C to 40°C)

**Humidity:**
0-95% RH (non-condensing)

**Enclosure:**
PC (dark gray)

**Wiring:**
Screw terminals

**Mounting:**
961-651G * (without metal enclosure) can be Wall mount, SnapTrack panel, or DIN rail (EN 50022) inside kick plate or metal enclosure

### Dimensions (WxHxD)

**ABS Plastic Enclosure:**
12.50 x 4.56 x 2.15 inches
318 x 116 x 55 mm

**Metal Enclosure: 963-651G * model**
15.2 x 6.8 x 3 inches
386 x 173 x 76 mm

**Metal Enclosure: 963-CC0R, CC1A, CC2R model**
24.2 x 6.8 x 3 inches
615 x 173 x 76 mm

## Compliance

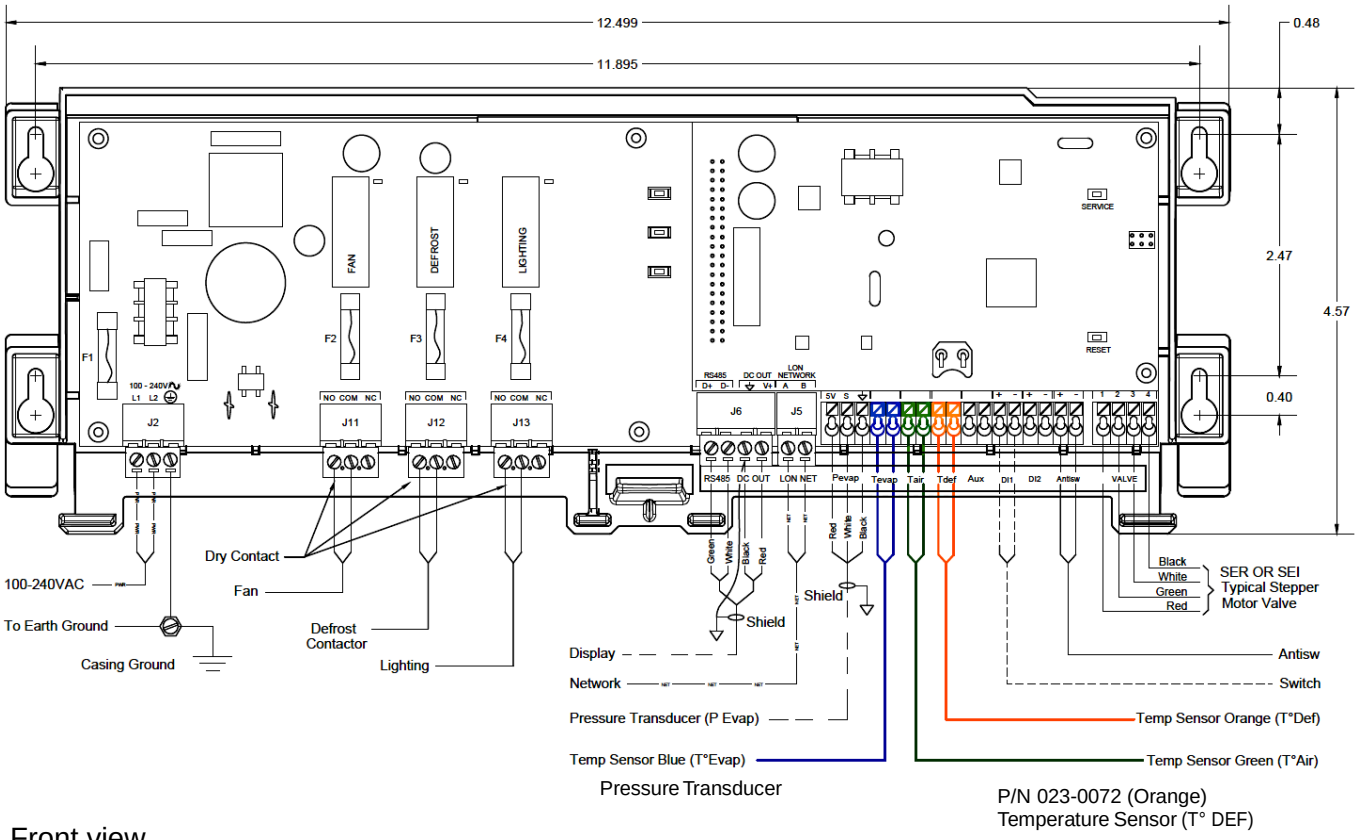
**Environmental:** ROHS

**Safety: Type 1.C Action Operating Control**

UL/CUL (LISTED per UL60730-1 and UL60730-2-9)
Pollution Degree 2
Impulse Voltage: 2500V
ELV limit realized 25V, 5V

* G can be replaced with C, D, E or F

# Appendices



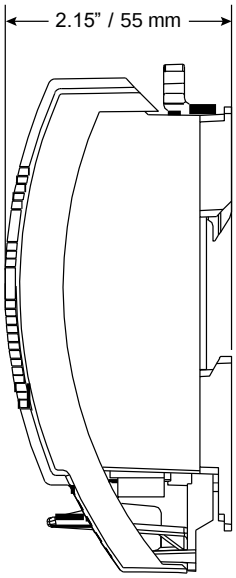

Front view
ABS Plastic enclosure

Pressure Transducer

P/N 023-0076 (Blue)
Temperature Sensor (T° COIL)

P/N 023-0072 (Orange)
Temperature Sensor (T° DEF)

P/N 023-0073 (Green)
Temperature Sensor (T° AIR)




**Side View**

## IN / OUT Description

**POWER:** 100V to 240VAC, field installed by electrical contractor

**FAN N.O.:** Maximum 4Amp when driven directly by the controller - need an external interface relay/contractor when amperage > 4Amp

**DEFROST N.O.:** Always use an external interface relay or contactor

**LIGHTING N.O.:** Max 2.4A @ 240V or 3.6A @ 120V when driven directly by the controller - need an external interface relay/contactor when amperage > 4Amp

**NETWORK:** Echelon Type 2#18, Stranded, 7/26 UTP (Unshielded Twisted Pair) Belden 8461 type or equivalent, field installed by the EMS Contractor

**RS485/DC OUT:** Commucation for remote display option

**Pevap:** Pressure transducer used with T° COIL to calculate Superheat

**Tevap:** 10K T° sensor P/N 023-0076 used for Superheat (blue)

**Tair:** 10K T° sensor P/N 023-0073 used for alarm monitoring (green)

**Tdef:** 10K T° sensor P/N 023-0072 used for end defrost (orange)

**Taux:** Auxiliary T° sensor 10K for Temperature monitoring or end defrost located in return air

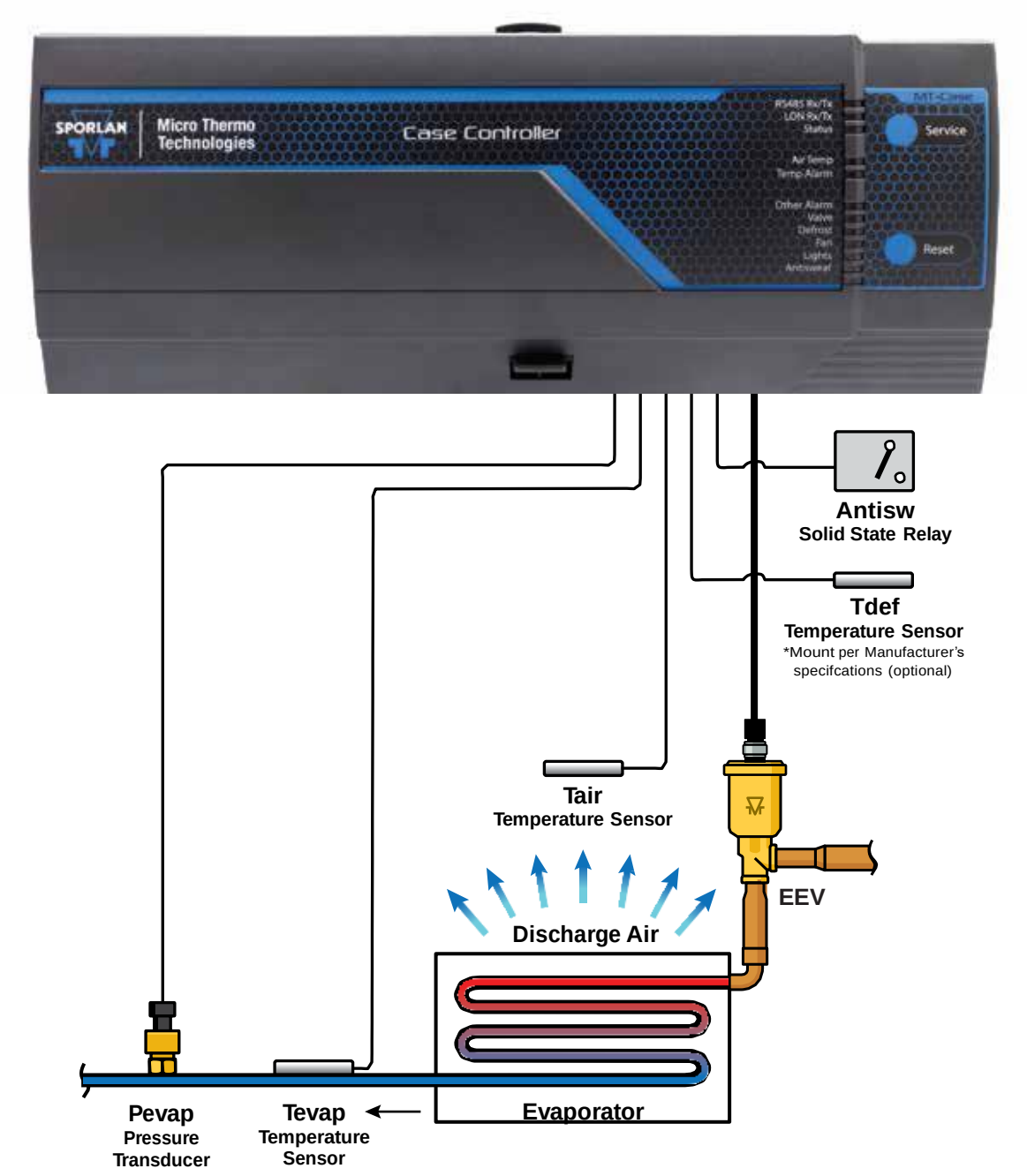
**Di1/Di2:** Configurable switches for following applications: Clean switch, Door Ajar & Dual Temperature Case. Type of switch: software, remote or local

**Antisw:** Pulse output to control external solid state relay for anti-sweat heater (SSR supplied by case manufacturer or when ordering 963-CC1A)

**Valve:** Stepper motor EEV

B: Example System Schematic

# Appendices




**NOT DRAWN TO SCALE.**
***For reference only. Some system components, such as piping and insulation, are not shown.**

# Appendices

## Sporlan Electric Expansion Valves Supported:

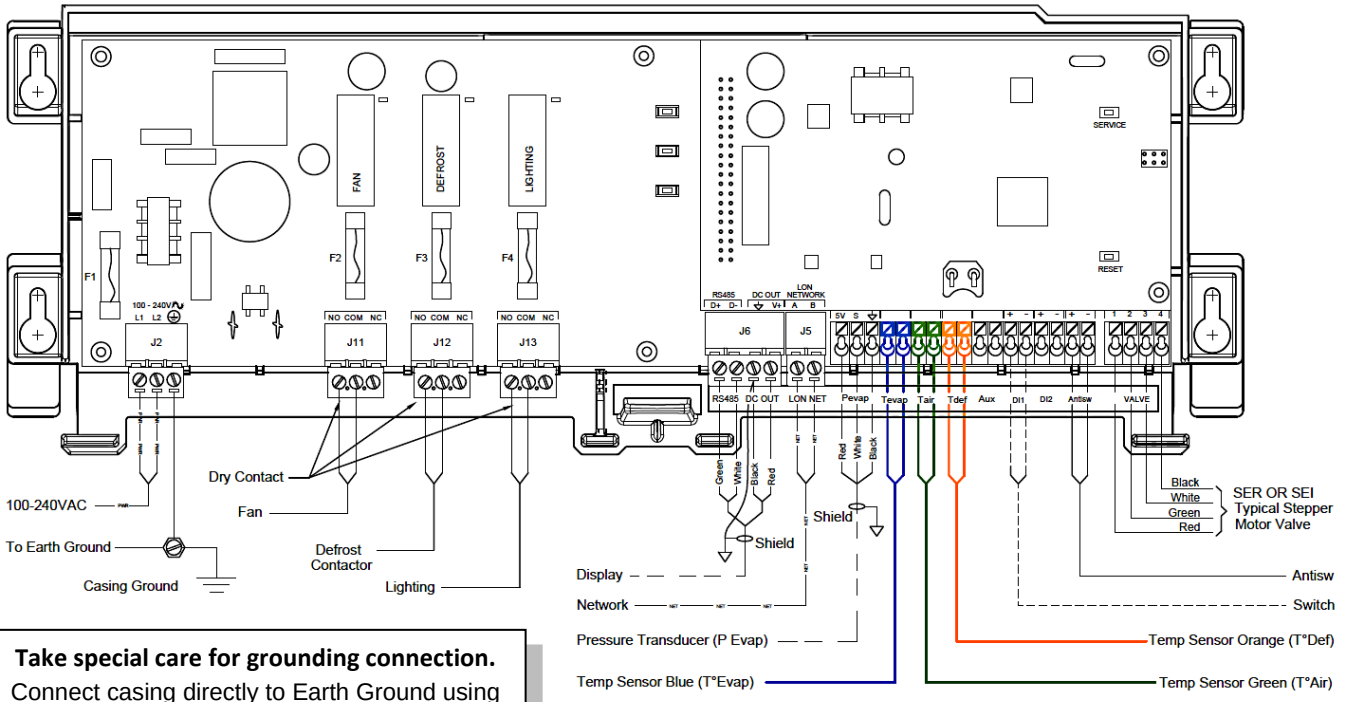
**SEI-0.5, -1, -2, -3.5, -6, -8.5, -11, -30**
**SER-1.5, -6, -11, -20**
**SER-AA, -A, -B, -C, -D**
**SERI-J**

## Accessories

| | Part No. | Description |
|---|---|---|
| **Temperature Sensors** | 023-0076 | Pipe Temperature Sensor Evaporator, 10K (Blue Lead) |
| | 023-0073 | Case Temperature Sensor Discharge Air, 10K (Green Lead) |
| | 023-0072 | Pipe Temperature Sensor Defrost Termination, 10K (Orange Lead) |
| **Pressure Transducers** | 952-0001 | Pressure Transducer for Refrigerant 100 psig, 5m Cable |
| | 952-0004 | Pressure Transducer for Refrigerant 200 psig, 5m Cable |
| | 952-0002 | Pressure Transducer for Refrigerant 500 psig, 5m Cable |
| | 952-0008 | Pressure Transducer for $CO_2$ 652 psig, 5m Cable |
| **Probe Accessories** | 252-0010 | Sensor Clip for Temperature Probe 3/8" Pipe |
| | 252-0011 | Sensor Clip for Temperature Probe 1/2" Pipe |
| | 252-0012 | Sensor Clip for Temperature Probe 5/8" Pipe |
| | 252-0013 | Sensor Clip for Temperature Probe 3/4" Pipe |
| | 252-0014 | Sensor Clip for Temperature Probe 7/8" Pipe |
| | 255-0007 | Thermowell, Stainless 1/2" NPT Connection, 12" |
| | 255-0008 | Thermowell, Stainless 1/2" NPT Connection, 6" |
| | 255-0009 | Thermowell, Stainless 1/2" NPT Connection, 2" |

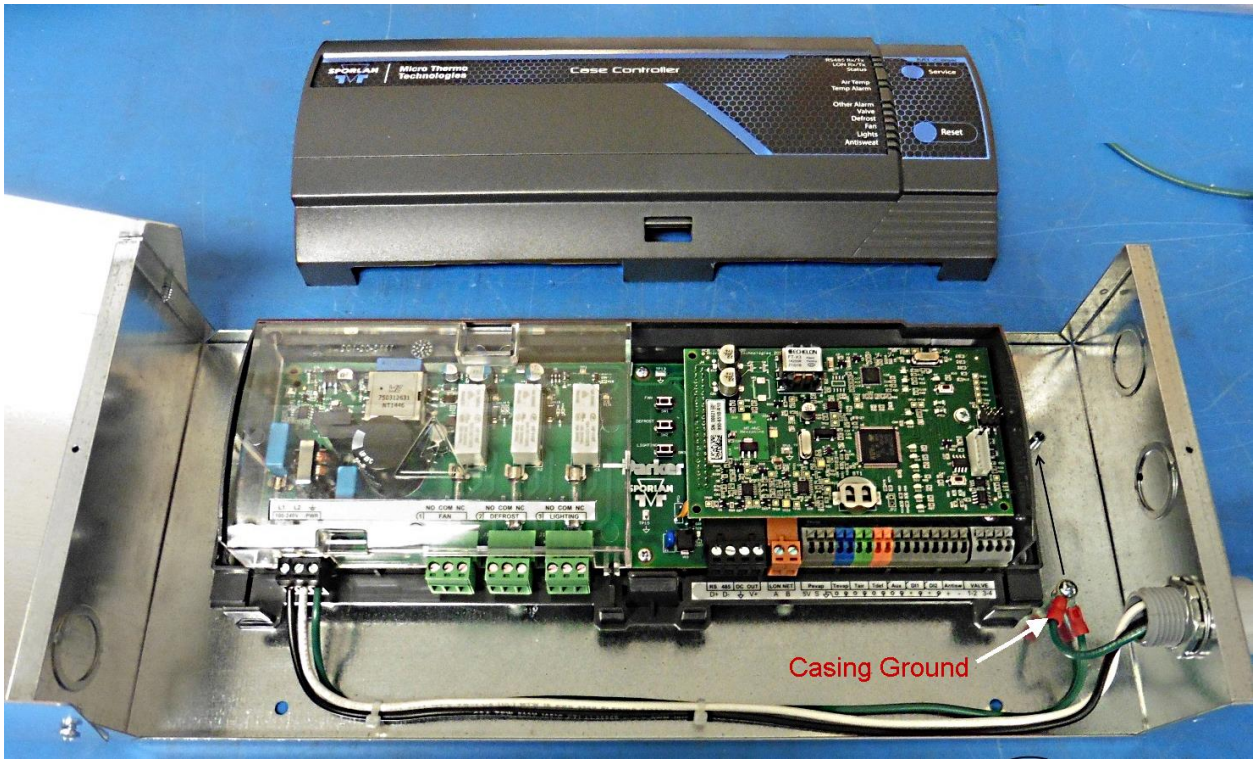
# Appendices

963-651C/D/E/F/G installation (Prefix 961-… does not include metal enclosure)



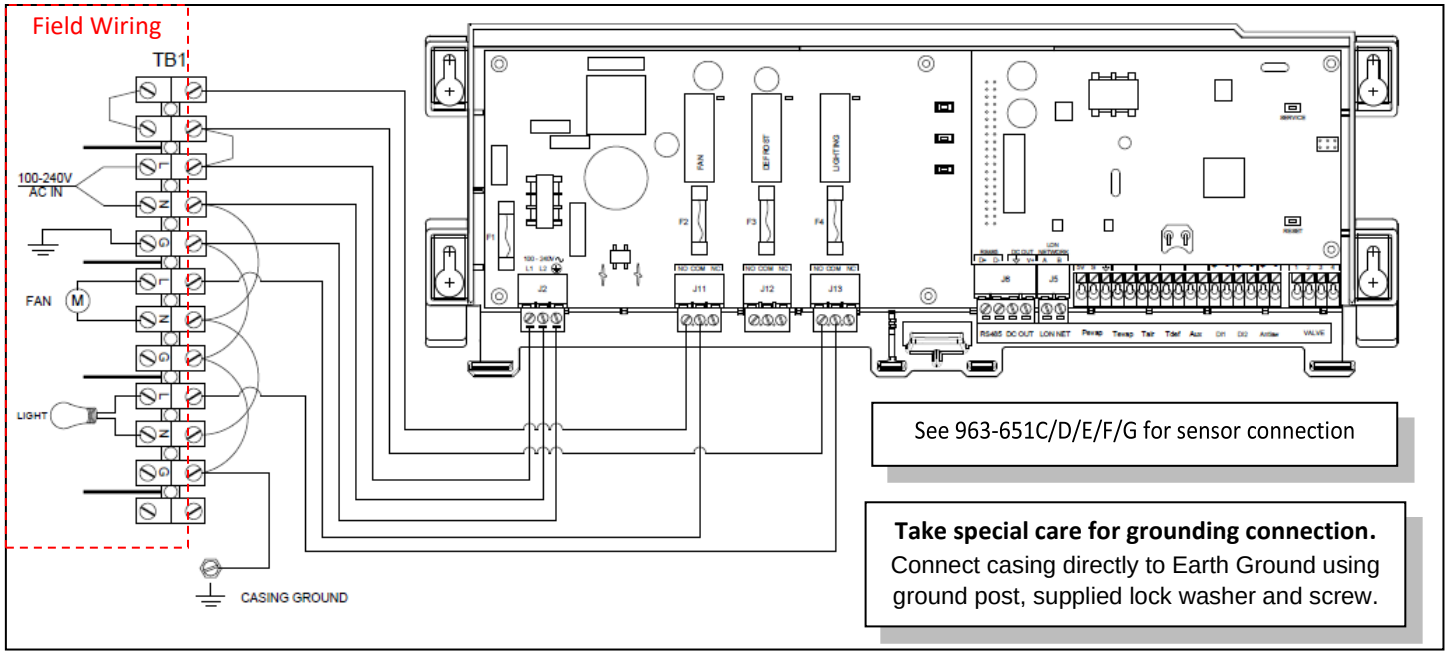

**Take special care for grounding connection.**
Connect casing directly to Earth Ground using ground post, supplied lock washer and screw.

Class 2 wiring section

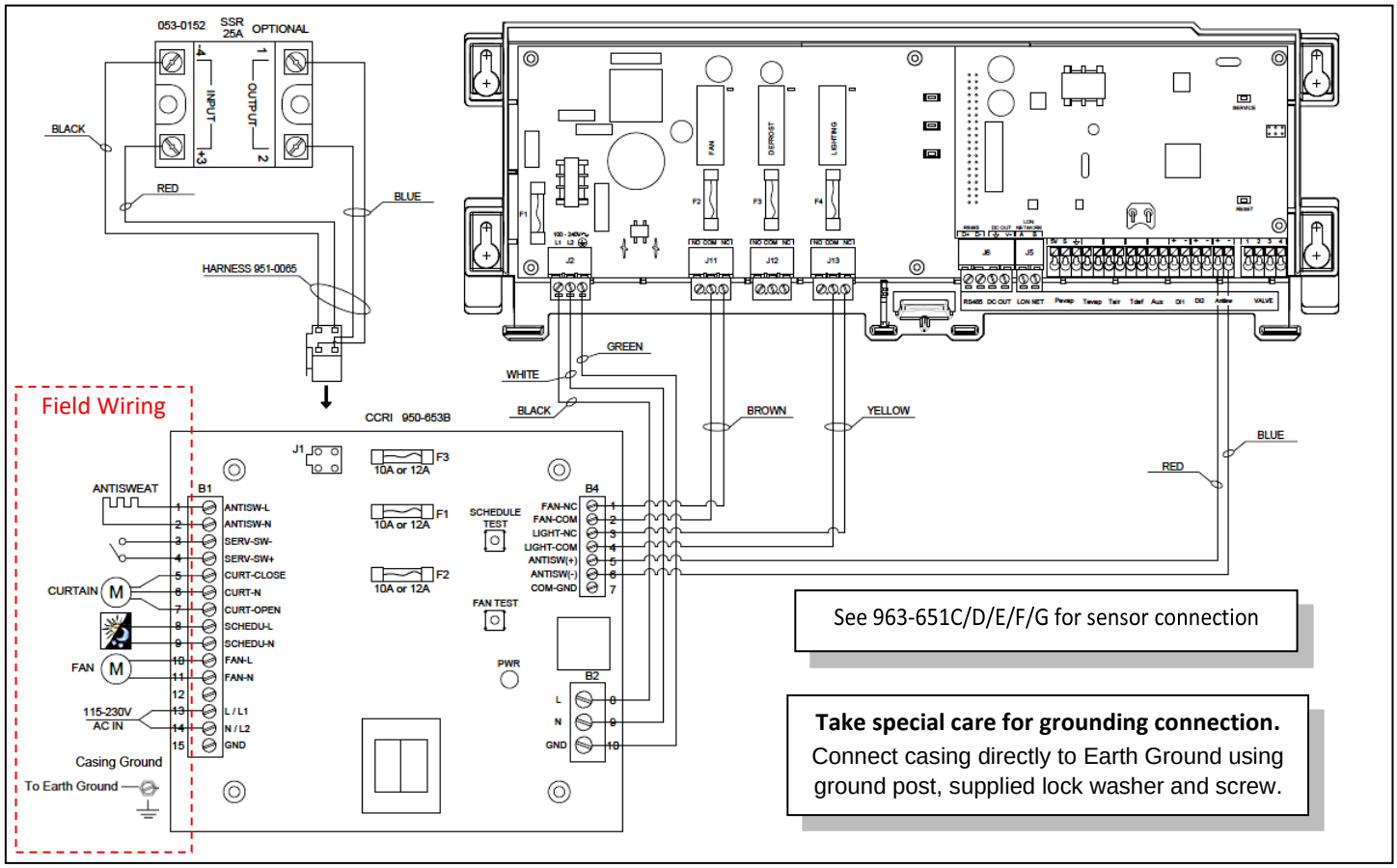


# 7

963-CC0R Installation




963-CC1A, 963-CC2R Installation



# 8

## Offer of Sale

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

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

**2. Price Adjustments; Payments.** Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which 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 placement of the products with the shipment carrier at Seller's facility. 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 acts or omissions.

**4. Warranty.** Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. 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 DESIGN, 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 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date 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 an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

**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. 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.

**8. 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, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items 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.

**9. 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.

**10. 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.

**11. 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.

**12. 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.

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

**14. Force Majeure.** Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

**15. 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.

**16. Termination.** Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

**17. 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.

**18. 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.

**19. 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 sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

**20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act.** Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

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