

Control Link RSC Installation Instructions

Overview

The Control Link Refrigeration System Controller (CL-RSC) is an electronic device that can control all functions of a single-compressor refrigeration system, including refrigeration, defrost, and alarming. Scheduled defrost and case light control is also possible with the addition of an expansion real-time clock module (P/N 618-2082) or network card (P/N 618-2080), both available separately.

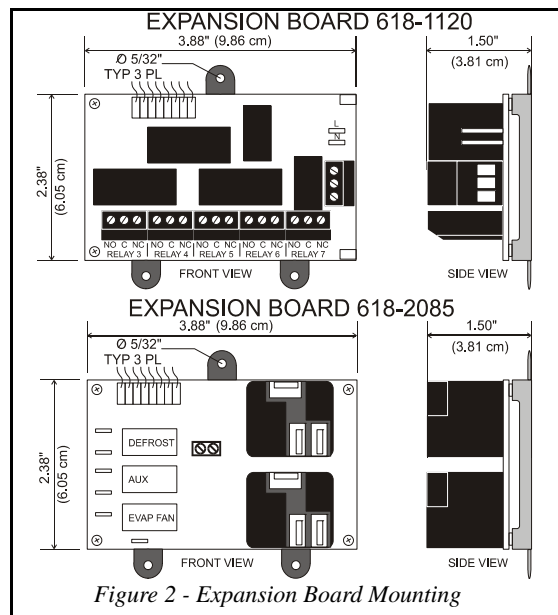
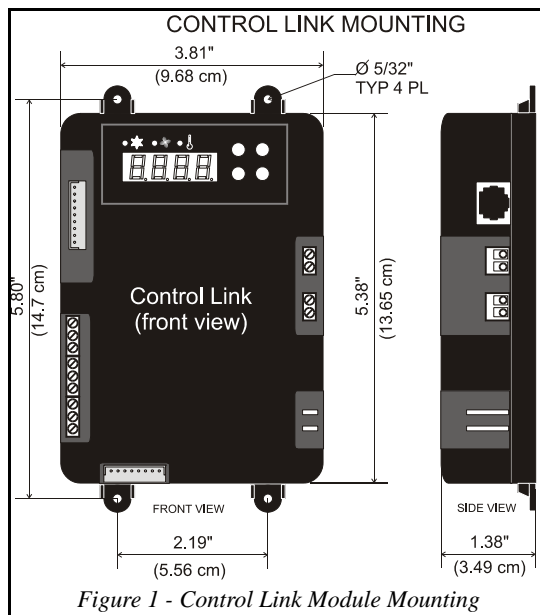
NOTE: For information about networking Control Link RSC with E2, refer to Technical Bulletin 026-4602 available on the Internet at <http://www.emersonretailsolutions.com/library>.

The CL-RSC reads discharge air and defrost termination temperature from sensors mounted in the case. The CL-RSC may control two external relays (compressor plus one configurable relay) directly from its two onboard dry-contact relay outputs, or it may use a pluggable expansion output board (P/N 618-2085 for compressor control, or P/N 618-1120 for refrigeration solenoid control) for activating case system components.

Mounting

Main Module / Relay Expansion Board

The Control Link main module and relay expansion boards are designed for mounting on a refrigerated case or in an enclosure near the case. The output board connects to the main module with a ribbon cable and therefore should be mounted directly below the main module using the attached stand-off bracket. Figure 1 shows module dimensions, and Figure 2 shows relay expansion board dimensions.



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Main Module and Expansion Board Environment Specs

Operating Temperature: 0 — 60°C (32—140°F)
Operating Humidity: 90% RH non-condensing
Storage Temp: -30—65°C (-22—149°F)
Max Power Consumption: 15W (Control Link w/expansion board)

Remote Display Mounting

The remote display is designed to be mounted on an accessible part of a refrigerated case or enclosure, no more than 25 feet from the main module. If flush mounting on a flat surface such as the front of a case or enclosure, punch a 5/8 inch square hole in the surface to allow the protruding RJ45 jack to recess, and then drill 5/32 inch holes for the mounting screws using the remote display itself as a template. *Figure 3* shows the dimensions.

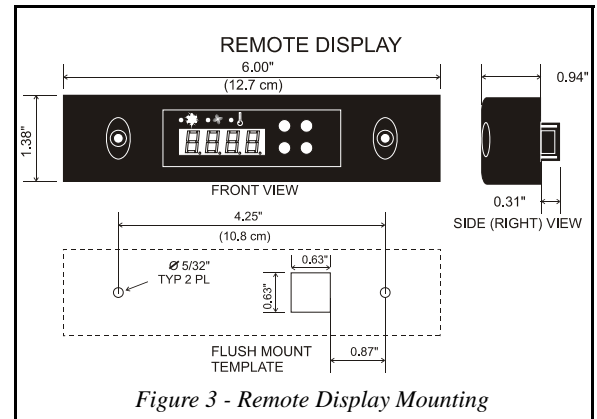


Figure 3 - Remote Display Mounting

Power down the main module before connecting the remote display. Use CAT5 wiring with RJ45 connectors to connect the Main Module with the Remote Display. Do not exceed a maximum length of 25 feet.

Wiring

Power (Control Link Module without output board, or with 618-2085 output board)

When the Control Link module is used without an output board or with the 816-2085 output board, connect 120-240 VAC 50-60 Hz line voltage to the spade lug connectors on the lower right side of the Control Link module and observe polarity markings (*Figure 4*). The expansion board is powered from the CL-RSC and requires no external power connection.

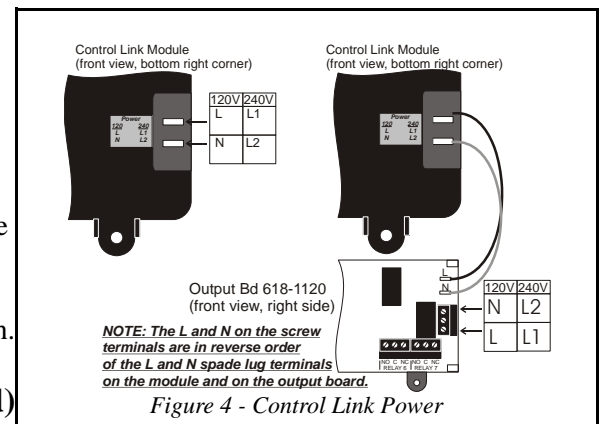


Figure 4 - Control Link Power

Power (Control Link Module with 618-1120 output board)

When the 618-1120 output board is used with a Control Link module, connect the L and N spade lug terminals on the module to the L and N spade lug terminals on the output board (*Figure 4*). Connect 120-240 VAC 50-60 Hz line voltage to the screw terminals labeled L and N on the output board. Do not connect any wire to the middle terminal.

NOTE: The L and N on the screw terminals are in reverse order of the L and N spade lug terminals on the module and on the output board.

Sensors

Case temperature and defrost termination temperature sensors must be wired to the top three-terminal connector on the left side of the Control Link module. Use only CPC NTC 10k thermistors. The defrost termination sensor must be a 10k thermistor, not a temperature switch. Wire as shown in *Figure 5*. Mount the case temperature sensor in the discharge air stream for the case. Mount the defrost termination sensor near the evaporator coil.

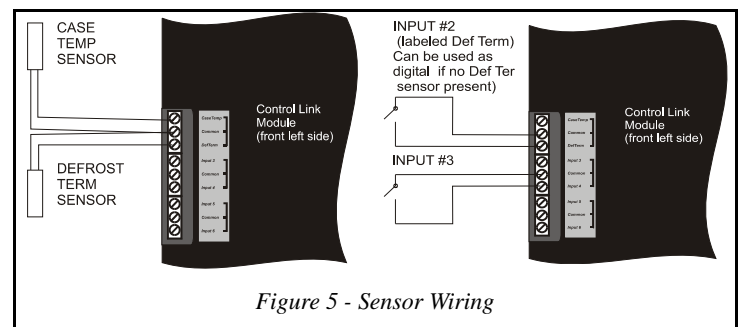


Figure 5 - Sensor Wiring

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Inputs for switches to activate setpoint shift and initiate defrost may be wired to Input 3, and also to the Def Term input (Input #2) if no defrost termination sensor is being used. The functions of these switches are determined by parameters $5i\ 2d$ and $5i\ 3d$ in Advanced Parameters.

CL-RSC Onboard Outputs

If using CL-RSC without an expansion board, wire the outputs to the two-wire terminals on the right side of the control unit, as shown in *Figure 6*. Each of these output points are rated to a maximum of 3A @ 250V. For loads greater than 3A, use the outputs to energize external relays for compressors, defrost, and case lights.

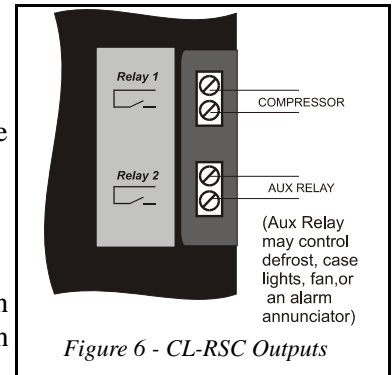


Figure 6 - CL-RSC Outputs

Expansion Board Wiring

Both types of relay output boards connect to the Control Link main module using an 8-pin ribbon cable. Plug the cable onto the Expansion Board connector at the bottom of the main module.

Relay and Pressure Switch Wiring (618-2085 Standard Output Board)

Defrost, Fans, and Aux Relay

Using spade lugs, connect the defrost heater(s), case fans, and auxiliary output (either case lights or an alarm device) to the three relays on the left side of the relay output board as shown in *Figure 7*. Refer to *Table 1* for relay ratings.

Compressor Relays

Standard Operation ($rbtP = 0-5t$)

The Control Link uses two relays on the output board to control the compressor. Line voltage must be connected to the Line 1 and Line 2 connectors on relays 1 and 2 respectively. The Load 1 and Load 2 connectors are wired to the compressor. *Figure 7* shows the wiring diagram. Refer to *Table 1* for relay ratings.

Relays	Output Board 618-2085
Defrost and Aux	10A at 120VAC
Fan	208-230VAC 2 FLA 4 LRA
Compressors ($rbtP = 0-5t$)	208-230VAC 10FLA 60LRA 115VAC 13FLA 86LRA

Table 1 - Relay Ratings (Output Board 618-2085)

Standard Pilot Duty Operation ($rbtP = 2-5P$)

The optional pilot duty mode of operation for the standard output board can be selected by choosing the $2-5P$ option under the $rbtP$ parameter. $2-5P$ stands for standard board, pilot duty. Both compressor relays will cycle on and off in a conventional manner based on the call for refrigeration by the RSC. One or both compressor relays can be used to pilot a refrigeration solenoid or a compressor contactor. The rLY alarm and phase firing logic will be disabled when this mode of

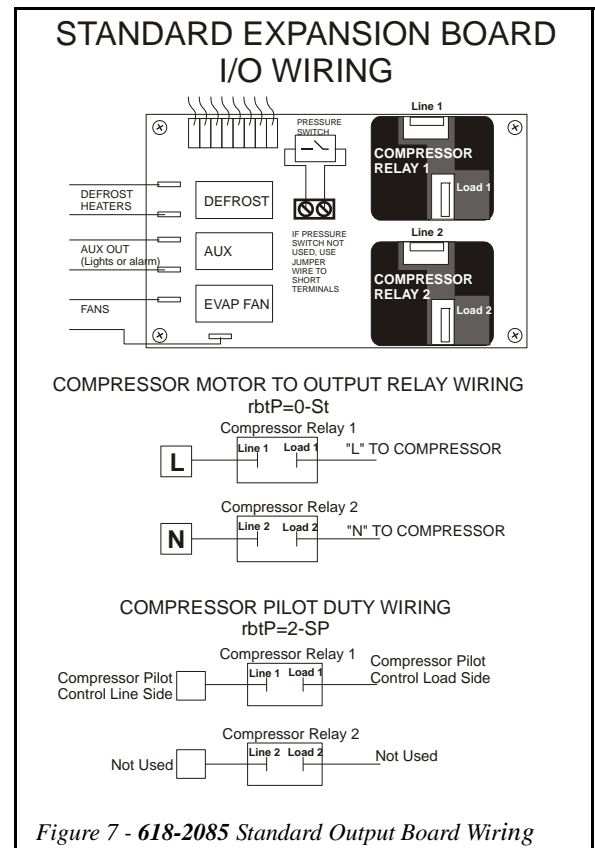


Figure 7 - 618-2085 Standard Output Board Wiring

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operation is selected. See *Figure 7* for example of wiring the RSC standard relay board for compressor pilot duty control. Note that this option is only available for RSC versions 4.14 and higher.

Pressure Switch Wiring

If desired, a pressure switch may be used to deactivate the compressor if a high/low suction pressure condition occurs. Remove the jumper wire and connect this switch to the dual screw-terminal Pressure Switch connector located in the middle of the relay output board. See *Figure 7*. If not used, these terminals must be jumpered in order for the board to work. The pressure switch must be N.C. (normally closed) type.

Relay Wiring (618-1120 General Purpose Output Board)

Use the Form C contactors on the output board points labeled RELAY 3 through RELAY 6 to connect the defrost, auxiliary, fans, and solenoid or contactor. Refer to *Figure 8*, and refer to *Table 2* for relay ratings and fail-safe positions.

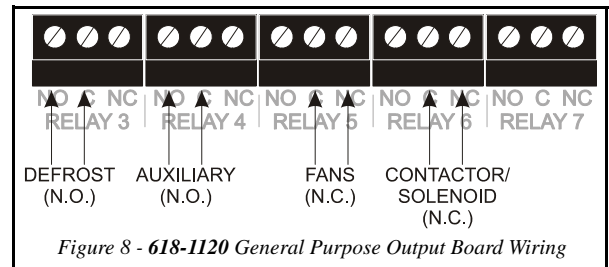


Figure 8 - 618-1120 General Purpose Output Board Wiring

#	Function	Fail-Safe	Output Board 618-1120					
			Contactor		Solenoid		Pilot Duty	
			Inrush	Steady-State	Inrush	Steady-State	VA	
RELAY 3	Defrost	N.O.	10A-N.C. or 12A N.O. @ 120-240 VAC					
RELAY 4	Auxiliary	N.O.	10A-N.C. or 12A N.O. @ 120-240 VAC					
RELAY 5	Fan	N.C.	1/2 hp N.O. or N.C., 120VAC 1 hp N.O. or N.C., 240VAC					
RELAY 6 & RELAY 7*	Contactor or Solenoid	N.C.	24VAC	2.5A	0.3A	4A	2A	50
			120VAC	0.5A	0.06A	0.8A	0.4A	50
			240VAC	0.25A	0.03A	0.4A	0.2A	50

* Relay 7 is not used by the Control Link RSC but has the same ratings as Relay 6

Table 2 - Relay Ratings (Output Board 618-1120)

CL-RSC Operation

The Display

The primary means of interaction with the CL-RSC system during programming and operation will be the display on the front of the Control Link module (or the remote display, if one is being used). *Figure 9* shows the display used on both the module and the remote display.

Seven-Segment Display

The four-digit seven-segment display is the primary means a technician or operator will use for viewing temperatures and alarm codes, and programming setpoints.

Status LEDs

The three LEDs above the seven-segment display show the status of the compressor relay, the fan relay, and whether or not a setpoint shift is active (illuminated if setpoint shift is active).

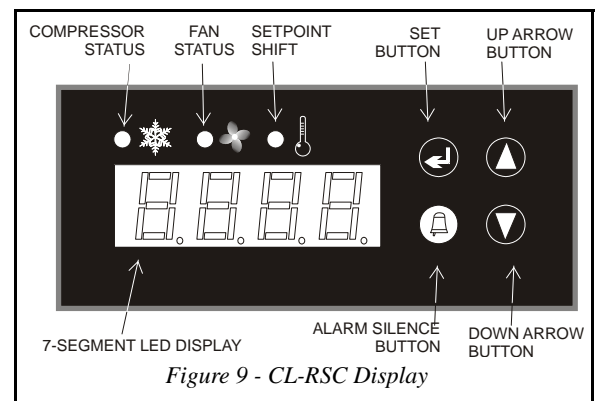


Figure 9 - CL-RSC Display

Buttons

The four buttons to the right of the seven-segment display are used to program the CL-RSC, select temperatures and alarms for viewing, and perform other functions such as alarm silencing and manual defrost.

Modes of Operation

Start-Up

Compressor operation will be suspended after power-up based on the value of the **CSUd** parameter (default 10 minutes). After this delay, the CL-RSC resumes normal refrigeration control. To prevent nuisance alarms when the case is first started up, no high temperature case alarms will be generated until 120 minutes after the start of the first cooling cycle.

Normal Operation (Refrigeration)

When in refrigeration mode, the CL-RSC turns on the compressor relay when the case temperature is above the setpoint, and turns it off when the case temperature setpoint is satisfied. The fan relay is activated and de-activated the same way as the compressor relay, unless the CL-RSC has been programmed to keep the fans always ON.

Alarms During Refrigeration

If the case temperature sensor value falls below the low temperature setpoint or rises above the high temperature setpoint, the alarm relay (if defined) will energize, and the display will alternate between the alarm code and the case temperature. The energized alarm relay and display code will continue until the temperature returns to normal (1°F below high temp alarm setpoint or 1°F above low temp setpoint) or until the Alarm Silence button is pressed (alarm is suspended for 5 minutes, then will reoccur if problem is still active).

Defrost Operation

Defrost cycles are initiated at the times programmed in the CL-RSC. During defrost, the compressor relay is turned off, and the defrost relay is energized. The defrost relay will be de-energized when the defrost termination temperature is reached or until the programmed defrost duration has elapsed (whichever occurs first). While the defrost relay is energized, the display will show **dEF** instead of the case temperature.

If a defrost drip duration has been programmed, immediately after defrost termination the compressor relay will remain OFF for an amount of time to allow moisture to drain off the coil. During this time, the display will read **dri P**. When the drip time is over, refrigeration will resume. Fans may be either off or on during defrost, based on user programming.

If the RSC advanced parameter **PULL** is set to **YES**, the RSC display shows **PULL** during the pull-down period following the drip period. The pull-down period will last the duration of minutes defined by the **Adtd** parameter or terminate earlier if the control temperature has reached the high end of the **dl FF** parameter (control setpoint deadband). This chain of events would indicate the case has returned to normal operating temperatures. Note that this advanced parameter option is only available for RSC versions 4.14 and higher.

Manual Defrost

A manual defrost may be initiated at any time by holding the SET button for 10 seconds until the **dEF** message is shown on the display. Defrost will begin immediately and terminate normally. If one of the auxiliary inputs is configured as a manual defrost switch, a contact closure on the switch will also initiate a manual defrost.

Compressor Fail-Safe Mode

If the case temperature sensor fails, the CL-RSC will operate in a fail-safe mode that cycles the compressor ON and OFF at a user-defined regular interval. The ON/OFF rate is determined by setting parameters **CSFP** and **CSFO** in the CL-RSC. **CSFP** sets the interval period, and **CSFO** sets the amount of time during that period the compressor will be ON.

For example, if during fail-safe you want the compressor to alternate being ON for three minutes and OFF for seven minutes, set **CSFO** to 3 and **CSFP** to 10. This will cause the compressor to be ON for three minutes of the 10-minute interval, and OFF for the remaining seven minutes.

Output Board Power Loss Fail-Safes

The 618-1120 Output Board has Form C contacts. The fan and contactor/solenoid outputs are wired to the normally closed (N.C.) contacts on the board, meaning refrigeration and fan outputs will fail to the CLOSED state when power to the RSC is lost. The defrost and auxiliary outputs are wired to the normally open (N.O.) contacts, meaning these outputs will fail to the OPEN state.

Auxiliary Relay Control

The auxiliary relay on the Relay Expansion board, or relay #2 on the Control Link main module, may be used to control various functions:

- **Defrost** (only an option for relay #2 if no Expansion Board is used).
- **Lighting Control:** Up to six ON/OFF times per day may be programmed for case lights. If not connected to an E2, the Control Link main module will require a real-time clock module to perform lighting control.
- **Case Fans:** Fans can be programmed to be always ON, or ON only when the compressor is ON. Other features include programmable fan state during defrost, and suspension of fan activation after defrost based on time and/or case temperature.
- **Alarm:** The relay will close when an alarm is active on the Control Link main module.

Programming the CL-RSC

General Parameters

General parameters are used by technicians and operators to set control setpoints, defrost schedules, time and date.

Before changing parameters, clear any active alarms by pressing the Alarm Silence button. Press the SET button and hold for five seconds. If general mode programming has been password protected, you will see **PASS** on the display. Press the SET button and use the arrow keys to increment the password number until the correct password is shown, and then press the SET button. (If general parameters are not password protected, PASS will not appear on the display.)

The display will show the first programmable parameter: **CSF** (case temperature setpoint). The arrow keys may be used to scroll through the list of general parameters. To change the value of any parameter:

1. Select the parameter using the arrow keys (until the code is shown).
2. Press the SET button.
3. The current value of this parameter will be displayed. Use the arrow keys to change the value.
4. Press the SET button to accept the value.
5. Repeat steps 1 - 4 until all setpoints have been properly configured.
6. When finished, press and hold the SET button to save changes and exit. After approximately 5 seconds, the display will go blank and then revert to normal display to indicate setpoints have been saved.
7. To **cancel all changes**, press and hold (SILENCE) for five seconds, or leave controller idle for 60 seconds. You will lose all setpoint changes made since you entered general programming mode.

CAUTION!

To make changes permanent, you MUST press and hold the SET button for five seconds. Leaving the controller idle for 60 seconds will log you out and cancel all of your setpoint changes.

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NOTE: The General Parameters that are shaded gray are only accessible in the RSC if the real-time clock module (P/N 618-2082) is being used, or the RSC has a network card (P/N 618-2080) and is online with E2.

General Parameters				
Code	Description	Min	Max	Default
CSP	Temp control setpoint (deg F, can be displayed in deg C)	-40	100	25
CLSt	Clock time set (military). UP button adjusts minutes. DOWN adjusts hours.			
YEARr	Year set (last two digits of year)	05	99	05
m0	Month set	1	12	1
dAY	Day set	1	31	1
dEFt	Defrost termination temperature (deg F, can be displayed in deg C)	-40	100	35
dEFd	Defrost cycle duration (minutes)	1	180	10
ndFt	Minimum defrost time. After defrost begins, the RSC will remain in defrost for the Minimum Defrost Time regardless of whether or not termination is being called for. A zero in this parameter disables the minimum defrost feature.	0	60	0
dUPU	Defrost upon power-up? (if yes, initiates defrost cycle after power restore)	no	YES	no
ddAP	Defrost delay after powerup (minutes). Visible only if dUPU is set to YES .	0	120	5
dr iP	Compressor OFF delay after defrost (minutes)	0	60	10
dCPd	Defrost cycles per day (if set to 0, no dFx schedule times will be shown)	0	12	10
dF 1 -dF 12	The number of dFx parameters in the list will be equal to parameter dCPd . Starting with dF 1 , enter the time of day each scheduled defrost cycle will begin.	00:00	23:59	see desc.
tAH	High temperature alarm setpoint (deg F, can be displayed in deg C)	-40	100	100
tAL	Low temperature alarm setpoint (deg F, can be displayed in deg C)	-40	100	-40
Adtd	Alarm delay after defrost (temp alarms are suspended for this many minutes after end of defrost)	0	60	10
AdEL	Alarm delay for high/low temp alarm. Temp must remain out of alarm setpoint range for this number of minutes before an alarm can occur.	0	60	10
SFE	Software revision number. This field is read-only.			

Advanced Parameters

Advanced parameters are used to change higher-level parameters. Selecting and changing advanced parameters works the same way as general parameters, except they are accessed in a different way and require entering a different password.

Before changing parameters, clear any active alarms by pressing the Alarm Silence button. Press and hold the up and down arrow keys simultaneously for five seconds to enter advanced programming mode. The display will show **APRS**. Press the SET button and use the arrow keys to select the correct password (default is 0000), and press the SET button to enter it.

Advanced Parameters				
Code	Description	Min	Max	Default
rybd	Selects whether outputs will be controlled from the RSC's onboard relays (no) or an expansion board (YES).	no	YES	no
LF	Line frequency (Hz)	50	60	60
r2Fn	Function of the aux relay (relay #2) on the RSC. dEF =Defrost, ALAR =alarm, LCOn =lighting control, FAn =case fans. Visible only when rybd = no .	dEF	FAn	dEF
F C	Temperature units (this affects units for both display and setpoints)	F	C	F
dI FF	Control temp setpoint differential (deadband around setpoint) in degrees	1	40	1
HSP	High temp control setpoint limit (CSP cannot be set higher than this value) in degrees	-40	100	100
LSP	Low temp control setpoint limit (CSP cannot be set lower than this value) in degrees	-40	100	-40

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<i>Advanced Parameters</i>				
<i>Code</i>	<i>Description</i>	<i>Min</i>	<i>Max</i>	<i>Default</i>
<i>SI 2</i>	Determines type of sensor on input #2 (defr. term). If <i>ntc</i> is selected, input will be used as defrost term; if <i>d9t</i> selected, input will be used as an auxiliary input (whose function is determined by <i>SI 2d</i>).	<i>ntc</i>	<i>d9t</i>	<i>ntc</i>
<i>SI 2d</i>	If input #2 (defr. term) is <i>d9t</i> , determines function of digital input. <i>SS</i> = setpoint shift ("ON" causes the value of <i>CSS</i> to be added to setpoints), <i>IDEF</i> = start manual defrost.	<i>IDEF</i>	<i>SS</i>	<i>IDEF</i>
<i>SI 3</i>	Determines type of sensor on input #3. <i>ntc</i> = 10K CPC thermistor, <i>d9t</i> = digital sensor.	<i>ntc</i>	<i>d9t</i>	<i>d9t</i>
<i>SI 3d</i>	If input #3 is <i>d9t</i> , determines function of digital input. <i>SS</i> = setpoint shift (closure causes the value of <i>CSS</i> to be added to setpoints), <i>IDEF</i> = start manual defrost.	<i>IDEF</i>	<i>SS</i>	<i>IDEF</i>
<i>CAL 1 CAL 2 CAL 3</i>	Value of <i>CAL 1</i> , <i>CAL 2</i> , and <i>CAL 3</i> parameters are added to their respective temp inputs for calibration purposes.	- 10	10	0
<i>FANd</i>	Fan during normal mode. <i>no</i> = on only when compressor is on, <i>YES</i> = always on during normal mode. Visible only if fan output is present (i.e., expansion board is being used, or <i>r2Fn=FAOn</i>).	<i>no</i>	<i>YES</i>	<i>no</i>
<i>FANd</i>	Fan during defrost. <i>no</i> = fan off, <i>YES</i> = fan on during defrost. Visible only if the RSC is controlling both fan and defrost with an expansion board.	<i>no</i>	<i>YES</i>	<i>no</i>
<i>FOTp</i>	Fan ON temp setpoint. After defrost, temp must fall below this setpoint before fans will be allowed to activate. Visible only if the RSC is controlling both fan and defrost with an expansion board.	- 40	100	32
<i>FdAd</i>	Fan activation delay after defrost, in seconds. (if zero, <i>FOTp</i> is used after defrost; if non-zero, <i>FdAd</i> is used). Visible only if the RSC is controlling both fan and defrost with an expansion board.	0	120	10
<i>CSUD</i>	Compressor ON delay after power-up (minutes)	0	15	10
<i>COt</i>	Minimum compressor OFF time (minutes)	0	15	5
<i>COnt</i>	Minimum compressor ON time (minutes)	0	15	1
<i>CSFP</i>	Compressor fail-safe period. When case temp sensor fails, compressor will cycle ON/OFF over this period (see <i>CSFO</i>).	1	60	10
<i>CSFO</i>	Amount of time in the <i>CSFP</i> fail-safe period that the compressor will be ON (minutes).	0	60	5
<i>CSS</i>	Control setpoint shift. Value is added to all control and alarm setpoints when a setpoint shift input is closed.	- 100	100	0
<i>Add</i>	Alarms display disabled. <i>YES</i> = no alarm codes displayed on the RSC. <i>no</i> = alarms enabled.	<i>no</i>	<i>YES</i>	<i>no</i>
<i>ArA</i>	For the expansion board, sets the function of the auxiliary relay. <i>ALAR</i> = close on alarm, <i>LCO</i> = lighting control. Visible only if <i>rYbd=YES</i> .	<i>ALAR</i>	<i>LCO</i>	<i>ALAR</i>
<i>L1 On L1 OF</i> . . <i>L60n L60F</i>	Visible only if <i>ArA=LCO</i> or <i>r2Fn=LCO</i> . There are six ON/OFF pairs where you may specify times of day for turning the lighting control relay ON and OFF. Enter the first ON time of the day in the <i>L1 On</i> field and the first OFF time in the <i>L1 OF</i> field. If necessary, continue entering ON/OFF times in the <i>L20n / L20F</i> fields, then <i>L30n / L30F</i> , etc. Leave all unused schedule time pairs set to <i>0:00</i> to disable them.	0:00	23:59	0:00
<i>LOC</i>	General parameter password enable. If <i>YES</i> , user must enter password to change general parameters.	<i>no</i>	<i>YES</i>	<i>no</i>
<i>PASS</i>	Password for general programming. If <i>0000</i> , no password is required.	0000	9999	0000
<i>APAS</i>	Password for advanced programming.	0000	9999	0000
<i>rbtP</i>	Relay board type. <i>0-5t</i> for the "standard" (618-2085) board, <i>1-9P</i> for the "general purpose" (618-1120) board, and <i>2-5P</i> for the "standard" (618-2085) board for Pilot Duty compressor control. Note that this option is only available for RSC versions 4.14 and higher.	0-5t	2-5P	0-5t
<i>PULL</i>	If set to <i>YES</i> , the RSC display shows <i>PULL</i> during the pull-down period following defrost and the drip period. Note that this option is only available for RSC versions 4.14 and higher.	<i>no</i>	<i>YES</i>	<i>no</i>

Restore to Defaults

The blue button located on the top of the Control Link main module (see *Figure 10*) may be used to restore the Control Link RSC to its “default setpoints,” which can be either the RSC’s factory default setpoints (as shown in the “Default” columns of the General and Advanced Parameters) or a customer-specific set of defaults programmed using the Control Link PC tool. **Do NOT press the Restore to Defaults button unless you are sure what default values will be restored.**

To perform a restore, press and hold this button for 15 seconds. The display will flicker briefly to indicate the command to reset was received. **Power down the Control Link**, wait 5 seconds, and restore power.

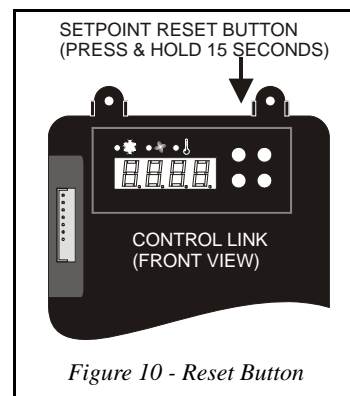


Figure 10 - Reset Button

Alarms

There are ten different alarms that may occur in a CL-RSC. When an alarm is detected, CL-RSC takes the following actions:

- Displays a four-character error code on the LED display (unless parameter “Add” is set to “YES”)
- Closes the Aux relay (if parameter “ArA” is set to “ALAR”)
- Uses fail-safe modes and settings to compensate for the alarm condition and attempt to keep the system running until repair can be done.

Alarm Codes	
Code	Description
ES 10 ES20 ES30	Open sensor alarm for sensor #1 (case temp), sensor #2 (defrost term), or sensor #3. When ES 10 is active, CL-RSC uses CSFP and CSFO to pulse the compressor ON and OFF as a fail-safe. When ES20 is active, defrosts will not terminate by temperature and will last the full duration (DEFd).
ES 15 ES25 ES35	Short sensor alarm for sensor #1 (case temp), sensor #2 (defrost term), or sensor #3. When ES 15 is active, CL-RSC uses CSFP and CSFO to pulse the compressor ON and OFF as a fail-safe. When ES25 is active, defrosts will not terminate by temperature and will last the full duration (DEFd).
HtP	High temperature alarm setpoint was reached after the AdEd(defrost delay) or AdEL (normal delay) elapsed. No fail-safe actions.
LtP	Low temperature alarm setpoint was reached after the AdEd(defrost delay) or AdEL (normal delay) elapsed. No fail-safe actions.
dEt	The case temperature did not reach the defrost termination temperature setpoint (dEFt) before the defrost cycle time finished. No fail-safe actions.
rLy	Compressor fault detected. If using an expansion board P/N 618-2085 with parameters rYbd, set to YES and rbtP set to 0-5t.

Clearing Alarms

To clear an alarm and cause the CL-RSC to resume normal operation, press the Alarm Silence button. The alarm message will disappear, the Aux relay will open (if parameter “ArA” is set to “ALAR”), and the CL-RSC will attempt to resume normal operation. If the condition or conditions that caused the alarm are still present, the alarm will reoccur after the appropriate alarm delays have elapsed.