



Operations Manual For
LogiTemp® Plus Reverse Cycle Defrost Electronic Controller System
Included In SciPak™ Self-Contained Refrigeration Systems





Important Notices

- Read this manual before operating your LogiTemp® Plus system. **Keep the manual and refer to it before doing any service on the equipment.** Failure to do so may result in personal injury or waived warranty of damaged equipment.
- Modifications to existing equipment are subject to approval by Refrigerated Solutions Group (RSG) and must be explicitly written. There are no implied flexibilities designed for this product.
- Due to continuous product enhancements, RSG reserves the right to make engineering changes and change specifications for product improvement without notice.

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Introduction

Thank you for purchasing Norlake Scientific equipment. This manual contains important instructions for using the LogiTemp® Plus electronic controller system. Please read it carefully.



DANGER

Improper or faulty hook-up of electrical components in the refrigeration units can result in severe injury or death.

All electrical wiring hook-ups must be done in accordance with all applicable local, regional or national standards.



NOTICE

Installation and service of the refrigeration and electrical components must be performed by a refrigeration mechanic and/or a licensed electrician.

The portions of this manual covering refrigeration and electrical components contain technical instructions intended only for persons qualified to perform refrigeration and electrical work.

This manual cannot cover every installation, use or service situation. If you need additional information, call or write:

Refrigerated Solutions Group

891 County Road U

Hudson, WI 54016

800-477-5253 - Norlake Scientific Sales

800-388-5253 - Norlake Scientific Parts/Service

rsgservice@refsg.com

Warning Labels And Safety Instructions



This is the safety alert symbol. When you see this symbol, be alert to the potential for personal injury or damage to your equipment. Be sure you understand all safety messages and always follow recommended precautions and safe operating practices.



NOTICE TO EMPLOYERS

You must make sure that everyone who installs, uses or services your refrigeration is thoroughly familiar with all safety information and procedures.

Important safety information is presented in this section and throughout the manual. The following signal words are used in the warnings and safety messages:

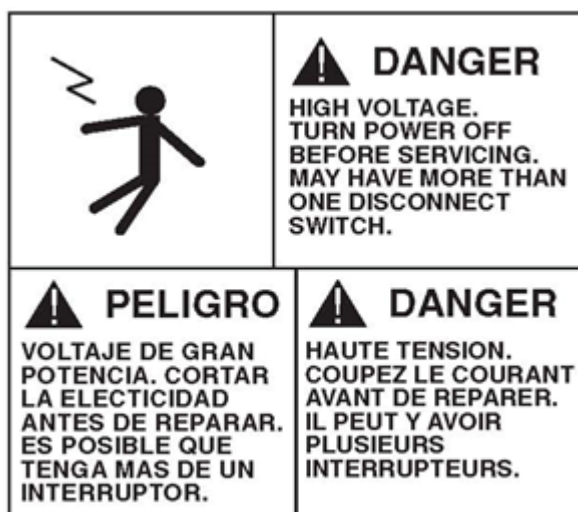
DANGER: Severe injury or death will occur if you ignore the message.

WARNING: Severe injury or death can occur if you ignore the message.

CAUTION: Minor injury or damage to your refrigeration system can occur if you ignore the message.

NOTICE: This is important installation, operation or service information. If you ignore the message, you may damage your refrigeration system.

The warning and safety labels shown throughout this manual are placed on your Refrigeration Solutions refrigeration system at the factory. Follow all warning label instructions. If any warning or safety labels become lost or damaged, call our customer service department at 800-684-8988 for replacements.



This label is on the housing of the refrigeration system typically located on the evaporator coil.

Applications

LogiTemp® Plus systems are designed to control SciPak™ refrigeration Systems for freezer and cooler applications. Each system contains a condensing unit, evaporator(s) with LogiTemp Plus control board(s), electric expansion valve(s), pressure transducers, temperature sensors, and reverse cycle valve.

Figure 1 below shows where the LogiTemp Plus controller is mounted on the system.



Figure 1: Location of the LogiTemp controller interface

LogiTemp® Plus Description

LogiTemp Plus is an OEM version of the custom-designed microprocessor-based electronic controller for RSG to control an electric expansion valve in response to evaporator superheat and return air temperature. The hardware and input/output descriptions and connections of a LogiTemp Plus are shown in figure 2 on page 8.

- **RSV or SER Terminals.** Ke2Therm RSV or Sporlan SER-type electric expansion valves are currently used for all applications. RSV has 500 nominal steps for the entire valve stroke and SER; has 1596 nominal steps for the entire valve stroke. The default is the RSV valve.
- **Pressure Transducer XDCR** is mounted at the evaporator suction header to measure saturated suction pressure in absolute value but displayed in gauge pressure in PSIG as “PrS”. The suction pressure is converted to saturation temperature displayed as “tSt”. The difference between suction outlet temperature and evaporating temperature is the true superheat displayed as “SUP”.
- **Suction Outlet/Fan Cut-In Temperature Sensor Tsuc** is mounted on the suction line about 6” to 10” away from the evaporator to measure outlet temperature during the cooling cycle and to serve as an evaporator fan cut-in temperature sensor. The sensor is at a 2 or 10 o’clock position on the suction line. The default value of the fan cut-in temperature is pre-set at 35°F for freezers and 55°F for coolers. It is displayed as “tSC”.
- **Room Temperature Sensor TAir** is typically mounted with a plastic tie at the drain pan on the side of the evaporator return air. It is located around the middle of the evaporator to allow even airflow across it. If necessary it can be relocated to a spot with better representation of the cold room temperature. It is displayed as “rtP”
- **Defrost Termination Temperature Sensor TCoil** is mounted downstream of the distributor tube after the valve and close enough to the evaporator coil to measure defrost termination temperature during defrost cycle. **Figure 2** on the next page shows the sensor locations of the evaporator and the controller. It is displayed as “tCL”.
- **One 30 Amp NO NC 277 vac Relay** is used for the compressor contractor or liquid line solenoid.
- **One 30 Amp NO 277 vac relay** is used to switch fans ON and OFF.
- **One 30 Amp NO 277 vac Relay** is used for a drain line heater.
- **0-10VDC Output** is used to drive an SSR relay for triggering a buzzer in the control panel indicating a local alarm inside the LogiTemp Plus controller.
- **One Ethernet Port** is used for connecting the edge manager (router) in the control panel to the LogiTemp Plus controller. This is used in unison with the iPad for an interface for the user to control the system.
- **Display Connection** is connected to a 3-Digit remote display and keypad.
- **RS485 (a+, B-, Shield) Terminals** are used to communicate with the remote display as well as auxiliary boards for extended applications.
- **Power Input 120 to 208/240 vac.**
- **Green, Yellow and Red LED Status Indicators.** The green LED will be on when the compressor relay is energized. The green LED will blink when the air temperature is satisfied, but the compressor minimum off timer has not yet timed out. The red LED indicates a critical alarm has occurred (Low-Pressure Alarm). The yellow LED indicates all other alarms.
- **Four Push Buttons on the remote display** are used to display set points and status as well as to reset operational parameters like room temperature, defrost mode, number of defrosts, etc. Their functions can also be performed by using the TCP/IP interface.

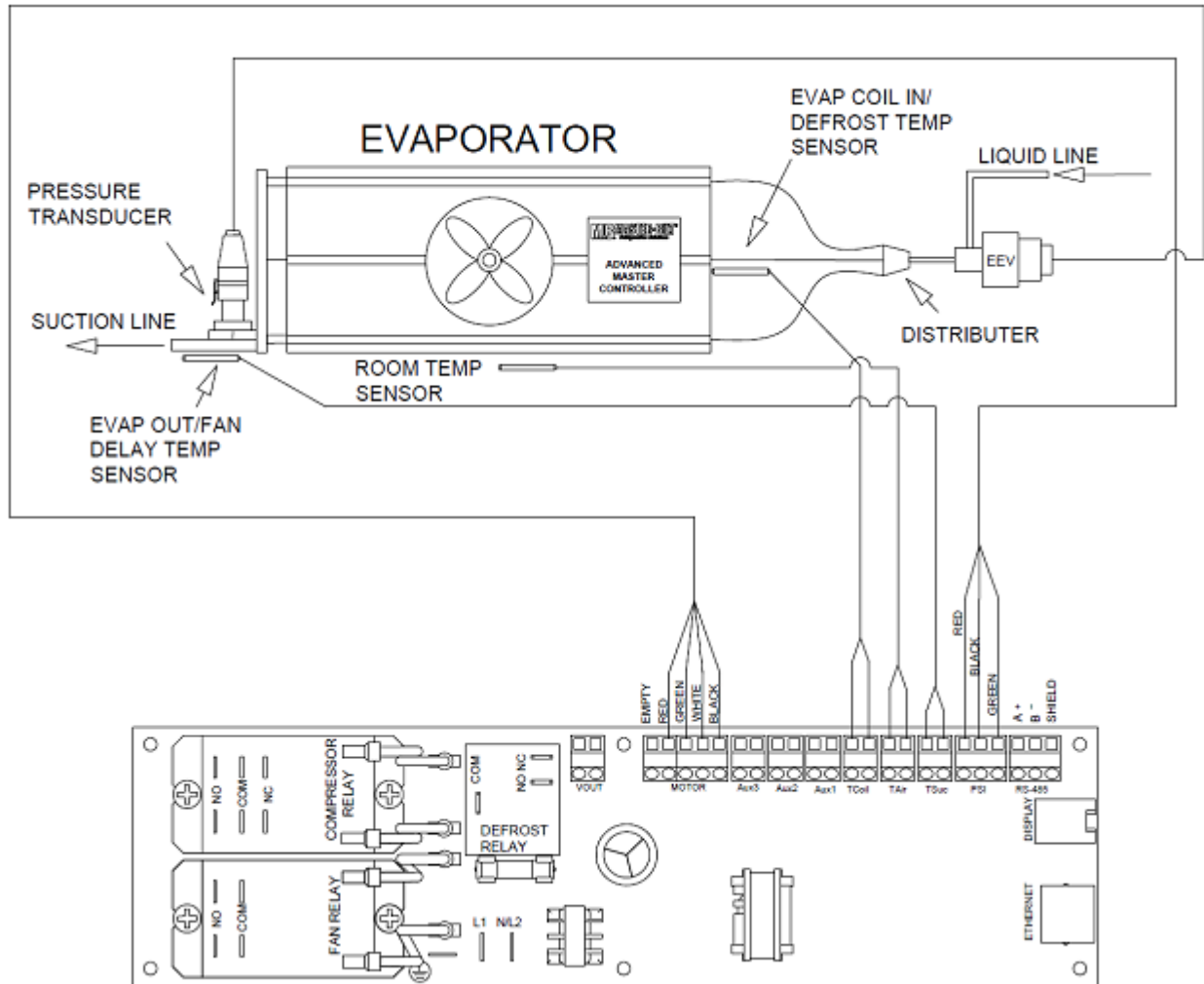


Figure 2: Hardware and input/output descriptions and connections

Factory-Mounted Parts

- A LogiTemp® Plus control board, an electric expansion valve, a pressure transducer, and three temperature sensors are pre-mounted at the factory. For a reverse cycle defrost system, a four-way reversing valve is mounted in the condensing unit. The defrost relay of a standalone or master evaporator controller is to provide power to the solenoid coil of the four-way reversing valve.
- An Edge Manager (router) is installed in the accompanying control panel so that the customer can easily access the home page and setpoints of the LogiTemp Plus controller.

LogiTemp® Plus Features

- The electric expansion valve replaces a thermal expansion valve. The refrigerant flow of the electric expansion valve is modulated by the true superheat, or the difference between the evaporator outlet and evaporating temperatures.
- The room temperature sensor replaces the conventional temperature control. The temperature is set with the push buttons on the LogiTemp Plus remote display or through its web page. The default temperature must be checked during the first startup of the machine against the actual application temperature. The default must be reset to the actual application temperature if there is a discrepancy.
- The onboard timer is used for runtime control and scheduling defrosts. No mechanical defrost timer is necessary for this system. Once the power is turned on, the timer starts counting.
- The LogiTemp Plus controller has the capability to perform scheduled defrost or demand defrost
 - When the scheduled defrost scheme is chosen, the onboard timer is used for scheduled defrosts. The system works in the same fashion as a regular conventional system with a mechanical defrost timer
 - When the demand defrost is chosen, the controller will not initiate a defrost unless it is needed. The low-temperature system is pre-set with demand defrost.
- The demand defrost scheme is a pioneering design by RSG for freezer applications. Extensive lab tests indicate that many unnecessary defrosts are eliminated and energy consumption reduced when using demand defrost compared to using a conventional refrigeration system equipped with a mechanical defrost timer.
- The operational status of modes, room temperature and alarms are displayed on the three-digit remote display.
- The patented reverse cycle defrost control (**United States Patent 7,073,344**) reduces defrost energy usage by up to 80% and decreases defrost time from 20-45 minutes (freezer equipped with electric heaters) to 3-5 minutes in a freezer or 1-1/2 – 2 minutes in a cooler with a completely clean defrost.

Sequences Of Operation

Start-Up

- When power is applied to the board, the controller closes the valve.
- The controller will display “bLt” for 3 seconds then will show ‘StU’ on its three-digit remote display for 3 seconds.
- It will then display ‘CFn’ on the three-digit display for 9 seconds.
- The evaporator fans will be on for the first 9 seconds allowing a service technician time to check them.
- The controller will then turn the fans off and check each sensor.
- The controller will check the pressure transducer for a short or open. It will display ‘CPr’ on the three-digit display for three seconds.
- If the sensor fails, the controller will display an alarm ‘PSA’ and go to safety mode for a failed sensor.
- If the sensor passes, it will display ‘oPr’ on the three-digit display for three seconds.
- The controller will check the sensor connected to ‘T_{SUC}’ for a short or an open. It will display ‘Ct1’ on the three-digit display for three seconds.
- If the sensor fails, the controller will display the alarm ‘SSA’ on the three-digit display and go to safety mode for a failed suction sensor.
- If the sensor passes, it will display ‘ot1’ on the three-digit display for three seconds.
- The controller will check the sensor connected to ‘T_{AIR}’ for a short or an open. It will display ‘Ct2’ on the three-digit display for three seconds.
- If the sensor fails, the controller will display the alarm ‘ASA’ on the three-digit display and go to safety mode for a failed air sensor.

- If the sensor passes, it will display 'ot2' on the three-digit display for three seconds. The controller will check the sensor connected to 'T_{coil}' for a short or an open. It will display 'Ct3' on the three-digit display for three seconds.
- If the sensor fails, it will display the alarm 'CSA' on the three-digit display and go to safety mode for a failed coil temperature sensor.
- If the sensor passes, it will display 'ot3' on the three-digit display for three seconds.
- If all sensors pass, the controller will display 'CFH' on the three-digit display for six seconds.
- The controller will not go into defrost during the preceding start-up procedure. It will check the number of defrosts per day (dPd) and timecoded (HOUR, MIN).
- If it is time for the controller to be in defrost, it will start in DEFROST mode. If not, the controller will start in COOL (rEF) mode after fan delay.
- The set points are stored in EEPROM (Electrically Erasable Programmable Read Only Memory). Batteries are not required to store the new set points. If power is lost, the set points which were in the controller at that time will be used when power is restored.

Off Mode (Off)

- The controller starts in OFF mode by fully closing the valve.
- The controller will keep the valve closed for the minimum OFF Time (Cot) to keep the compressor in pump down or off for a minimum amount of time.
- When room temperature reaches the cut-in set point (room temperature set point "tS" plus the temperature difference set point "Atd"), the controller goes to COOL mode (rEF).
- If a scheduled defrost scheme is selected, while the controller is in OFF mode, it is constantly checking the number of defrosts per day and the timecoded and calculating the time for defrost.
- When the timecoded is right for a defrost, it will immediately go into DEFROST mode (dEF) after the current OFF mode.
- If the demand defrost scheme is selected, defrost will be checked and initiated only during the COOL mode.
- After the Minimum OFF Time is timed out and the room temperature reaches the Cut-In temperature, the controller will go into COOL mode(rEF).
- While in OFF MODE, the three-digit display on Master will show 'OFF' for three seconds, 'rtP' for two seconds, and the numerical display of the room temperature for four seconds.

Cool Mode (rEF)

- The controller starts COOL mode by opening the valve.
- The condensing unit will start with a suction line low-pressure control cut-in.
- The electric expansion valve is modulated by the controller so that a preprogrammed superheat set point is maintained during the refrigeration process.
- Actual superheat is the temperature difference of the evaporator outlet (t_{SC}, T_{SUC}) and the evaporating temperature (t_{St}, T_{SAT}) converted from the reading of the pressure transducer, or T_{SUC}-T_{SAT}.
- The controller will keep modulating the valve so the superheat will equal the superheat set point.
- Meanwhile, the controller also reads the room air temperature rtP (T_{AIR}).
- When the room temperature is below the room temperature set point (pre-set to -10 oF for low temp), it goes back to OFF mode.
- All the time that the controller is in COOL mode rEF, it is constantly checking the criteria to determine if a defrost should be initiated. It will immediately go into DEFROST mode (dEF) when defrost criteria are met.
- If the suction pressure is above the maximum operating pressure set point (HoP), the valve will modulate to control the pressure at or below the maximum operating pressure set point (HoP).
- When the operating suction pressure is lower than HoP, it will go back to superheat control. Suction pressure is used to calculate saturated

Defrost Mode (dEF)

There are two methods of initiating a defrost with the LogiTemp® Plus controller: scheduled defrost and demand defrost. If the number of defrosts per day 'dPd' is set to 0, the controller will do the demand defrost by default. If the number of defrosts per day 'dPd' is set from 1 to 8, the controller will do the scheduled defrost.

1. Scheduled Defrost

The following is the description of the scheduled defrost.

Note: The time of day can only be set through the web pages

- The time-of-day is an elapsed counter that counts the number of minutes that have passed. An elapsed count of 0 is 12:00 AM.
- The count goes up to 1439 which corresponds to 11:59 PM.
- The counter then will reset to 0.
- The time of day will be kept if the input power is connected.
- If input power is turned off, then back on, time of day will be reset to 0 which corresponds to 12:00 AM.
- The first defrost start time is an elapsed time of 0 (12:00 AM).
- The subsequent defrost start times are determined by adding the number of minutes between each defrost to the previous start time until there is a defrost start time for each defrost per day.
- The number of minutes between each defrost is determined by taking $1440 / \text{number of defrosts per day}$ as set up by the 'dPd' set point.
- When starting an electric defrost, the FAN relay is de-energized to turn off the fans. The controller waits for five seconds, then the DEFROST relay is energized to start a defrost.
- **When starting a reverse cycle defrost**, the FAN relay is de-energized to turn off the fans while, at the same time, the COMPRESSOR relay is de-energized to turn off the compressor.
- There is a 10-second delay before the DEFROST relay is energized to switch the four-way reverse valve.
- Then there is a 30-second waiting period for pressure equalizing.
- Afterward, the COMPRESSOR relay is energized to turn the compressor.
- Hot gas will be reversed to flow to the evaporator while the electric expansion valve is modulated to start a defrost.
- The controllers use the coil sensor 'T_{COIL}' as the defrost termination sensor.
- When this temperature gets above the preprogrammed Defrost Termination Set Point (dtP) before the preprogrammed Maximum Defrost Time (dtL), the defrost will terminate. Otherwise, it will be terminated when the Maximum Defrost Time (dtL) times out.
- While in DEFROST MODE, the three-digit display will be 'dEF' for three seconds, 'dtt' for two seconds, and the numerical display of the temperature reading from sensor T_{COIL} for four seconds.

2. Demand Defrost

- When 'dPd' is set to '0', the controller will initiate a demand defrost.
- The controller will not go to 'DEFROST MODE' until a heavy frost accumulation is in the evaporator coil.
- When frost is built up in the evaporator, it will block the air flowing through the evaporator coil and reduce the heat transfer area.
- It will also decrease the evaporating temperature, which, in turn, increases the probability of frosting.
- A demand defrost scheme to detect the frost build-up and the criteria to start a defrost are programmed in LogiTemp® Plus.
- Unlike scheduled defrost, LogiTemp Plus with demand defrost is really an energy saver. If no selection is made, the controller will automatically select demand defrost when the power is applied to the controller.

- The defrost procedure is the same as described for the scheduled defrost.
- After selecting the demand defrost, if the elapsed time since the last defrost has been a selectable time (Int) from 8 hours (480) to 72 hours (4320), Maximum Defrost Interval, LogiTemp Plus will go into defrost to ensure a proper oil return.

Manual Defrost

The controller allows manually initiated defrost when needed. The manual defrost will be disabled if the evaporator inlet sensor detects a temperature higher than the defrost termination temperature. The operation of the manual defrost will be discussed in a later section.

Coil Drain Mode (Drn)

The controller automatically goes into COIL DRAIN whenever a defrost is terminated. The controller stays in this mode for the preprogrammed 'DRIP TIME'(drn). When this time is completed, the controller opens the expansion valve and goes into FAN DELAY mode (FdL). While in COIL DRAIN MODE, the three-digit display on the controller will show 'Drn' for three seconds, 'rtP' for two seconds, and the numerical display of the room temperature for four seconds.

Fan Delay Mode (FdL)

The controller will pull down the temperature of the evaporator without the fans on until one of the following occurs: The FAN DELAY TIME of five minutes times out or the fan cut-in sensor's temperature (Fdt) T_{SUC} goes below the FAN DELAY TEMPERATURE of 20°F on freezers or 35°F on coolers. The controller will then go into COOL mode (rEF). While in FAN DELAY MODE, the three-digit display will be 'FdL' for three seconds, 'Fdt' for two seconds, and the numerical display of the temperature reading from sensor T_{SUC} for four seconds.

Safety Mode

When an alarm occurs, such as a sensor failure or a communication alarm, the controller will go into 'SAFETY MODE'. SAFETY MODE provides minimum refrigeration to the refrigerated room before the corrective action is taken and the alarm is cleared. The system will do the following in Safety Mode:

- Pressure Transducer Alarm (PSA)
 - Cool Mode (rEF)
 - Valve open for the minimum compressor run time (Crt)
 - Valve closed for the minimum compressor off time (Cot)
 - Keep doing the above cycle until the alarm goes away
 - Ignores maximum pressure control mode
- Outlet Sensor Alarm (SSA)
 - Cool Mode (rEF)
 - Valve open for the min compressor run time (Crt)
 - Close the valve for the minimum compressor off time (Cot)
 - Keep doing the above cycle until the alarm goes away.
 - Fan Delay Mode (FdL)
 - Defrost Mode (dEF)
- Room Temp Sensor Alarm (ASA)
 - Cool Mode (rEF)
 - Valve open for the min compressor run time (Crt)
 - Close the valve for the minimum compressor off time (Cot)
 - Keep doing the above cycle until the alarm goes away.

- Defrost Term Temp Sensor Alarm (CSA)
 - Defrost Mode (dEF)
 - Use outlet sensor for defrost temperature termination
 - Open the valve until defrost terminates for reverse cycle defrost
 - Close the valve for electric defrost until defrost terminates
 - If this alarm and outlet temp sensor alarm, defrost will last only three minutes.
- Low Superheat Alarm (LSH)
 - Close the valve and wait for alarm to go away
- High Room Temperature Alarm(HtA)

The high room temperature alarm occurs when the room temperature is above the preprogrammed 'HIGH-TEMPERATURE ALARM' for a preprogrammed number of minutes. The alarm is cleared when the room temperature is less than the 'Room Temperature Setpoint + High temp Alarm Offset (Hao) set point'.
- Low Room Temperature (LtA)

The low room temperature alarm occurs when the room temperature is below the preprogrammed 'LOW-TEMPERATURE ALARM' for a preprogrammed number of minutes. The alarm is cleared when the room temperature is below the 'Room Temperature Setpoint – Low Temp Alarm Offset (LAo) set point'.
- Communication Alarm (COA)
 - For Alternating Mode, (ALt) go to standalone mode.
 - For Synchronous Mode, (SYC)
 - Cool Mode (rEF)
 - Run on superheat control for the minimum compressor run time
 - Close the valve for the minimum compressor off time
 - Keep doing above cycle until alarm goes away.
- Pumpdown Mode (Pdt)
 - Wait until pump downtime times out.
- Drip Mode (Drn)
 - Wait until Drip time times out.
- Defrost Mode (dEF)
 - Valve will close when defrost termination temperature meets its set point if reverse cycle defrost. The valve will close at all time if the electric defrost. It will then wait until the full defrost time for other evaporators to defrost.
 - If in demand defrost mode, defaults to three defrosts per day.

Definition Of Onboard Symbols

Status, Default And Reading Display

When the onboard green light is on, the compressor relay is energized. When the green light is blinking, the room temperature sensor is satisfied, but waiting for the minimum off time or minimum run time to time out. When the red light is on, there is a critical alarm. When the yellow light is on, there is a non-critical alarm.

The status and the digital data are displayed on the onboard three-digit LED display. Below is a list of the parameters of the operational status.

Onboard 3-Digit Display	Description
bLt	LogiTemp® Plus
StU	Indicates the status of Start Up Mode CFn Check fan working status
CPr	Check pressure transducer
oPr	Indicates the pressure transducer is working as it should

Onboard 3-Digit Display	Description
Ct1	Check sensor T _{SUC} , the suction temperature sensor
ot1	Indicates the T _{SUC} is working as it should
Ct2	Check sensor T _{AIR} , the room temperature sensor
Ct3	Check sensor T _{COIL} , the coil temperature sensor
ot3	Indicates the T _{COIL} is working
CFH	Indicates all sensors are OK
FdL	Indicates FAN DELAY MODE
Fdt	Actual T _{SUC} value F in FAN DELAY
rEF	Indicates REFR (COOL) MODE
rtP	Room temp value in F
OFF	Indicates OFF MODE
Pdt	Indicates PUMPDOWN MODE before electric defrost
Drn	Indicates COIL DRAIN MODE
dtT	Inlet sensor T _{COIL} value in DEFROST MODE
SoF	System OFF mode
LAG	Lag mode: Alternating or Lead Lag mode

A list of the parameters that can be displayed and/or changed is shown below when access to the default settings is needed. **Changes are usually made by a trained technician.**

The following symbols are for viewing the status of the refrigeration system and cannot be changed.

Control Board Output	
rtP	Room or air temp connected to blue connector labeled 'TAIR' (-60°F to 150°F)
SUP	Actual Superheat in rEF (COOL) MODE
PrS	Suction Pressure connected to gray connector labeled G B R for green, black, red leads (-14 psig to 140 psig)
tSC	Suction Outlet Temperature Sensor connected to 2 pin black connector labeled 'TSUC'
tSt	Saturated Suction Temperature calculated from Suction Pressure PrS
tCL	Coil/defrost Temperature connected to yellow connector labeled 'TCOIL'
oPn	Percentage the EEV is open (0-99%)
StA	Status of the controller: rEF for cool mode, OFF for off mode, dEF for defrost mode, Drn for drain mode, FdL for fan delay mode, LAG for lag mode and SoF for system off mode
rCo	Compressor relay status: On if relay is energized, OFF if relay is de-energized
rdF	Defrost relay status: On if relay is energized, OFF if relay is de-energized
rFn	Fan relay status: On if relay is energized, OFF if relay is de-energized
AU1	Aux input 1's status (see below for more details) connected to green connector labeled 'AUX1'
AU2	Aux input 2's status (see below for more details) connected to black connector labeled 'AUX2'
AU3	Aux input 3's status (see below for more details) connected to black connector labeled 'AUX3'
iP1	first octet of ip address
iP2	second octet of ip address
iP3	third octet of ip address
iP4	fourth octet of ip address
Fir	firmware version

The following are manual modes of the controller and may be changed for diagnostic purposes:

Control Board Output	
UCt	Manually change the control mode of the controller: Go from cool or off mode to defrost mode, from defrost mode to
UOE	Manually open the EEV a percentage(0-99%)
CLA	Manually clear the alarms
bnd	When controller needs to communicate with other controllers, this mode will 'bond' the controllers to communicate with each other

These parameter values of the controller may be changed to customize the refrigeration system:

Control Board Output	
rFG	Refrigerant Type (If rFG = 449, then R-449A refrigerant, If rFG = 404, then R-404A refrigerant)
SSP	Superheat Set Point seen at the evaporator (5°F to 20°F)
tS	Room Temperature Set Point or "cut-out" (-40°F to 75°F range)
Atd	Cut-in Temperature Differential (0°F to 25°F)
COt	Minimum Time the EEV is closed, or minimum off time (0 to 15 minutes)
Crt	Minimum Time the EEV is open, or minimum run time (0 to 15 minutes)
LoP	Minimum Suction Pressure Set Point (-14.6 psi to 100.0 psig)
HoP	Maximum Suction Pressure Set Point (10.0 to 150 psig)
dPd	Number of Defrost/Day. When dPd=0, demand defrost, when dPd = 1 to 8, scheduled defrost
dtY	Defrost Mode (If dtY = ELE, then electric or air, If dtY = rCd, then reverse cycle)
Int	Only applicable when in the demand defrost scheme and tS <=35°F, this Set Point designates the time between a safety defrost. Example; if Int = 480, then a defrost will occur every 8 hrs (480/60).
Pdt	Pump Down Timeout duration (0-90 minutes). Only applicable to elec. and air defrost schemes
dtP	Defrost Termination Temperature (35°F to 90°F)
dtL	Maximum Defrost Duration (0 to 90 minutes)
drn	Drip Time Duration (0 to 15 minutes)
bnt	Multiple Evaporator Mode, ALt = Alternating mode, SYC = Peer to Peer synchronous Mode
Ato	If in alternating mode, this value indicates the number of degrees above the cut-in Set Point (tS + Atd + Ato) at which both controllers are overridden and both go into COOL MODE.
HAo	High Temperature Alarm Offset (0°F to 99.0°F)
LAd	Temperature Alarm Delay (0 to 120 minutes)
L Ao	Low Temperature Alarm Offset (0°F to 20°F)

Alarm Display

Any alarm will cause the analog output voltage (across CN1) to switch. 10 VDC output corresponds to no alarms. 0 VDC corresponds to any alarm set. The 10VDC is wired to power an external alarm relay (SSR in the Cap Pak).

All alarms have a distinct display shown on the three-digit display on the controller. The red LED will be on for a pressure or suction temperature sensor alarm and the amber LED will on for all other alarms. Multiple alarms can exist. On the following page is the list of the alarm acronyms.

Remote 3-Digit Display

Description

PSA	pressure sensor alarm
SSA	Suction Temp sensor alarm
ASA	Air Temp sensor alarm
CSA	coil sensor alarm
LSH	low superheat alarm
HtA	high air temperature alarm
LtA	low air temperature alarm
LPA	low suction pressure alarm

Remote 3-Digit Display	Description
Dor	Door open alarm
COA	Comm alarm with other controllers
EA1	External Alarm 1
EA2	External Alarm 2
EA3	External Alarm 3
EFL	Email failure alarm (email not sent)
A1A	Aux Input 1 Temp sensor alarm
A2A	Aux Input 2 Temp sensor alarm
A3A	Aux Input 3 Temp sensor alarm
FrA	flash memory read/write failure
CCA	Comm alarm with comp sequencer

Setting Up Parameters By Onboard Push Buttons

There are two levels for programming the controllers with the three-digit display and four pushbuttons. The first level (User's Level) will enable the USER to set the room temperature set point 'tS', the refrigerant set point 'rFG', and the defrost type set point 'dtY'; the second level (Technician's Level) allows access to the other parameters as described above.

User's Level

- Press and hold the 'ENTER' button until the display reads 'tS' (about 3 seconds).
- Use the 'up arrow' and 'down arrow' buttons to scroll between room temperature set point 'tS', refrigerant set point 'rFG', defrost type set point 'dtY', and password 'PAS' to enter the 'TECHNICIAN LEVEL'.
- Press the 'enter button' to view the value of the selected set point.
- Use the up and down buttons to change the value.
- Press the 'enter button' to change the blinking digit.
- When the desired value is displayed, press and hold the 'ENTER' button until the name of the set point is displayed (about 3 seconds).
- At any time, pressing the 'BACK' button will escape to the step before.

Technician's Level

- Press and hold the 'ENTER' button until the display reads 'tS' (about 3 seconds).
- Use the 'up arrow' and 'down arrow' buttons to scroll to 'PAS'.
- Press the 'enter button' and '000' is displayed with the one's digit blinking.
- Press the 'up arrow button' until the display reads '002'.
- Press and hold the 'ENTER' button (about 3 seconds) until a set point is displayed.
- Use the up and down buttons to get to the set point that is wanted. Press 'enter button' to view the value of the selected set point.
- Use the up and down buttons to change the value.
- Press the 'enter button' to change the blinking digit.
- When the desired value is displayed, press and hold the 'ENTER' button until the name of the set point is displayed (about 3 seconds).
- At any time, pressing the 'BACK' button will escape to the step before.

Manual Valve

- Press and hold the 'down arrow button' until the display reads a number. This is the valve open percentage.
- The tenths digit will be blinking.
- Press the 'enter button' to change the blinking digit
- Use the up and down buttons to increase or decrease the percentage open.
- At any time, pressing the 'BACK' button will escape manual valve mode and go back to auto mode.
- If no buttons are pressed for 1 hour, the controller will go back to auto mode.

Clear Alarm

- Press and hold the 'ENTER' button until the display reads 'tS ' (about 3 seconds).
- Use the 'up arrow' and 'down arrow' buttons to scroll to 'PAS'.
- Press the 'enter button' and '000' is displayed with the one's digit blinking.
- Press the 'up arrow button' until the display reads '002'.
- Press and hold the 'ENTER' button (about 3 seconds) until a set point is displayed.
- Use the 'up arrow button' or 'down arrow button' until display reads 'CLA'.
- Press and hold the 'enter button' until the red led flashes (about 3 secs)

Manual Defrost

- Press and hold the 'enter button' and the 'down arrow button' until the display flashes (about 3 seconds).
- If the controller was in 'rEF' or 'OFF', it will go to 'DEF'. If the controller was in 'DEF', it will go to 'drn'.
- If the controller was in 'drn', it will go to 'Fnd'. If the controller was in 'Fnd', it will go to 'rEF'.

Temperature Sensors

The application range of the temperature sensors used for this controller is -60 F to +150 F. If the sensor detects a temperature out of the range, an alarm will show on the controller display.

Three temperature sensors are used in the LogiTemp® Plus refrigeration system:

- The room temperature return air sensor
- The evaporator defrost termination temperature surface sensor
- The evaporator outlet (suction line) temperature surface sensor.

All sensors are solid-state devices with the same characteristics that change electrical resistance in response to a change in temperature.

The room temperature sensor is factory-mounted on the inner cowl wall in the evaporator inlet air. This placement avoids heat from defrost heaters and lights and still allows a good air stream over the sensor.

The defrost termination sensor is mounted in the evaporator coil.

The outlet sensor is mounted on the suction line at the outlet of the evaporator. These can be seen in Figure 3 on the next page. The second sensor shows the room air temperature sensor location.

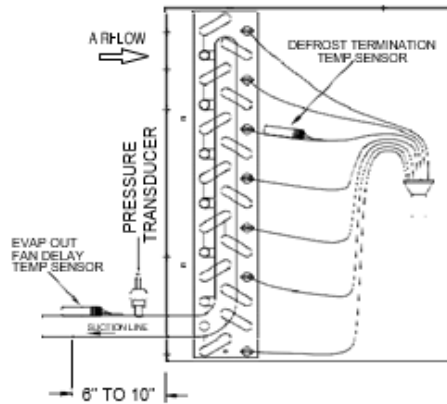


Figure 3: Sensor Locations

Sensor Service Instructions

The temperature sensor cannot be repaired. Using the measurements in Char A on the next page, you can determine if they are functioning correctly. If the sensors are found out of tolerance, they should be replaced.

As mentioned above, the temperature sensor changes electrical resistance in response to temperature changes. Disconnect the sensor from the controller, check the temperature at the sensor location, then check and record the resistance through the temperature sensor.

Procedures to check temperature sensor tolerance with ice water:

- 1) Use a cup of water with well-stirred ice. The water should be distilled and at an even 32 F.
- 2) Submerge the room temperature sensor (T_{AIR}) into the water while the LogiTemp® Plus controller is normally operating. Check the display for the value. If the sensor shows 32°F, it is working properly.
- 3) Press the up or down buttons until the display shows the name of one of the variables. When the display shows $tSC(T_{SUC})$, which is the suction temperature, press the “ENTER” button to show the digit value. Submerge the sensor into the water. Check the display for the value. If the sensor shows 32°F, it is working properly.
- 4) Press the down button until the display shows tCL , which is the coil temperature T_{COIL} , press the “ENTER” button to show the digit value. Submerge the sensor into the water. Check the display for the value. If the sensor shows 32°F, it is working properly.

Compare the temperature and resistance in Chart A on the next page.

Chart A. Temperature/Resistance Characteristics (-50 to 80 F)

Temp. °F	Temp. °C	ohms*1k		Temp. °F	Temp. °C	ohms*1k
-50	-45.6	43.45		15	-9.4	7.579
-40	-40.0	32.31		20	-6.7	6.731
-35	-37.2	27.96		25	-3.9	5.993
-30	-34.4	24.27		30	-1.1	5.349
-25	-31.7	21.13		32	0	5.123
-20	-28.9	18.43		35	1.7	4.781
-15	-26.1	16.12		40	4.4	4.281
-10	-23.3	14.13		50	10.0	3.454
-5	-20.6	12.42		60	15.6	2.805
0	-17.8	10.94		70	21.1	2.294
5	-15.0	9.651		80	26.7	1.888
10	-12.2	8.544				

NOTE: Use resistance at 32°F for sensor checking.

Pressure Transducer

The LogiTemp® Plus controller is equipped with one of two types of pressure transducer (PT). The difference is in the color of the sensor wires as noted below:

Remove the transducers while the vacuum and charge take place.

New PT (19-14226, 19-14223)	OLD PT (19-13955, 19-14092)	Description
RED (R)	BLACK	+VDC (+5)
BLACK (B)	GREEN	GROUND (5-)
GREEN (G)	WHITE	SIGNAL (sig)

The GROUND is connected to terminal '5-' on the board. The SIGNAL lead is connected to terminal 'sig' on the board. The +VDC lead is connected to terminal '5+' on the board. Chart B shows the characteristics of the pressure transducer.

NOTE: The pressure transducer cannot be repaired but replaced only.

Chart B. Pressure Sensor Simulation Values (0 to 150 PSIA)

Bar	PSIA	PSIG	V (Signal to Ground)
0	0	-14.6	0.509
0.69	10	-4.6	0.784
1.379	20	5.4	1.058
2.069	30	15.4	1.332
2.758	40	25.4	1.587
3.448	50	35.4	1.862
4.137	60	45.4	2.136
4.827	70	55.4	2.391
5.516	80	65.4	2.665
6.206	90	75.4	2.920
6.895	100	85.4	3.194
7.585	110	95.4	3.469
8.274	120	105.4	3.724

Technical Notes

- An optional alarm relay (10VDC Coil) can be connected to terminals (+,-) of CN1. When the relay is energized, there's no alarm. The alarm does not indicate what causes the alarm. To find out what has caused the alarm, check the onboard three-digit display for alarm codes and refer to the diagnosis chart for corrective action.
- Defrost termination set point (dtP) can also be set up to 80oF. When setting the defrost termination temperature, make sure that the frost is free after each defrost. Also adjust the maximum defrost duration when necessary.
- Always clear the "LSH", "HtA" and "LtA" alarms after corrective action is taken. The sensor and communication alarms cannot be cleared unless they are corrected.
- Cat5/E communication cable should be rated 300 V 80oC or higher. If the wire is rated lower than 300 V, a separate conduit must be used for communication cables.

Reverse Cycle Defrost

General Information

RSG's patented (U.S. patent no. 7,073,344) reverse cycle defrost is a standard feature on LogiTemp® Plus-equipped refrigeration systems. A reverse cycle valve is already factory-installed on the condensing unit. The valve's primary function is to reverse the direction of the refrigerant flow during defrosting. When the LogiTemp Plus demand defrost determines that a defrost is necessary, the reverse cycle valve is activated, and the high-temperature refrigerant flow is reversed.

Under the normal refrigeration cycle, the refrigerant flow is the same as in traditional refrigeration modes. During the defrost mode, the refrigerant flow is reversed back through the evaporator coil heating it from the inside out along its entire length and eliminating frost buildup. See figure 4 below.

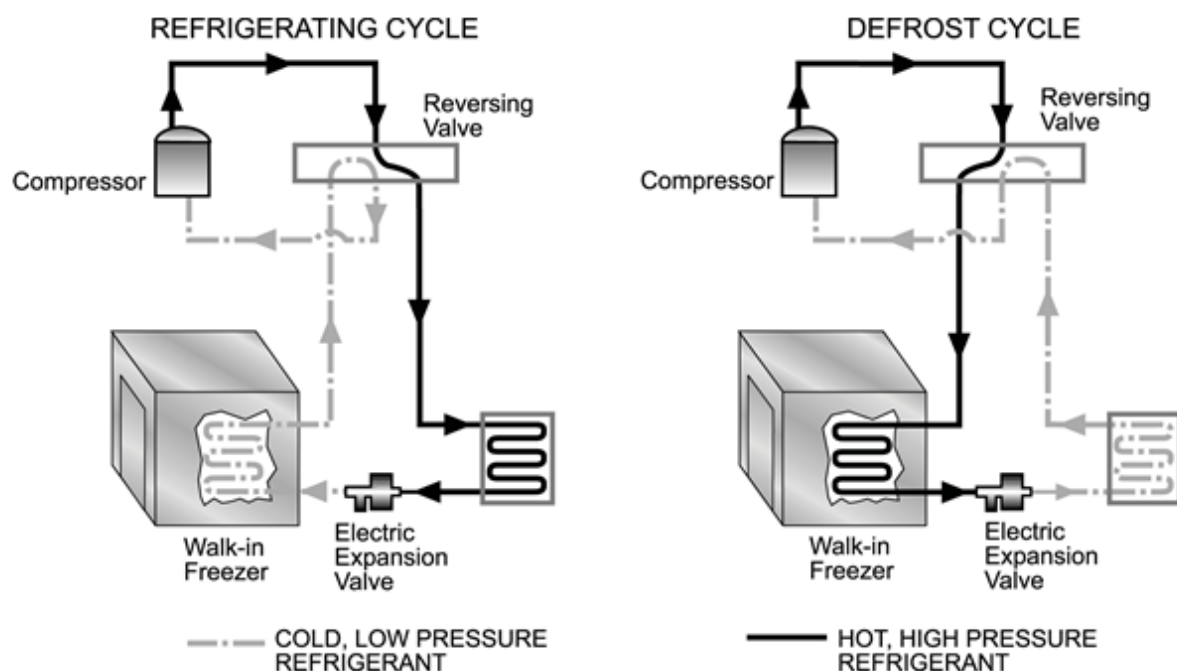


Figure 4: Reverse Cycle Defrost

Advantages

Reverse cycle technology offers several significant advantages:

- An up to 80% reduction in defrost energy usage. This savings, coupled with that from the demand defrost feature, dramatically reduces energy consumption.
- Eliminates many mechanical parts
- Reduces cost of evaporator, installation, and wiring
- Reduces defrost time
- No significant increase in freezer room temperature
- No noticeable increase in product temperature

Factory-Installed Parts

A 4-way reversing valve is installed.

Eliminated Parts

The Reverse cycle's unique technology, coupled with the bi-flow electric expansion valve and drier, eliminates:

- Defrost coil heaters
- Check valves and expansion valves at the condenser that are normally necessary for traditional hot gas defrost systems, although the 7.5 hp still uses check valve bypass loops
- Bypass valves
- Liquid line solenoid valves
- Receiver tanks

Defrost Time

Defrost time is greatly lessened with the reverse cycle option. The average time using electric defrost heaters is 20-30 minutes, but reverse cycle performs a completely "clean" defrost typically in 3 – 5 minutes for freezers and 1-1/2 – 2 minutes for coolers.

Because the defrost is so rapid, there is no noticeable increase in freezer room temperature and the product temperature rise is also significantly less.

Reverse cycle defrosts, combined with demand defrost, assures the evaporator receives the number of complete defrosts needed at the necessary times to prevent iced evaporators while assuring the protection of the valued product being stored.

Electrical And Wiring



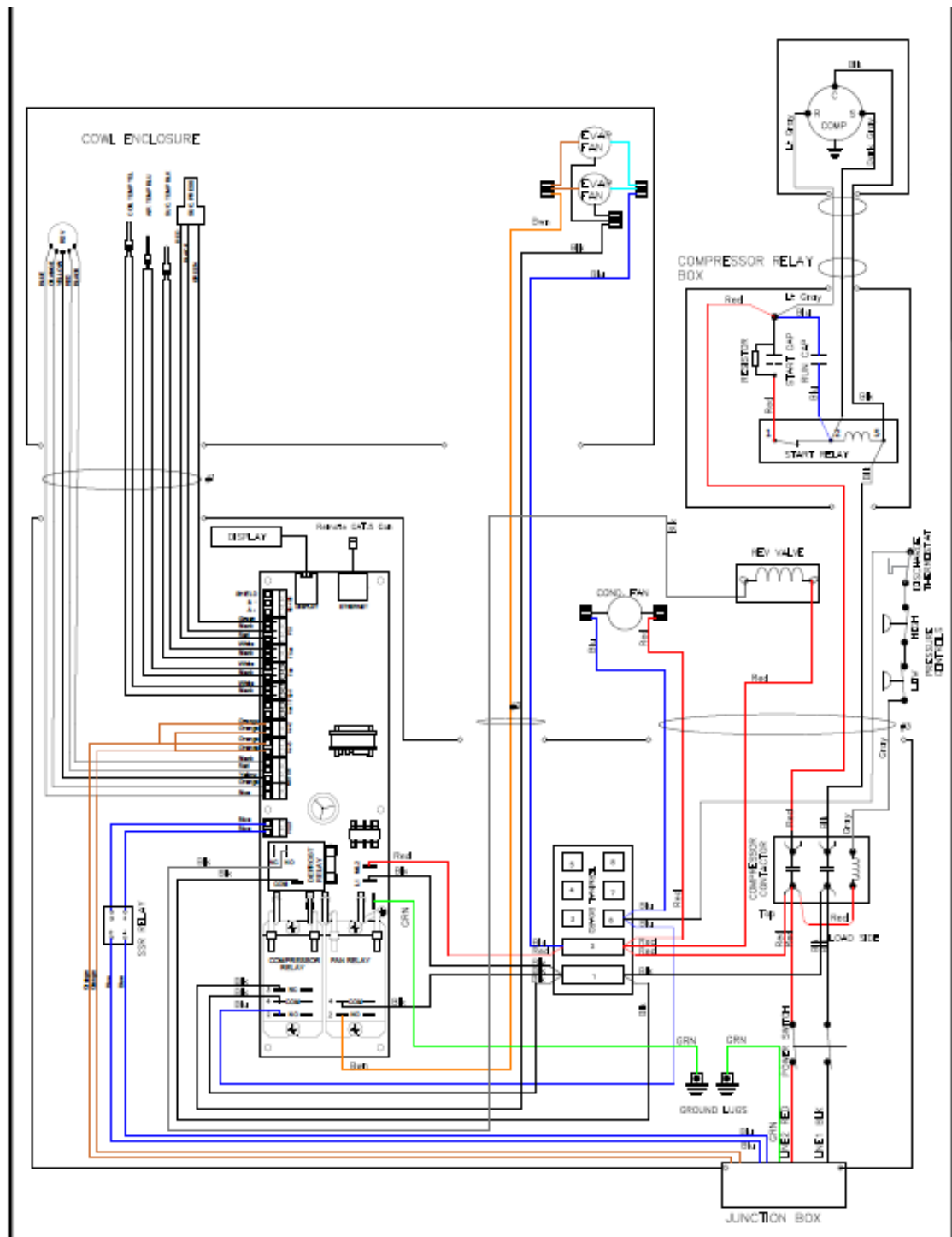
WARNING

Please make sure to turn all power off before servicing electrical equipment. Always use a qualified and trained technician. If you are a technician and a first-time installer of a LogiTemp® Plus system, call our service department at 800-684-8988 for free training and support.

Wiring Diagrams

The wiring diagrams included in the next section are for reference. Note: For feature-specific configuration, please refer to the wiring diagram in the actual system for installation.

SciPak™ Medium Temp Refrigeration System (230V)



The diagram illustrates the electrical system for a cooling unit, showing the following components and connections:

- Power Source:** A 12V battery connected to a junction box.
- 12V Relay:** Controls the main power line to the compressor relay box.
- Compressor Relay Box:** Contains a heater valve, liquid inlet solenoid valve, and a compressor contactor.
- Condenser Fan:** Connected to the relay box.
- Pressure Thermostat:** Controls the compressor contactor.
- Control Panel:** Includes a display, buttons, and a 'TO TPA' connection.
- Wiring:** Color-coded wires (Red, Blue, Green, Black) connect the components.
- Labels:** 'COOL ENCLOSURE' and 'JUNCTION BOX' are present.

Typical Set Points For The LogiTemp® Plus Controller

Setting	Definition	Reverse Cycle Defrost	
		Low Temp	High Temp
tS	Setpoint	-10	35
rFG	Refrigerant	449	449
dtY	Defrost Type	rCd	rCd
Edt	Valve Type	rS	rS
SSP	Superheat S.P.	10	10
HoP	Max Suction	150	150
LoP	Min Suction	0	0
LPP	Min Valve Def.	20%	20%
HPP	Max Calve Def.	75%	75%
FoT	Fan on Temp	35	55
Ctd	Coil Temp Diff.	10	10
LLt	Time Lead/Lag	0	0
Ato	Alt Temp Diff.	5	5
Crt	Min Run Time	2	2
Cot	Min Off Time	2	2
Cyr	Refrig, Fan Mode	PEr	PEr
din	Defrost Initiate T.	SCH	SCH
dPd	Defrost Per Day	4	2
Int	Max Interval Def.	360	720
dFS	Defrost Fan State	oFF	oFF
dtP	Defrost Term T.	50	50
dtL	Max Defrost Time	10	10
drn	Drain Time	5	0
Cyd	Defrost Heat Mode	Prm	Prm
Fdt	Fan Cut-in Temp	20	35
Fnt	Max Fan Delay	5	5
Pdt	Pumpdown Time	12	2
bnt	Bond Type	SyC	SyC
HAo	High Temp Offset	10	10
LAo	Low Temp Offset	10	10
LAd	Temp Alarm Delay	45	45
drd	Door Open Alarm	30	30
AU1	Aux 1	diS	diS
A1A	Aux 1 State	CLo	CLo
AU2	Aux 2	diS	SoF
A2A	Aux 2 State	CLo	CLo
AU3	Aux 3	diS	SoF
A3A	Aux 3 State	CLo	CLo
tS2	2nd Room T.	-5	40
Atd	Air Tep Diff.	5	3
CLA	Clear Alarms	-	-
bnd	Bonding	-	-
SA	Smart Acess	diS	diS
dHC	Client Mode	diS	diS

Troubleshooting Guide

Use the alarm display with the chart below to check the causes of each error message.

Trouble, Alarm Codes	Causes	Corrective Actions
Pressure transducer alarm PSA	<ul style="list-style-type: none"> • Bad transducer • Out of range • Loose wire • Wrong hook-up 	<ul style="list-style-type: none"> • Replace the pressure transducer • Turn off power for a few seconds, turn back on • Wire correctly
Suction temp sensor TSUC alarm SSA	<ul style="list-style-type: none"> • Mechanical damage • Connection wire loose • Overheated • Out of range 	<ul style="list-style-type: none"> • Tighten the connection wires on the controller terminal • When brazing suction line, take out the sensor • Install the sensor after brazing
Room sensor TAIR alarm ASA	<ul style="list-style-type: none"> • Mechanical damage • Connection wire loose • Overheated • Out of range 	<ul style="list-style-type: none"> • Tighten the connection wires on the controller terminal • The room sensor can be replaced by surface sensor
Defrost termination sensor TCOIL fails CSA	<ul style="list-style-type: none"> • Mechanical damage • Loose connection wire • Overheated • Out of range 	<ul style="list-style-type: none"> • Tighten the connection wires on the controller terminal • Let the sensor cool down to application temperature range: -50°F to +103°F • Replace failed sensor
Low superheat LSH	<ul style="list-style-type: none"> • Superheat setting too low • Wrong locations of TS2 • Sensors may be loose • Uneven feeding of coil circuits • Overcharge of refrigerant Defective electric expansion valve (EEV) • Compressor stops 	<ul style="list-style-type: none"> • Change to correct set point • Make sure the distributor is feeding each circuit evenly • Insulate the sensors with foam tape • Use correct refrigerant charge • Check EEV wiring • Replace defective EEV • Check compressor
High room temperature HtA	<ul style="list-style-type: none"> • Insufficient refrigeration • Heat load too large • Compressor fails or high pressure cuts out • Evaporator fans may not run • Door open for too long • Coil iced-up 	<ul style="list-style-type: none"> • Check system design to select a sufficient system • Replace failed compressor • Fix the evaporator fans • Keep the cold room door closed during refrigeration • Check possible air leak through the walls of cold room
Low room temperature LtA	<ul style="list-style-type: none"> • Improper low temp setpoint • Over designed system 	<ul style="list-style-type: none"> • Change low temp set point • Re-select the system
Low pressure alarm LPA	<ul style="list-style-type: none"> • Refrigerant leak • Bad transducer 	<ul style="list-style-type: none"> • Fix leak • Replace pressure transducer
Door open alarm dor	<ul style="list-style-type: none"> • Door open • Wiring loose • Digital input set-up incorrectly 	<ul style="list-style-type: none"> • Close the door • Tighten the terminals. Correct wiring • Check the setting and correct it
Communication alarm COA	<ul style="list-style-type: none"> • Loose connection • Failed communication port 	<ul style="list-style-type: none"> • Tighten the terminals and bonding set-up • Change a new controller board
External Alarm 1 EA1	<ul style="list-style-type: none"> • Loose connection • Incorrect set-up 	<ul style="list-style-type: none"> • Tighten the terminals • Check the setting and correct it
External Alarm 2 EA2	<ul style="list-style-type: none"> • Loose connection • Incorrect set-up 	<ul style="list-style-type: none"> • Tighten the terminals • Check the setting and correct it
External Alarm 3 EA3	<ul style="list-style-type: none"> • Loose connection • Incorrect set-up 	<ul style="list-style-type: none"> • Tighten the terminals • Check the setting and correct it
Email failure alarm(email not sent) EFL	<ul style="list-style-type: none"> • Incorrect set-up 	<ul style="list-style-type: none"> • Check the set-up and correct it

Note: When the LogiTemp® Plus system is set for demand defrost instead of scheduled defrost, an algorithm considers the coil temperature and run time, among various other parameters, and decides whether the system needs to defrost.

If demand defrost is selected, energy consumption is reduced due to fewer defrosts. This also means that the number of daily defrosts is not controlled by the installer/service company. If a scheduled defrost is desired, do not select demand defrost.

For condensing unit installation and wiring, please consult the RSG Remote Condensing Unit Manual. If any discrepancy is found in this manual, please contact the RSG technical service department immediately.

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