CoolTrol®

Energy Control Products

INSTALLATION INSTRUCTIONS FOR

CCS2

COOLER AND FREEZER ENERGY CONTROL SYSTEM

National Resource Management, Inc.

Rev 1.0.055

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WARNING

Risk of fire or electrical shock! Several disconnect switches must be disconnected before installation or servicing.

Installing refrigeration control systems requires knowledge of electrical wiring and control systems. **If you are not qualified, do not attempt an installation. Contact a qualified, trained, and experienced electrician.**

Use caution and make note of the circuit voltage and amperage where the controls will be spliced into the circuit. The control relays are intended to operate the solenoid valve or contactor coils. **DO NOT ATTEMPT TO CONTROL ANY OF THE LOADS DIRECTLY THROUGH THE CONTROL RELAYS!** Check the enclosed wiring and components.

1. Before attempting to install, wire, or operate any of the components of the controls or economizer, carefully read these installation instructions. Failure to comply with these instructions could result in personal injury and/or property damage.

2. Follow all local electrical and safety codes, the National Electrical Code (NEC), and the Occupational Safety and Health Act (OSHA).

3. Disconnect the power to the control system, compressor(s), and evaporator fan(s) to be controlled. Lock and tag disconnects to prevent unexpected application of power.

4. Make sure that the power source conforms to equipment or component requirements.

5. Fans have moving parts that may cause injury. Do not remove safety guards.

6. All system components must be grounded properly.

7. It is recommended that the controller section of the control system be mounted in a reasonably dry and user-accessible location. The relay enclosure section can be mounted remotely in a wet location as long as the connectors and conduit are liquid tight.

8. Any wiring that penetrates the cooler wall must also be air- and liquid-tight to prevent condensation from forming within the conduit. Use a sealant recommended for conduit.

9. All low-voltage connections are made in an isolated section while 115 VAC or 220 VAC connections are made within another isolated enclosure section. See the wiring diagrams.

10. The controller is designed to control the existing thermostat circuit, which controls either a solenoid valve or the coil to the compressor's contactor. See the enclosed wiring diagram to determine the splice points for each control relay.

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Introduction

The CoolTrol Cooler and Freezer Energy Management System is a microprocessor-based digital controller that is designed and programmed to operate a walk-in cooler in an energy-efficient manner. The controller features a display and a keypad, which allows operating parameters to be viewed and changed. The system can control one cooler and an outside air economizer.

The control box has a run/bypass button and optional switch. When the controller is in bypass mode, all relays are de-energized. The relays go to their normally closed (NC) positions, and the original control circuit is reestablished. The cooler is now operating on the original thermostat.

Features

- Shutdown button—timed shutdown while loading the cooler
- Optional outside air economizer (E option)
- Night setback of coolers with non-perishable products (NS option)
- Optional Dewpoint based Anti-Condensate Heater Control (DH option)
- Optional heater control
- Alarms—high/low-temperature
- Defrosts based on load and terminated on temperature
- Data logging—up to 10 years of data on internal microSDHC card
- Two 4-20 mA inputs for logging data from current/pressure transducers
- Two low-voltage PWM outputs for controlling Door Heater SSRs
- Remote monitoring/control with Remote Site Manager System. Requires a paid subscription for access.
- Modbus-TCP and Web REST API for access to data and settings.
- Distributed Control – Defrost, Compressors, Shutdown, Bypass, and Outside temperature are synchronized between groups of controllers.

Specifications

Power supply	24 VAC 20 VA
Onboard relays	1 A at 24 V AC/DC
Control relay rating	250 VAC 7.5 A G.P., 1.5A Pilot Duty
PWM outputs	14 VDC 34 mA
Agency approvals	UL listed 34BA Refrigeration Controller
Temperature sensors	5 kΩ thermistor, Z curve
Digital inputs	Dry contact
Communication ports	Ethernet, USB
Control range: • System with air defrost • System with electric/hot gas defrost	 31°F - 65°F -35°F - 90°F

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Options

_E	Outside air economizer
_NS	Night shutoff control: Single channel, seven-day on/off control
_DH	Door Heater anti-condensate control, 2 channels

Figure 1. Typical System Connections

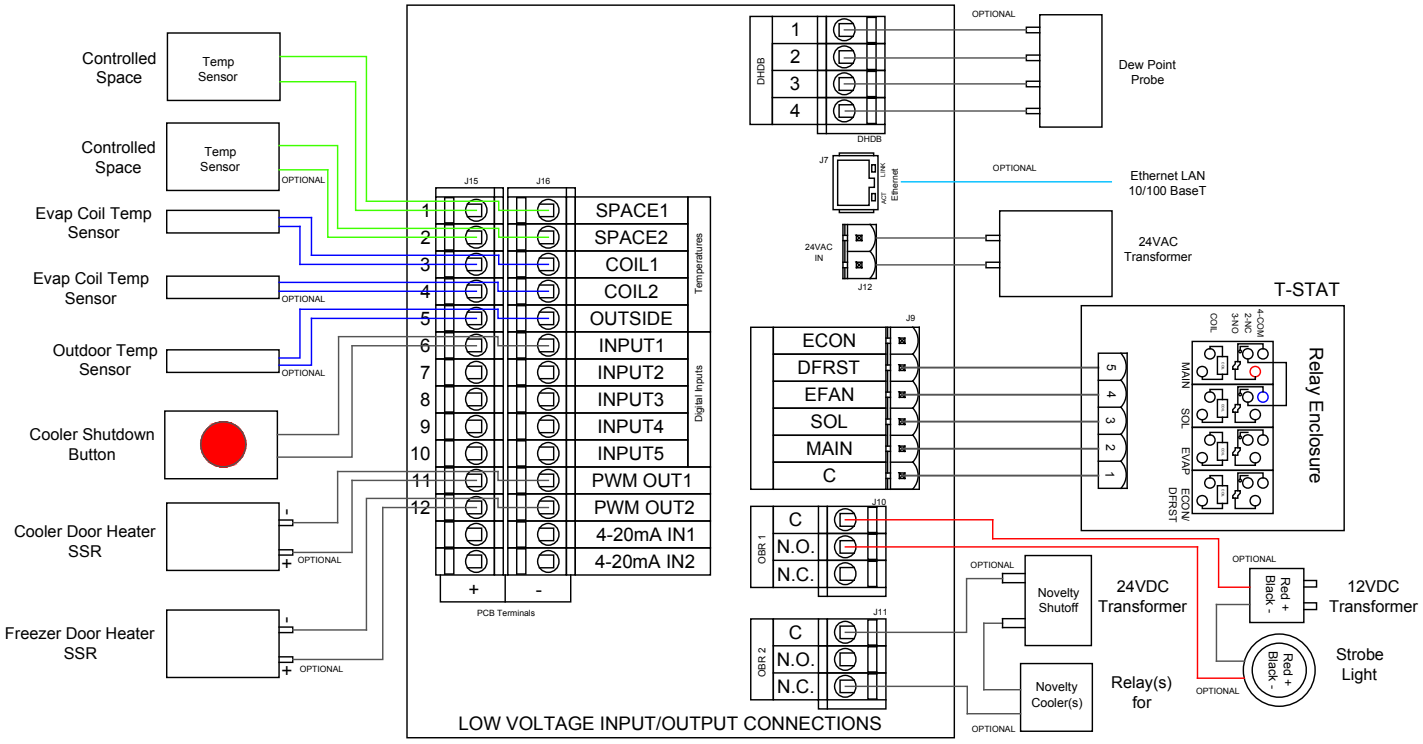

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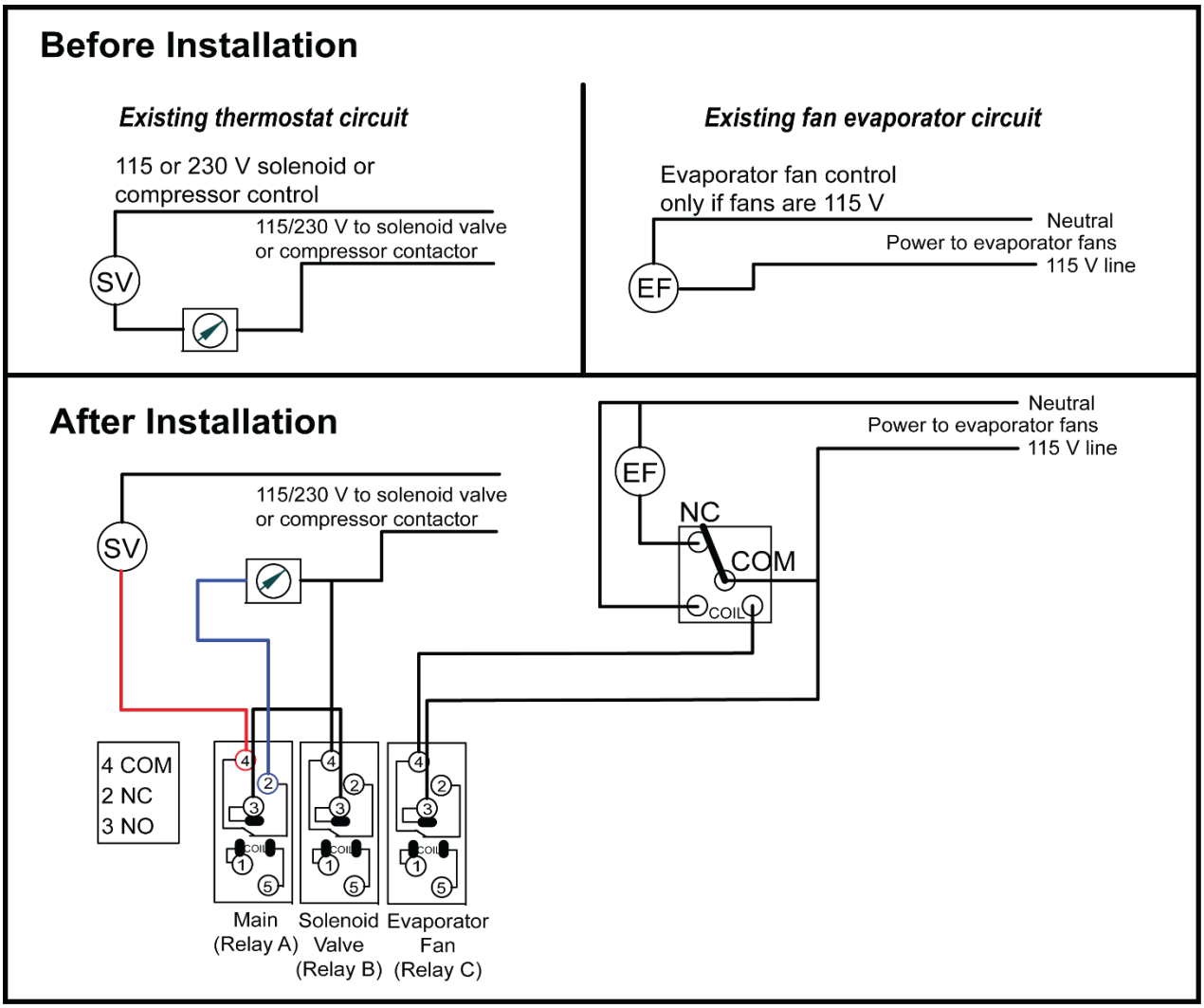
Figure 2. Typical Control Connections



The controller is powered by a 24 VAC, 20 VA class 2 transformer.

Each control relay is rated for 7.5 Amps G.P. or 1.5 Amps pilot duty at 250 VAC, and is intended to be used to switch control circuits only.

The controller is designed to be remote mounted from the relays for ease of access to the display and keypad.

The system is designed to be a retrofit for an existing system. It is wired into the existing circuits such that the preexisting control system is an emergency back-up if there is a system failure. This also allows a technician unfamiliar with the controller to service the mechanical system by temporarily switching it to BYPASS.

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Control Relay Functions

The basic controller system normally controls only the solenoid valve and evaporator fans. The electric defrost and winter economizers are options.

Control Relay Designation	Control Relay Name	Description
A	Main	Isolates the existing thermostat from the control circuit and allows the controller to replace the thermostat. While the controller is in RUN mode, the Main relay is always energized.
B	Solenoid Valve	Energizes the solenoid or compressor contactor whenever the controller is calling for cooling.
C	Evaporator Fan	Energizes an evaporator fan power relay. The evaporator fans are connected to the normally closed contacts on the power relay so that the fans are switched OFF when the Evaporator Fan relay is energized.
D	Defrost	Used only when the system is also controlling electric defrost. Optionally used to control a heater.
E	Economizer	Used only when the system is also controlling an economizer. Optionally used to control a 2nd electric defrost.

Notes:

1. Install a power relay (120 VAC coil and 30 A contact rating with a dust cover) as needed. If the fans are on a 220 V circuit, a 220 V power relay may be used if more convenient.

2. Some relays may not be applicable, depending on the application. Only the A, B, and C relays are present in every application. The A, B, C, and D or E relays are located in the relay enclosure.

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Solenoid Valve or Compressor Contactor Circuit

This circuit is switched on by the existing thermostat when the thermostat calls for cooling. The thermostat circuit must be rerouted through the Main (A) relay and the Solenoid (B) relay. Keep in mind that because of the BYPASS feature, the control logic may vary from your usual procedures for installing controls. Before setting up these circuits, review the wiring schematic and be sure that you understand the control circuit.

To reroute the thermostat circuit:

1. Locate the thermostat circuit, and cut the wire between the thermostat and solenoid valve.
2. Connect the wire lead from the solenoid valve side to the C (common) terminal of the Main (A) relay.
3. Connect the wire lead from the thermostat side to the NC (normally closed) terminal on the Main (A) relay.
4. There is a jumper from the NO (normally open) terminal on the Main (A) relay to the NO (normally open) terminal on the Solenoid (B) relay. To complete the controller's thermostat circuit, connect a wire from the C (common) on the Solenoid (B) relay and splice it to the wire on line side of the thermostat.

Notes:

1. If the existing thermostat is switching the "compressor load," a new power relay or contactor must be added to allow the control relays to switch the contactor. The existing thermostat must also be rewired to switch the contactor. This procedure must be done to so that the BYPASS mode works properly.
2. The controller will be performing all defrost functions in coolers with ambient air defrost and the **existing defrost clock** must be disabled by removing the pins that initiate defrost. We **strongly** recommend that the installer leave a note with the clock and the controller operating instructions indicating the pin positions and defrost duration settings. Then if the controller fails or there is an emergency, the defrost clock pins may be reinstalled when the controller is bypassed for an extended period of time.

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Evaporator Fan Control Circuit

In most coolers, the evaporator fans operate all of the time, but in some coolers and most freezers with electric defrost, they only cycle off during a defrost. To control the fan circuit, a separate appropriately sized power relay is used to switch one leg with both leads connected to the NC (normally closed) terminals. When the relay is energized, the controller switches the fans off. This assures that the fans are on if the controller is switched off. A 30-amp relay with dust cover is supplied with each cooler control kit.

The control relay (C) in the controller's relay enclosure switches the power relay. In most systems with electric defrost, a relay/contactor controls the evaporator fans. In these situations, the control relay can be used to switch that relay/contactor instead of installing the relay supplied in the kit. (See the next section.)

Evaporator Fan Control Circuit with Electric Defrost

In coolers and freezers **with electric defrost**, the evaporator fans are usually cycled off by the defrost clock either directly controlling the load or by switching a contactor.

If the electric defrost will be controlled by the CCS2 system, in order to assure proper functioning of the system during defrost while in either in the RUN or BYPASS mode, all of the functions performed by the defrost clock must be rewired such that the existing defrost clock performs defrosts when the controller is in BYPASS and the controller performs them while in the RUN position. Please reference the *CoolTrol Installation Diagrams for Electric Defrost* document.

Low-Voltage Wiring

Sensor wiring should be shielded communication cable of 24-18 gauge. (For typical small cooler applications with wire runs of less than 100 feet, 24-22 gauge is acceptable.) Use thicker gauge wire for longer wire runs. For normal installations, 22-20 gauge wire is safe. The installer should have one roll of one-pair cable and one roll of three-pair cable.

Improper splices and connections of the temperature sensor wires cause temperature measurement errors. Gel-filled crimp connectors are supplied for these connections. The gel filling prevents the connections from oxidizing, which would otherwise become a problem after several years of operation.

To reduce effects of EMI on sensor wires, the low-voltage wires and sensors should not be mounted near high voltage, high current wires, and electrical equipment. Motors and motor feeds produce a lot of electrical noise, which could cause erroneous readings. In industrial applications, or where the sensor cables are run long distances, the sensor cable shield should be connected to a ground reference terminal on the CCS2.

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Thermistors

Each thermistor requires two connections. One is a 3 V reference, and the other is the temperature input. Please note that the references cannot be combined; they need to be run separately to each thermistor.

There are two space and coil temperature inputs. Either one or both can be used. When an economizer is being controlled, an outside temperature sensor is also used. It is very important to properly place all of the sensors to assure proper equipment operation. The cooler room sensors are supplied pre-mounted to a standard aluminum cover, which is attached to a small plastic enclosure. The sensor is usually mounted on the wall near the existing cooler thermostat or somewhere behind the evaporator coil.

Here are some precautions for placing the room sensor:

1. Do not place the sensor where an evaporator or economizer is directly blowing on it.
2. Do not place the sensor near a door into the cooler.
3. Do not place the sensor in an area where it will be blocked by objects or near the area where it will sense only fresh warm product brought into the cooler.
4. Be careful of other sources of heat and cold in a cooler, such as a heated condensate pipe.

The coil temperature is used to determine when to cycle the fans off after the compressor has stopped and when to terminate a defrost. The coil sensor(s) should be placed in the coldest area of the evaporator. If two sensors are installed, the system will use the coldest temperature. The sensor can be attached by either tie wrapping it directly onto a coil or inserting it completely into the fins and squeezing the fins shut behind it. This prevents the sensor from being pushed out by ice formation or by someone accidentally pulling on the wire.

The outside temperature sensor is affected by direct sunlight. The best location is usually a north facing wall in a shaded location. Be aware that vents, lights, electrical equipment, and large overhangs cause improper temperature readings because of localized heating.

It is best practice to use shielded cable for sensor runs, and to ground the shield at the controller.

Strobe Light Alarm

An optional strobe alarm light is powered by a 6-12 VDC wall mount transformer and is switched by one of the controller's onboard relays (OBR1). First, place the strobe light in an area where it can easily be seen by someone. Then wire it and the power supply into the terminal blocks following the schematic. The default is the normally open (NO) terminal, but the system can be configured to use the normally closed (NC) terminal. The strobe light will not operate if the polarity is incorrect.

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Cooler Load Button (Optional)

The cooler load button is mounted near the main entrance to the cooler and is used to shut down the cooler when it is being loaded. There are two wires from the load button that must be connected to Digital Input 1 on the terminal block.

Controlling Free-Standing Novelty Coolers using Remote Relay (Optional)

Many liquor and convenience stores have one or more free-standing coolers provided at no charge by brand name distributors...Coke, Pepsi, etc. In the stores that do not operate 24 hours and that do not store perishable items in those coolers, they may be shut off at night using a remote relay which is controlled by the cooler control system. Most of these coolers draw 7-15 amps at 115 volts and they run constantly. Switching them off for 7 hours will save approximately 170 kwh or about $15/month. A 20-amp relay is mounted within a 1-1/2" by 1-7/8" deep handy box, which switches the hot leg of the heavy duty appliance cord.

To install a remote relay for a free-standing novelty cooler:

1. Unplug the cooler from the wall outlet feeding it and plug it into one of the relay controlled extension cords provided in the control kit.

   Caution: The extension cords MUST be mounted on the wall or on the cooler such that they are not allowed to lie on the floor and there is no tension placed on the cords.

2. With the power off, install the provided 40 VA 24 VAC transformer (mounted on a 4" square cover plate) near the cooler controller. This transformer should be wired so it is always energized.

3. Connect one side of the 24 VAC power leads to the OBR2 C terminal. Connect a second wire to the OBR2 NC terminal and run it with the other lead from the 24 transformer to the relay leads found on the side of the night setback relay. If multiple coolers are controlled, each cooler must have its own dedicated relay controlled cord with each relay wired in parallel to the others. Check the loads to make sure that the circuits feeding the coolers are not overloaded.

4. Turn the power back on, set the off and on times, and test the relay for proper operation.

5. Some of these coolers are equipped with compressors that are plugged into an outlet located in the compressor compartment for convenient servicing. **DO NOT** install the cord to this location, because the fans and lights in the cooler will still run and heat the product. **FOR THIS SYSTEM TO WORK, THE ENTIRE COOLER MUST BE SHUT OFF.**

When the onboard control relay is energized, the 24 VAC from the transformer to the relay(s) is switched OFF, and the appliance cord feeding the cooler will be de-energized. In the event of a controller failure, the cooler can still operate normally (because of the normally closed NC connection). When the controller is brought back online, the shutoff routine will run.

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Outside Air Economizer (optional)

Economizer Circuit

Each economizer unit consists of two blowers mounted inside of a stainless steel enclosure that is attached to the outside of the building/cooler wall. The fans must be connected to a 115 VAC circuit, which is controlled based on cooler setpoint, and are only allowed to work when the outside temperature falls at least 3° F below the cooler's temperature setpoint. To control the fans, the controller switches free cooling relay E, which is connected to the line side of a 115 VAC feed to a small 40 VA 24 VAC transformer, which is used to power the motor that opens a set of dampers connected to the intake and exhaust ducts (6" PVC). The damper motor is equipped with an end switch that closes once the dampers are fully open. The end switch is used to energize a 24 VAC circuit to a 20-amp relay, which turns on the 115 VAC circuit to the intake and exhaust blowers. See figure below.

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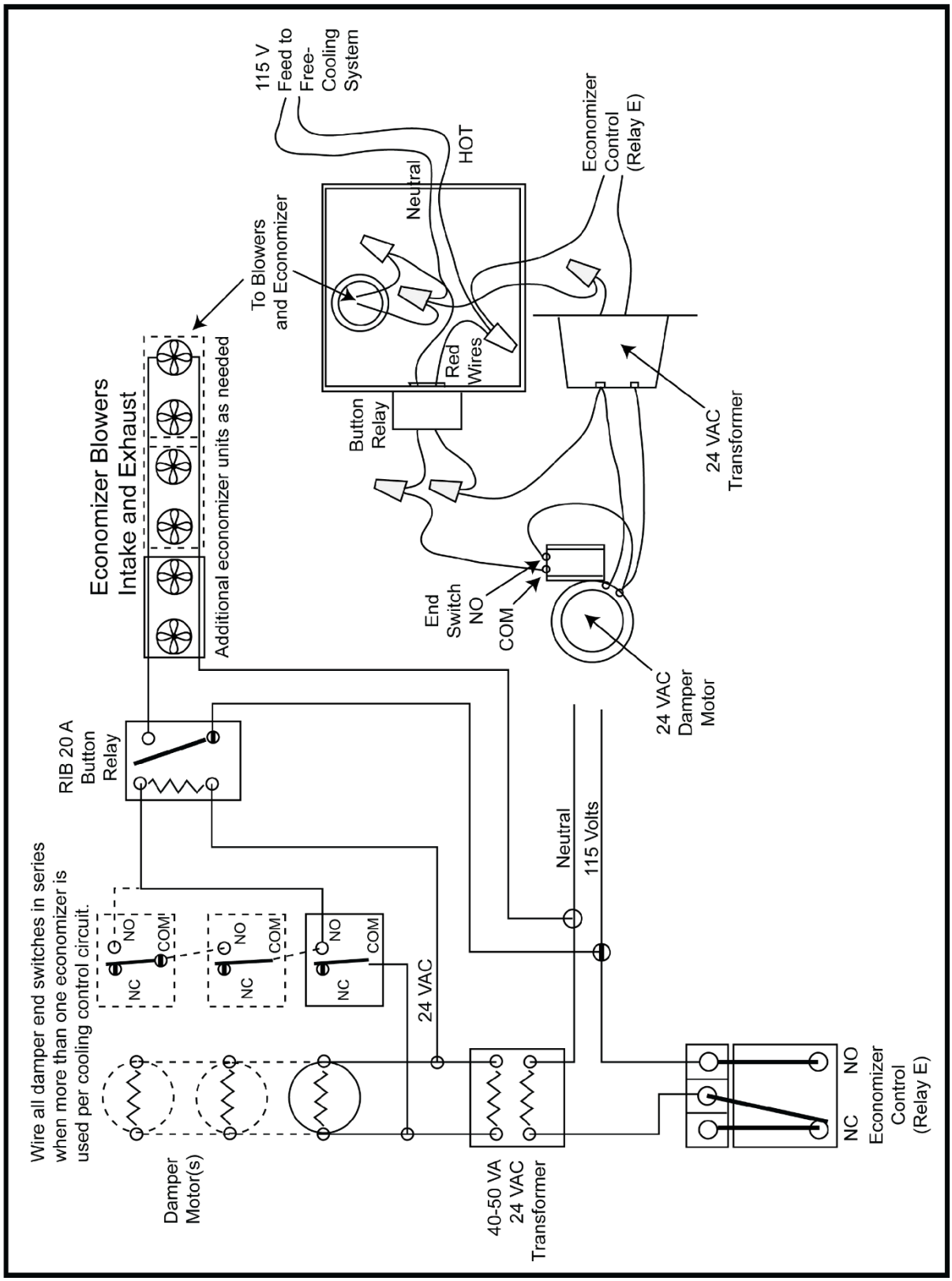
Figure 3. Economizer Circuit



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Mechanical Installation for the Economizer

When the installation also includes one or more economizers, pay close attention to the following installation guidelines to insure a good quality installation.

1. Before beginning the installation of any controls or other items associated with a project that includes economizers, perform the following steps:

    a. Carefully plan the location of the economizer(s), and review overall system details and equipment to be installed.

    b. Consider the following guidelines for the installation.

    - The air intake should not be located near vents, exhaust ducts, extremely heavy traffic areas, or anywhere else where noxious odors and fumes could be introduced into the cooler.

    - To maintain optimum airflow, avoid any obstacles or barriers that could impede performance.

    - Locate the unit a safe distance from power lines, service entrances, and where vandalism or tampering is less likely.

    c. Check the parts list and components supplied to make sure you have all of the items needed for the installation.

2. Measure and mark the cutout in the structure wall by using the dimensions shown in the installation drawing. The economizer's intake/exhaust ducts fit through a hole in the wall equal to the size of one standard cinder/cement block. Suggestion: Prepare a template with all of the mounting-hole locations to assist in the installation process.

3. Inside the marked cutout area, drill four pilot holes, one in each corner.

4. Cut out the entire marked area.

5. Mount the unit on the wall by sliding the intake/exhaust ducts through the cutout. Secure the unit to the wall using the mounting holes on the unit.

6. Insulate and seal the economizer and all penetrations through the wall and cavities (PVC ducts, etc.) with silicone sealant or the equivalent as to allow for the exclusion of dust, insects, and animals. Use expanding spray foam from can to seal potential problem areas, where necessary.

7. Align the pipe and fittings, and mount the automatic PVC damper on the inside wall of the cooler. The damper motor should be located on a side that makes it easily accessible.

8. Make the electrical power connections to a dedicated circuit breaker or fused load center. Wire the damper motor and end switch control.

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9. **Ducting:** Depending on the application, the economizer may be ducted using lightweight 6" PVC drain pipe and fittings.

    a. From inside the cooler, the pipe on the right is the intake (brings in cold fresh air), and the one on the left is the exhaust (discharges warm stale air to outside).

    b. The intake side should be ducted to bring air to the desired point in the room and to assure proper mixing with cooler air. The duct should be brought half to two thirds of the way into the cooler with the air stream directed toward the end of the cooler and up toward the ceiling to mix and diffuse the air. Proper ducting also prevents the air coming in from getting shunted and sucked out through the exhaust.

    c. Any ducting used inside the cooler must conform to National Sanitation Foundation (NSF) requirements such that the ability to clean the interior of the cooler and food protection is not compromised.

    d. If the cooler is not on an outside wall, the duct passing through the heated space must be insulated and tightly sealed to prevent condensation on the outside of the PVC duct. The damper should still be located on the inside wall where the duct enters the cooler.

Preventive Maintenance for the Economizer

Caution: Make sure that the electrical power is disconnected before servicing the economizer.

1. Clean the unit before seasonal startup.

    a. Wash the unit with soap and water to remove any dirt buildup during the off period.

    b. Clean the interior of the unit (ducting and chambers) with a solution of bleach and water to sanitize the interior sections of the system.

2. Inspect and clean any inlet and exhaust screens.

3. Clean and check the damper for correct operation and clearances.

4. Check all gasketed surfaces for proper sealing.

5. Check and change the air filter.

    a. Remove the screws and open hinged door to access and remove the old filter.

    b. Installing the proper filter for the application is critical.

    c. In packaged food coolers, conformance to the Food and Drug Administration's "Grade A Pasteurized Milk Ordinance (1989)" must be followed.

    d. In areas with open foods, a charcoal filter is recommended and should be changed more frequently (from two to four times per cooling season).

    e. The filter may require more frequent changing, depending on the run time and surrounding environmental conditions.

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6. Lubricate the motors.

    a. The motor manufacturer recommends a monthly lubrication of two drops of 20-weight motor oil into each lube hole.

    b. Do not over lubricate the motor. Wipe up all spills and excess oil to prevent introducing oil vapors into the air stream.

7. Turn on the electric power.

8. Test the system for proper operation.

9. The system is now ready for service.

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Figure 4. Typical Line Voltage Signal

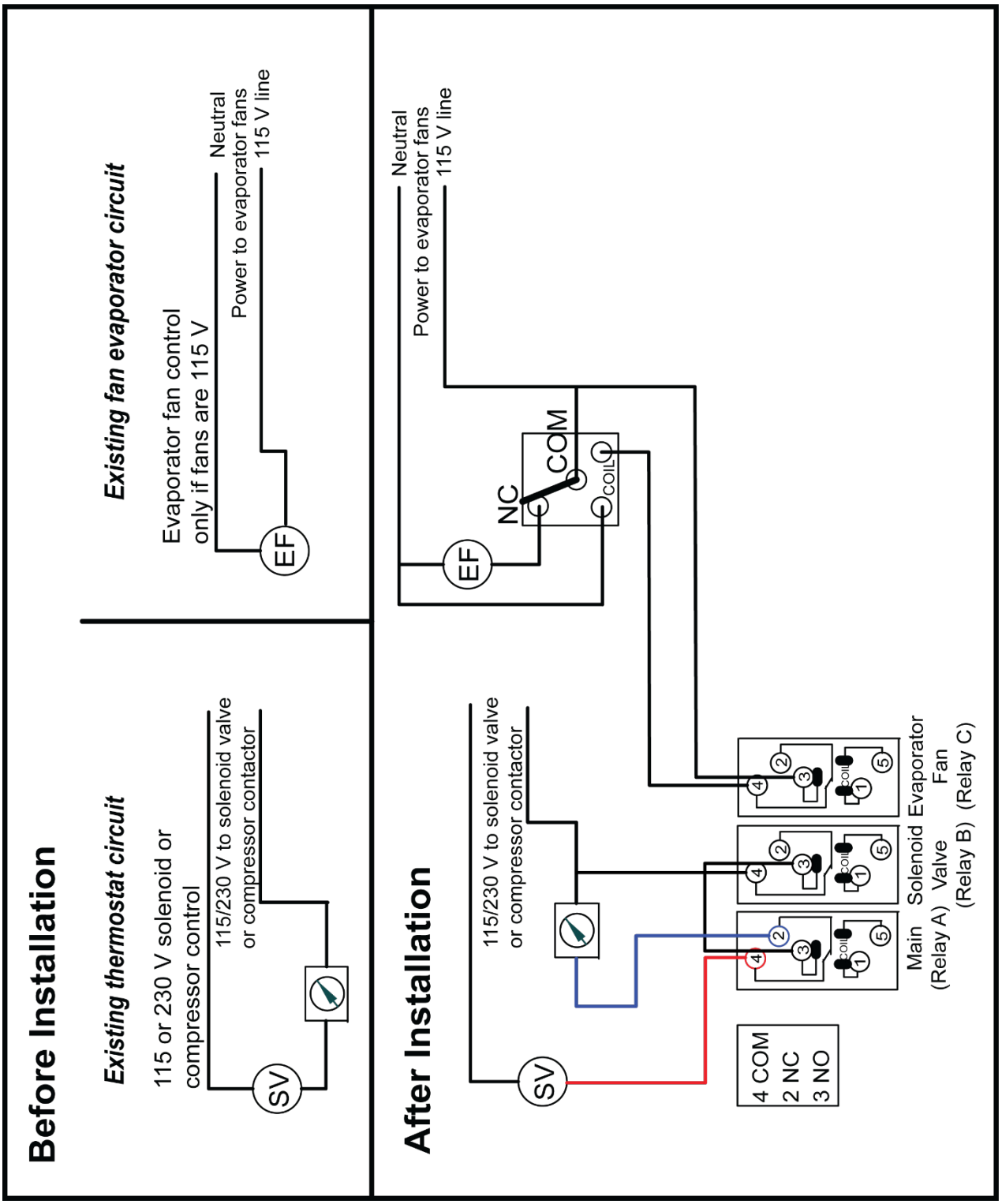

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Figure 5. Evaporator Fan Control with 24-volt Coil

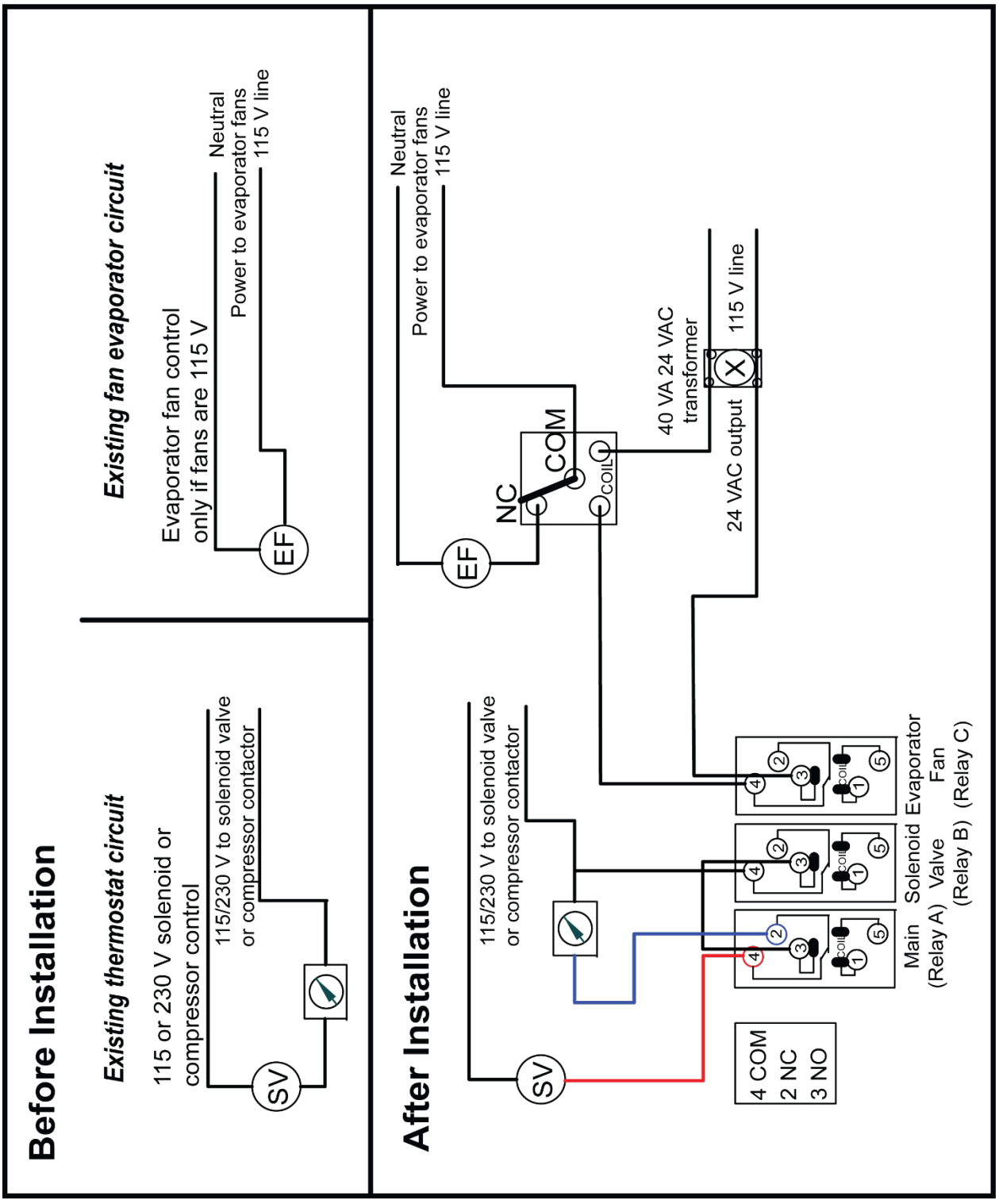

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Figure 6. Solenoid and Evaporator Fans: Two Zones with One Existing Thermostat

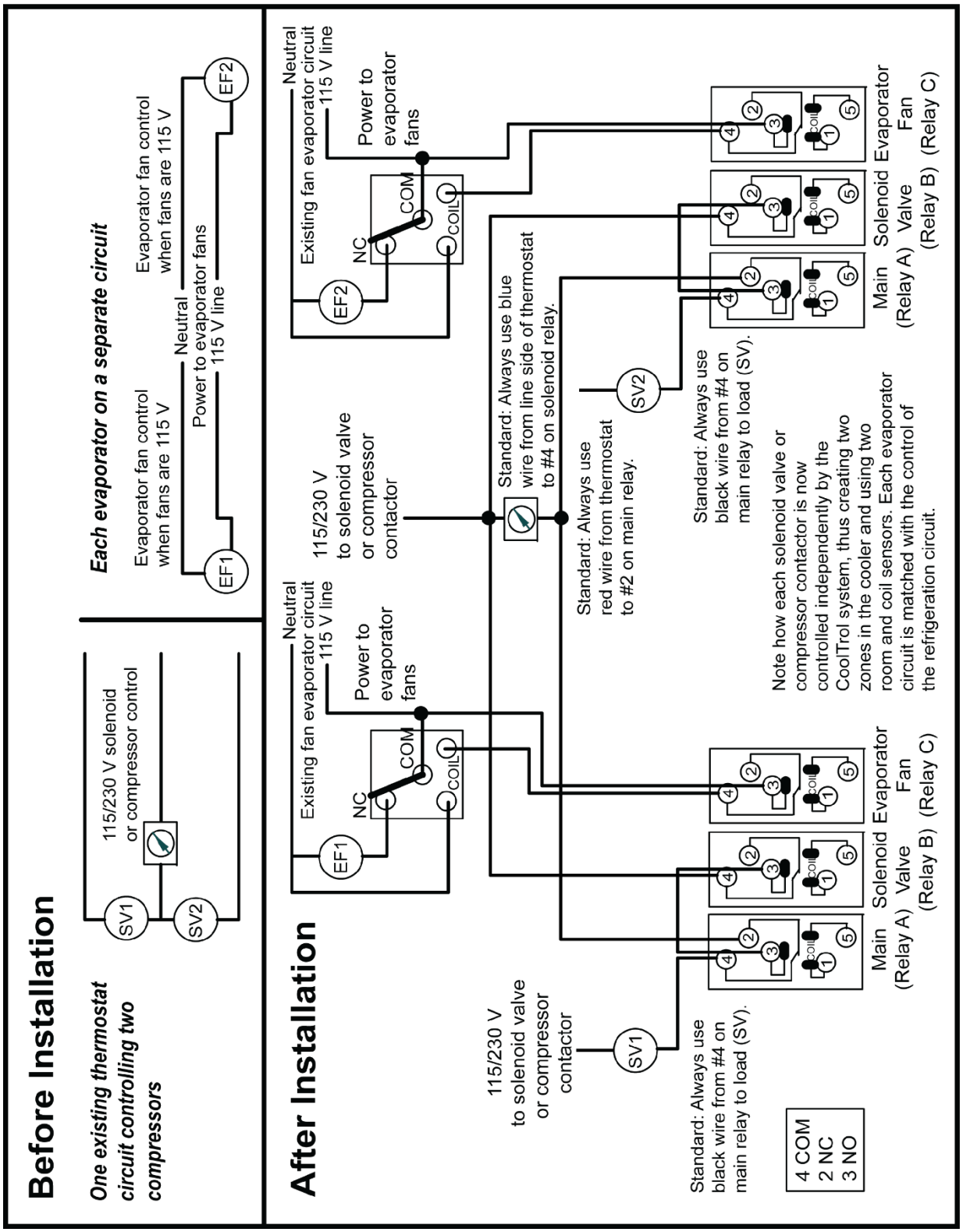

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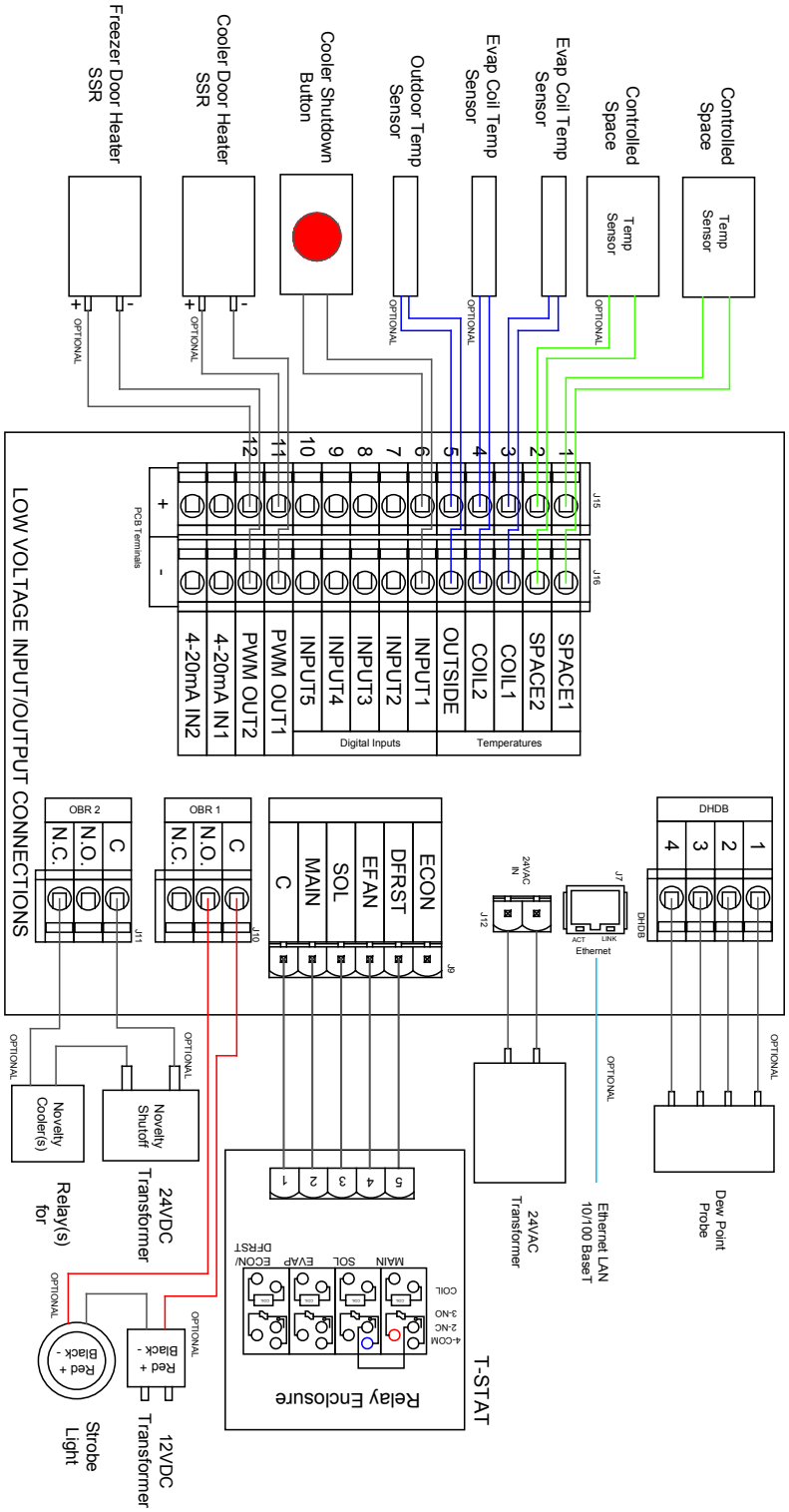
Figure 7. System Layout



CCS2 Installation Procedure

Pre-Installation Cooler Evaluation

1. Is each thermostat controlling one cooling circuit?
2. Where is the best location to mount the controller?

   Note: In rare cases, the thermostat is switching one leg of a single-phase compressor. In this case, a contactor/relay capable of switching the rated load must be installed, such that the existing thermostat will control the contactor. This is important, because the small control relays can only carry 10 amps and would fail if switching compressor load.
3. Is the controller properly configured? Does the setup of the controller match the equipment on site?
4. Are evaporator fans and other equipment operating properly?

   Evaporator fans that fail could cause icing problems on coil due to low heat pickup. (Note all pre-existing conditions or problems with equipment, and inform the manager/owner.)
5. Is the cooler/freezer operating within the desired temperature range?

   Note settings and observe during installation.

Installing the Cooler Control System

1. Install the controller.
   a. Locate the controller at roughly eye level so that any clerk can view the display. Review where equipment will be mounted with the owner/manager, and explain why you selected a particular location.
   b. Install the power supply to controller, but do not power it up yet.
   c. Install the cooler and coil sensors. Use 18- to 22-gauge shielded cable and crimp connectors. Use gel-filled crimps, especially on sensors, to prevent oxidation and ensure a reliable long-term connection.

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Important:

It is very important to locate and mount the cooler room sensor(s) in a location that allows the controller to optimally control and maintain temperature. Carefully examine the location of the existing temperature probe/thermostat and consider airflow within the space. The probe should be somewhere behind the evaporator where it draws in the air to be cooled. The sensor should sense the air temperature just before it passes through the evaporator where it is cooled. If two room sensors are installed, the controller uses the average temperature as the control temperature.

d. Power up the controller (leave in bypass mode) so that you can monitor temperatures while you install the rest of the system, including the shutdown button, strobe light, and relay enclosure (tie into thermostat circuit(s) and evaporator fans).

DO NOT MAKE FINAL CONNECTIONS TO LOW-VOLTAGE RELAYS AT THIS TIME.

ALWAYS SEAL PENETRATIONS INTO COOLER OR FREEZER TO PREVENT CONDENSATION FROM FORMING USING SILICONE OR OTHER ACCEPTABLE SEALANT.

BE SURE THAT POWER TO THE CONROLLER IS OFF WHEN CONNECTING TO THE LOW-VOLTAGE SIDE OF THE RELAYS OR TO THE TERMINAL BLOCKS.

Note:

If you are controlling a freezer, locate the relay enclosure outside of the freezer and pipe over to it. Usually the freezer is very full and hard to work in. Sometimes you can locate all circuits in the junction box outside of freezer and make your connections there, but most likely if the thermostat and solenoid are in the freezer, you must run at least one wire into freezer to bypass the thermostat.

4. Install the cooler load (shut down) button(s). Locate the cooler load button in a place that the clerks can reach it: 48 inches from the floor, near the handle, to open the cooler.

   In certain cases where there are two entrances to a cooler, two buttons can be used in parallel to control the same cooler.

5. Run the low-voltage wire to the relay boxes. Use 4- or 5-conductor 18- to 20-gauge thermostat wire, since it is less expensive than shielded twisted-pair cable, which should be used for sensor wire. **MAKE SURE THE POWER IS OFF TO CONTROLLER BEFORE ATTEMPTING TO CONNECT WIRES.** As long as the controller is in bypass, you should be able to make connections safely, but why take a chance?

6. Once all of the connections are made, verify that the wires are going to the correct terminals.

7. Optional Alarm Strobe Light - Install the strobe light and power supply.

   a. The strobe light should be mounted on ceiling, or in a location where a clerk will notice it. Also, you should ask the owner/manager for their preference in placement. It should be installed in a location where it will be noticed at all times.

b. Install the plug-in 6-12 VDC transformer to power strobe light by plugging it into an outlet that will always be energized (where they plug in modems, etc.; be careful not to disconnect sensitive equipment like computers or gas pump monitors).

c. Note that polarity is important for the strobe to work properly.

YOU ARE ALMOST THERE.

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System Test Procedure for the CCS2

Testing the Inputs

To determine if installation was successful, the controller must be turned on. (If an optional bypass switch is installed, it must be placed in the run position.) Then follow the test procedure outlined in the setup instructions that are also summarized below:

- ☐ Check the setpoint, time, and cooler name in the **Setup Menu** and adjust, if necessary.
- ☐ Press **[Info]** once to view the temperature probe values (Local Probes display). Then check the temperatures for each probe (see table below).

P1	Space probe 1
P2	Space probe 2
P3	Coil probe 1
P4	Coil probe 2
P5	Outside temperature

  Make sure that the thermistors are wired to the correct inputs. You can check this by placing your hand on the temperate sensor to warm it and checking the display to make sure the appropriate sensor registers the temperature increase.

- ☐ Check the **Shutdown Button**. While the cooler is running, press this button and watch for the cooler operation to shut down.

Testing the Outputs

- ☐ Press **[Menu]** to enter the **Main Menu**, and press the arrow keys to select the **Test Menu**. Then press **[Set]** twice to start the test. Wait until "Test System" is displayed. All equipment (solenoid/compressor and evaporator fans) should turn off immediately. (If this is a pump-down system, the compressor may still run.)
- ☐ Test the solenoid, evaporator fan, strobe, night shutoff and free cooling, if present. Press the arrow keys to select the item. Then press **[Set]** to toggle functions on and off. To move to the next group of outputs, press the **[Menu]** button. Make sure the equipment is turning on and off for the correct cooler.
- ☐ If an economizer system is included, check the damper's operation and clearances.
- ☐ To exit Test System mode, press **[Esc]**. Please note that the controller will end test mode after 45 minutes.
- ☐ After completing the test procedure, **verify that the pre-existing controls still work when the controller is placed into Bypass mode**.
- ☐ Don't forget to place the controller back in **Run** mode when you are finished testing.

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Post-Installation Inspection Checklist

After you have installed the controller system, review the following checklist and follow the test procedure to make sure all systems are functioning properly.

- ☐ Verify that the controller is in a safe location, away from potential abuse.
- ☐ Check the wiring to ensure that the connections are secure.
- ☐ Verify that the sensors are in the proper locations. Relocate if necessary.
- ☐ Make sure that any cooler penetrations are sealed to prevent condensation from entering through conduits or holes for low-voltage wiring.
- ☐ Verify that the Night Shutdown cord is in a safe location. Relocate if necessary.
- ☐ Test the controller system using the test procedure outlined in this manual.
- ☐ Note any special wiring or control issues that may be useful during future service calls and leave this information with the controller information packet. Important information would be the location of door heater relays that may be hidden from plain sight or special wiring schematics for controlling the cooler. Note any unusual operation of the compressor and evaporator fans, or other malfunctions observed during installation. (Report this to the owner/manager.)
- ☐ Make sure that the Economizer filter is installed correctly.
- ☐ Make sure the time is set, and the correct time zone is set.

Contacting Technical Support

If you have questions or need help with installation, call National Resource Management at:

(800) 377-5439, ext. 1

or via email at **service@nrminc.com**

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Alarms

High-Temperature Alarm (default configuration)

- If the temperature is greater than the setpoint + differential + 5° F for more than 45 minutes, the alarm will flash. (If the defrost is not controlled, and the defrost type is Air Defrost, the time is 90 minutes).
- The alarm time increases during defrosts and shutdowns.
- Setbacks increase the alarm temperature, or disable the alarm if the cooler is turned off during a setback.
- The high-temperature alarm can be enabled or disabled in software. The high temperature alarm can also be set to alarm in the Bypass mode; however, the original thermostat's setpoint may be different, which could cause false alarms.
- The alarm is silenced for one hour the first time the alarm silence button is pressed. After the first alarm silence period is over, the alarm is silenced for 24 hours on subsequent presses.

Low-Temperature Alarm

- If the temperature is 3° F below the setpoint for more than 20 minutes, the alarm will flash.
- If the economizer is active, the alarm temperature is 3° F below the economizer's setpoint.
- The low-temperature alarm can be enabled or disabled in software.
- The alarm is silenced for one hour the first time the alarm silence button is pressed. After the first alarm silence period is over, the alarm is silenced for 24 hours on subsequent presses.

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Frequently Asked Questions

How can I change the setpoint?

1. Press **[MENU]**.
2. Press **[SET]**.
3. Press the down arrow repeatedly until the display reads, “Setpoint.” Then press **[SET]**.
4. Use the up and down arrow keys to adjust the temperature setpoint. When the setpoint is what you want, press **[SET]**.
5. You can exit the menus by pressing **[ESC]**, or you can just wait a minute, and the controller will return to normal operation.

How do I set the?

1. Press **[MENU]**.
2. Press **[SET]**.
3. Press the down arrow repeatedly until the display reads, “Time.” Then press **[SET]**.
4. Use the up and down arrow keys to adjust the hour. Press **[SET]** to move to the minutes, and use the up and down arrow keys to adjust. Then press **[SET]** and repeat to set the seconds. When you are finished, press **[SET]** to save the time.
5. You can exit the menus by pressing **[ESC]**, or you can just wait a minute, and the controller will return to normal operation.

What if my CoolTrol needs service?

If you should ever need service for the CoolTrol system, you can call NRM and receive phone support or set up an appointment for a controls technician to come to your location. You are also free to work through your regular service technician. NRM is always happy to provide phone support and parts to your preferred technician.

Can my refrigeration technician still service my cooler?

Absolutely! If your refrigeration technician is unfamiliar with CoolTrol, they can simply switch CoolTrol to the Service Bypass operating position and service your equipment no differently than they would a cooler with an ordinary thermostat. When the mechanical equipment is running correctly, they can simply switch CoolTrol from Service Bypass to the Run operating position to restore the energy-saving features.

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What is the Run Bypass Mode?

The control box has a run/bypass button and optional switch. When the controller is in bypass mode, all relays are de-energized. The relays go to their normally closed (NC) positions, and the original control circuit is reestablished. The cooler is now operating on the original thermostat.

This mode is used for these purposes:

1. Your service technician can put the CoolTrol CCS2 into the Service Bypass mode so they can work on your refrigeration equipment no differently than they would a cooler/freezer with an ordinary thermostat.
2. If you suspect the CCS2 has a problem with the cooler/freezers control.
3. If there is a problem with the CCS2 and you want your cooler/freezer to run the same as it did before the CCS2 was installed.

What is the difference between the Run and Bypass settings?

The CCS2 has two operating modes: Run and Bypass. When the system is running, the CCS2 has full control of the cooler/freezer's temperature and fan cycling. When the system is bypassed, the CCS2's control has been taken away. This means the existing mechanical thermostat is now controlling your cooler/freezer, and the evaporator fans will run continuously. This is the way your cooler/freezer was controlled before the CCS2 was installed.

I put the CCS2 into the Run mode, and the fans and compressor shut off. Is this okay?

This is normal operating procedure. The CCS2 has a built-in two minute time delay when the CCS2 either powers up or is switched from Bypass to Run. After the two minute time delay, the CCS2 will resume its normal operation.

Are there any ramifications with putting the CCS2 into Bypass mode?

Yes. The main and most important issue is that your cooler/freezer no longer has energy savings measures available when it's operating in Bypass mode. Your cooler/freezer should run fine (as long as refrigeration equipment is working properly), but you are not saving any energy. (Isn't this why you purchased the CCS2 in the first place?)

Another issue with Bypass mode is that your cooler may not have any defrost times set. When the CCS2 is running, it will control the air defrost in a cooler, but when it's in Bypass mode, it will not perform any defrosts. If your existing defrost clock has been disabled, your cooler will not perform any defrosts while in Bypass mode. If it is a freezer that is bypassed, there's no need to worry, because the CCS2 does not perform its own defrost. The CCS2 is wired to let the existing time clock perform its original defrost schedule.

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How many sensors does the CCS2 use?

The CCS2 can use up to two sensors to measure the space temperature. It uses the average temperature to control the cooler. The CCS2 can have up to two coil sensors, which is used to control the length of defrosts and safely shut off the evaporator fans after pump down. It uses the coldest of the two temperature values to control the evaporator fans.

Where are the CCS2 sensors located?

The space sensor is placed in the return draft of the evaporator fans in the controlled space. This is usually located behind the evaporator unit on the wall. If this space is not available or determined unsatisfactory, it is then usually located next to the existing mechanical thermostat. The coil sensor is located in the fins of the evaporator coil.

Note: If the sensor is hanging out of evaporator coil, just push the sensor back into the fins of the coil.

Do I have to maintain my CoolTrol equipment?

The CoolTrol system does not require any scheduled maintenance. The only item that should be changed once a year is the Economizer Air Filter. NRM is always updating its CoolTrol software. You may contact NRM at any time to see if your CoolTrol can be updated to the new program version. Please note that your refrigeration system should be maintained regularly. We always say, "CoolTrol is only as good as the refrigeration system in which it's installed." If your refrigeration is not running at peak performance, this will impact CoolTrol's potential savings.

Is it okay that my cooler/freezer seems to run all the time, but is maintaining temperature?

This is cause for concern, because it means you are not saving any energy. There can be a couple of reasons for this. Switch the CCS2 into Bypass mode. If the cooler/freezer begins to run better, call NRM. If it is still running continuously, call your service technician.

How does the defrost work on the CCS2?

The CCS2 is programmed from the factory to initiate a minimum 14-minute defrost for every 2.6 hours of compressor run time. The CCS2 automatically logs the number of hours the compressor has been on. Once the compressor has been on for 2.6 hours, The CCS2's defrost will last a minimum of 14 minutes. The defrost will extend longer if the coil sensor detects any ice. The termination temperature is automatic for air defrosts, but can be adjusted for electric defrosts.

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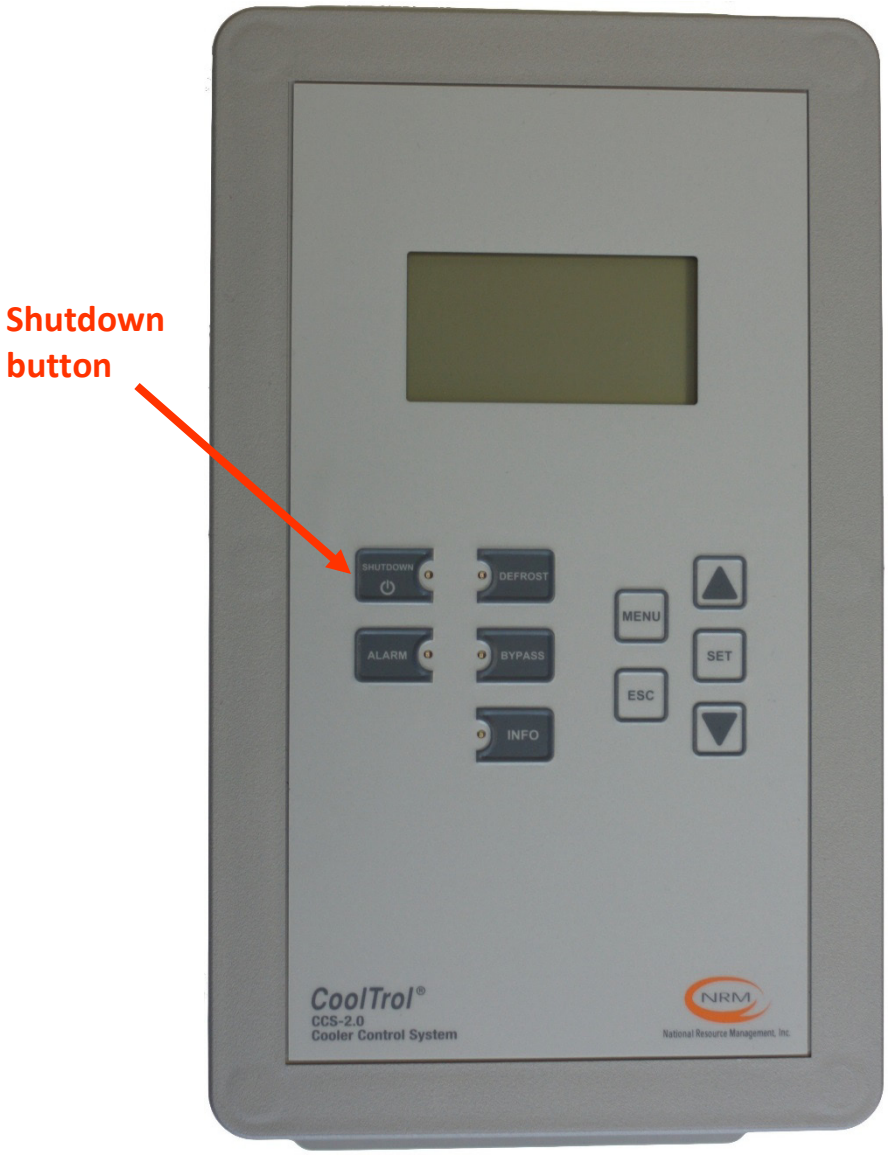
What does the Shutdown button do?

A CCS2 installation includes a Shutdown button. This button is for your convenience and energy savings when you are loading or doing inventory of your cooler/freezer. If you push this button once, it will shut off the fans and refrigeration for 20 minutes. If you push the button again within the 20-minute period, the refrigeration and fans will return to the original cycle. If the button is not pushed, the refrigeration and fans will start automatically after 20 minutes. If the button is then pushed after the 20-minute restart, it will go into another 20-minute shutdown. After the second 20-minute shutdown, the CCS2 will not allow another shutdown until the cooler/freezer has reached setpoint.



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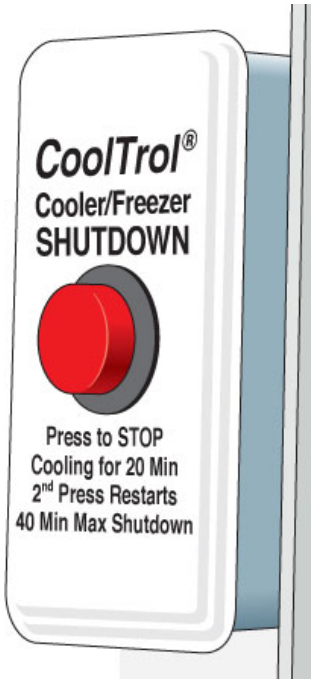

What is my temperature differential on the CCS2?

Temperature differential is a term used by the refrigeration trade to describe the temperature difference between the time your system stops calling for cooling to the time it starts calling for refrigeration again. The temperature differential for the CCS2 is 3 degrees. For example: if your setpoint on your cooler is 38 degrees, this is the temperature at which the CCS2 will stop calling for refrigeration. The CCS2 will then stay idle until the temperature reaches 41 degrees. The purpose of this is to prevent your compressor from turning on and off at a rapid pace. If you are concerned about your product temperatures, don't allow the air temperature changes (your differential) to rise above the product's recommended levels.

How can I maximize the efficiency of my cooler/freezer?

The CCS2 offers various ways to help you keep your refrigeration system running at its peak performance. You can use the information that the CCS2 collects to help you determine if your cooler/freezer is running at its maximum efficiency.

- **Cooler Setback**—This option is good for coolers that do not contain any perishables, and it allows you to increase the setpoint of the cooler for a period of time. This is usually used during the time your store is closed. (Refer to your operation manual for setup instructions.)
- **Time/Date**—As trivial as this sounds, it is very important to make sure the time and date are maintained correctly. The time is used mainly for shutting down novelty coolers, but it may also be used for cooler setback times and defrost start times.
- **Economizer Filter**—The Economizer filter should be changed at least once a year. The more nice cold, *free* air the economizer can bring in, the less the compressor will have to run—saving money and energy.

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- **Cooler Bypassed**—If your CCS2 is in Bypass mode, the CCS2 has no control of your cooler/freezer. In order for the CCS2 to control your refrigeration and save energy, you must make sure it is kept in the Run mode.