

ClimateMaster

CMC 2000 Series

Electronic Controller

Installation, Operating & Maintenance Instructions

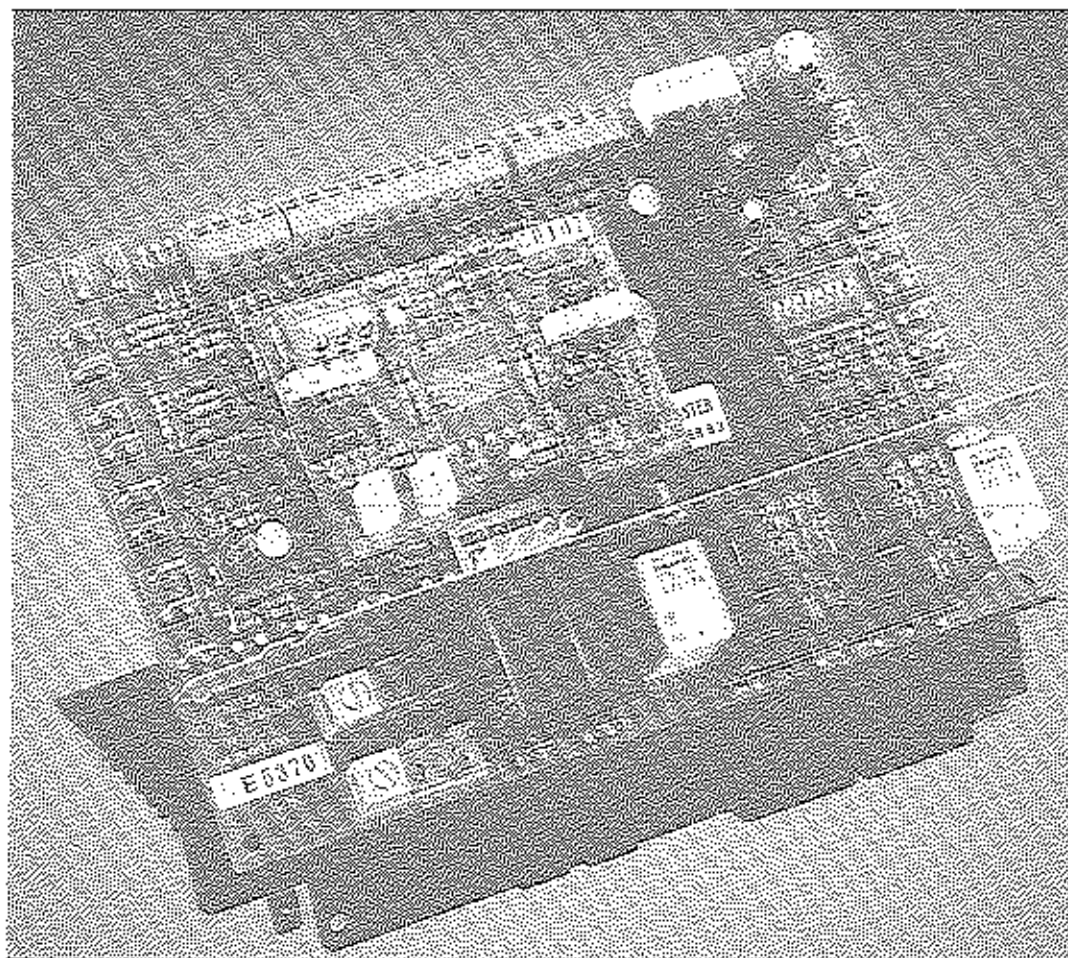


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INTRODUCTION

This Installation and Operating manual is for ClimateMaster CMC 2000 Series Electronic Controller (CMC).

ClimateMaster CMC Controllers are typically factory installed within the control section of the ClimateMaster HVAC equipment and are shipped with the unit. Sensors and other peripherals are typically shipped loose in the same carton for field installation.

ClimateMaster offers three standard electronic controller configurations of the CMC Controller to allow flexible matching of controller features to application requirements. Refer to the Table below to determine the features available in the CMC Controller to be installed.

Feature	Electro-Mechanical	Electronic CMC-2001	Electronic CMC-2005	Electronic CMC-2010
High Pressure Protection	S	S	S	S
Low Pressure Protection	S	S	S	S
Low Refrigerant Gas Protection	S	S	S	S
Low Water Flow Protection	S	S	S	S
Room Temperature Set Point - In Room	S	S	S	S
Room Temperature Set Point - Remote				S*
Display Room Temperature - In Room	S	S	S	S
Display Room Temperature - Remote				S*
Demand Load Shed	O	S	S	S
Low Voltage Protection	O	S	S	S
High Voltage Protection	O	S	S	S
Emergency Shutdown	O	S	S	S
Random Start	O	S	S	S
Anti-Short-Cycle Time-Delay	O	S	S	S
Condensate Overflow Switch	O	S	S	S
Intelligent Re-set	O	S	S	S
Quick Service Test		S	S	S
Reduced Reversing Valve Operation		S	S	S
LED Status Lights	O	S	S	S
Night Setback	O	S	S	S
Night Setback Override - Remote				S*
Night Setback Override - Local	O	S	S	S
High/Low Fan Speed			S	O*
Pump Restart	O	O	S	O
Compressor Run Hours				S*
Compressor Starts				S*
Fan Run Hours				S*
Remote Alarm				S*
Local Alarm	O	O	O	O
Local Alarm For Filter Replacement	O	O	O	O
Remote Alarm For Filter Replacement				O*
Local Alarm For Condensate Overflow	O	O	O	S*
Remote Alarm For Condensate Overflow				O*
RS-485 Communication		U	U	S
Outdoor-Air Damper-Control	O	O	e	e
Motorized Water Valve	O	O	e	e
Totally-Automated Building Interface				O*
Leaving Water Temperature Display				O*
Multiple Units On One Thermostat		3	3	3
Leaving Air Temperature Display				O*

S = Standard Feature

O = Optional Feature

U = Upgrade

e = either Outdoor-Air Damper-Control or Motorized Water Valve can be selected, but not both.

* This feature requires a personal computer to link to the system with the required ClimateMaster software.

GENERAL INFORMATION

Overview

This manual includes discussion on the following controller options:

Centralized communications via Direct Digital Control (DDC); Diagnostics; Fan speed control; Energy management functions; Controller use with standard mercury-bulb thermostats; Controller use with electronic programmable thermostats; Controller use with damper or water valve electric operators.

General Operating Parameters

The following are general operating parameters for the CMC 2000 Series Controller:

Operating Environment: 40° F (4.4° C) to 140° F (60° C) 5 to 95% relative humidity, non-condensing.

Storage Environment: 0° F (-18° C) to 158° F (70° C) 5 to 95% relative humidity, non-condensing.

Power Requirements: A dedicated 24/8.5 VAC, 50-60 HZ, 1 PH, 40 VA transformer is required. (Revision E uses a 24 VAC secondary only)

Relay Ratings

The following relays are included with the CMC 2000 Series Controller:

- **Compressor Relay:** 2 HP at 277 VAC
- **Fan High Speed Relay:** 2 HP at 277 VAC
- **Reversing Valve Relay:** 5 Amps at 24 VAC

Optional Components

The following optional components are available on the CMC 2000 Series Controller:

- **Fan Medium, Low Speed Relays:** 3/4 HP at 277 VAC
- **Water Valve Relays:** (Standard on Revision E) 5 Amps at 24 VAC

Optional RS-485 Communications

The following is required for optional RS-485 Communications:

Communication Link Wiring: Wires must be 18 to 22 AWG twisted pair, shielded wire. Maximum total wire length is 5000 feet.

Suggested cables: Belden No. 9855, Belden No. 9184 or Signal No. 88101

Revision Identification

A Revision E controller is indicated by an 'E' in the first character of the CMC board serial number. A serial number consisting of *numbers only* indicates a Revision D controller.

Features

The CMC 2000 Series controller offers the following features which improve the operation and safety of water source heat pump systems:

- Anti-short cycle protection
- High and low pressure cutouts
- High and low voltage cutouts
- Low water temperature (freeze) protection
- Random start
- Quiet reduced cycling reversing valve operation
- Diagnostic LED's
- Reset lockout at unit or at disconnect
- Intelligent reset
- Condensate overflow sensor
- Ability to work with any electronic or electro-mechanical thermostat. (Revision D requires adapter board)
- Night set back, compressor shut down and emergency shut down. (Revision D uses an adapter board or auxiliary isolation relays)
- Elimination of time delays for field servicing
- RS-485 communications (Optional)
- Three-speed fan control (Optional)
- Damper control relay (Optional)
- Electronic room sensor (Optional)

Installation of Power Wiring

▲ WARNING

All wiring must comply with the National Electric Code and all local codes.

CAUTION!

The CMC 2000 Series Controller uses static sensitive CMOS components which may be damaged by static. To prevent damage to the components during service, **DO NOT TOUCH CIRCUIT BOARD COMPONENTS. HOLD THE CIRCUIT BOARD BY THE EDGES ONLY.**

Single-Phase Equipment

Wire Single-Phase equipment requiring less than 10 amps at 240 VAC (2.4 kva) as follows:

1. Connect the incoming main power from an NEC or local code approved disconnect device to terminals L1 and L2 on the control board. Refer to the wiring diagram attached to the unit.
2. Connect a ground wire from the power source. Earth-ground couple to the chassis ground screw is provided in the control box. Use copper conductors only.
3. Do not run the AC power wiring in the same conduct with low voltage wiring.

Three-Phase Equipment and Single-Phase over 10 AMPS:

Wire Three-Phase equipment and Single-Phase equipment requiring 10 amps or more at 240 VAC (2.4 kva) as follows:

1. Connect the incoming main power from an NEC approved disconnect device to the line voltage connections in the control box. Refer to the wiring diagram attached to the unit.
2. Connect a ground wire from the power source. Earth-ground couple to the chassis ground screw is provided in the control box. Use copper conductors only.
3. Do not run the AC power wiring in the same conduct with low voltage wiring.

UNIT OPERATION

Powering up Unit

Turn on power. Verify that the green LED light is illuminated. The following conditions indicate that a fault may be present.

- Green LED is not illuminated (located below dip switch - Version E)
- Four (4) alarm LED's are blinking
- One (1) alarm LED is illuminated

Refer to diagnostic and Control Board Trouble Shooting charts on pages 13-15.

Normal Operation

The Controller operates in normal mode when the green LED is illuminated to indicate that power is applied and no alarm LED's are illuminated or blinking.

Thermostat Inputs

R - G Fan Only - The fan energizes when a closure occurs. On units without fan speed control, the closure is controlled by the tap at the motor wired to meet the installation requirements. On units where the fan speed option has been supplied, closure occurs at the speed selected.

R - Y Cooling - The first time a closure occurs, the fan starts immediately unless one of the Hi, Me, Lo inputs are activated, due to the fan switch on the thermostat. The water valve relay is then energized,

which is followed by a 5 to 80 second random start delay. At this time, a 20 second fixed delay is applied, after which the reversing valve is energized. One second later, the compressor is energized.

When the input opens, the compressor is de-energized. One second later the water valve is de-energized. After an additional 30 seconds, the fan is de-energized unless one of the Hi, Me, Lo inputs are activated.

On all subsequent closures, the sequence is the same as for the initial closure except that the 5 to 80 second random start delay is omitted.

NOTE: The compressor energizes 20 seconds after the water valve and the fan are energized unless the controller has damper option selected. If the damper option is selected, the 20 second delay for the compressor is eliminated and the water valve relay is energized 30 minutes after the compressor first start-up at initial power on or the deactivation of the USD Set back function.

R - W Heating - R-Y Heating operations follow the same sequence of functions as R-Y Cooling except that the reversing valve is *de-energized* during the heating mode.

R-L Night Setback (Unoccupied) Over-ride

1. CMC 2000 Revision E - A momentary closure between R and L returns the unit to the occupied mode for 2 hours. At the end of this 2 hour period, the unit returns to the unoccupied mode. If the closure between R and L is continuous, the controller acts as if a thermostat is connected and returns the unit to occupied mode until the thermostat is satisfied.

2. CMC 2000 Revision D - When the CMC 2000 Controller Revision D is used without a USD, CSD, ESD adaptor board (part number 69183003), Dip Switch #6 functions as follows: Set Dip Switch #6 to OFF and a momentary contact closure of R-L provides a 2 hour override. Set Dip Switch #6 to ON and R-L turns the unit on in heating mode as long as R-L is closed.

When the CMC 2000 Controller Revision D is used with a USD, CSD, ESD adaptor board, Dip Switch #6 functions as follows: Set Dip Switch #6 to Off and a momentary contact closure of R-L provides a 2 hour override. A closure of R-W2 activates a temperature override and the unit runs in heat mode until satisfied.

R-HI-ME-LO Fan Speed Select (Optional)

Fan Speed Control (Optional) - Fan speed is manually selected at the thermostat for high, medium or low. The selected speed provides contact closure between R-Hi or R-Me or R-Lo to activate the fan. Consult equipment blower performance tables in the product specifications for air volume and pressure characteristics typical of each speed. Select the speed which allows the blower to overcome any excess static pressure drop from ductwork, registers or grilles connected to unit supply or return openings.

Dip Switch Settings

Check Board Revision Before proceeding.

CMC 2000 Revision D

Dip Switch #1-5 - Address for RS-485 communications. See Table 4, Page 11.

Dip Switch #6 - "OFF" - Momentary R-L closure provides a 2-hour override of the unoccupied mode. A closure of R-W2, initiated on a manual or automatic call for heat from the thermostat activates a *temperature override* until demand for cooling or heating has been satisfied. "ON" - R-L closed, unit runs in the occupied mode as long as R-L is closed (i.e. from a low temperature, set back thermostat). An "ON" setting deactivates the *timed override* capability.

Dip Switch #7 - "ON" - Normal operation. "OFF" - Used in consoles with normally open safety controls.

Dip Switch #8 - "OFF" - Over/under voltage protection active. "ON" - Over/under voltage protection deactivated.

CMC-2000 Revision E

Dip Switch #1-5 - Address for RS-485 communications. See Table 4, Page 11.

Dip Switch #6 - "ON" - Auxiliary relay for pump restart or motorized valve option is energized 20 seconds prior to compressor energization. "OFF" - Auxiliary relay for damper option opens 30 minutes after USD returns to occupied mode.

Dip Switch #7 - "ON" - Safety contacts LTS, LPS and HPS are normally open. "OFF" - Safety contacts LTS, LPS, and HPS are normally closed.

Dip Switch #8 - "ON" - Resets board from main power switch on a console unit. A horizontal or vertical unit, reset is accomplished by momentarily turning the system switch to the "OFF" position at the thermostat. "OFF" Reset function by cycling the main power only.

NOTE: To reset the board at the thermostat, the fan switch on the thermostat must be in the "AUTO" position.

▲ CAUTION

After changing dip switch settings, turn the unit off at the disconnect and power up to initiate the new unit settings.

Energy Management Operation Modes

Load Shedding - (CSD Terminal)

CMC-2000 Revision E - When the CSD terminal is connected to a chassis ground through an external contact closure, the compressor is stopped. When the contact opens, the compressor returns to control by the thermostat after random time delay and anti-short-cycle times functions have elapsed. This function cannot be over-ridden.

Unoccupied - Night Setback - (USD Terminal)

CMC-2000 Revision E - When the USD terminal is connected to a chassis ground through an external relay closure, the compressor and the fan de-energize. When the USD terminal is opened, the unit returns to occupied mode after all random start and anti-short-cycle time functions have elapsed. This function can be over-ridden at the thermostat.

Emergency Shutdown - (ESD Terminal)

CMC-2000 Revision E - When the ESD terminal is connected to a chassis ground through an external contact closure, the controller de-energizes all outputs. These outputs remain de-energized until the ESD terminal is opened. The unit returns to normal operation after random start and anti-short-cycle times functions have elapsed. This function cannot be overridden.

CMC-2000 Revision D - This revision is provided in two versions. One version has an adapter board mounted to the USD, CSD and ESD terminals. Reversion E does not require an adapter board.

When an adapter board is used, the method of activation and function of CSD, ESD and USD is the same as with the Revision E board. When the adapter board is not used, the ESD, CSD and USD functions are activated by OPENING a circuit. The function of the unit itself is the same.

Safety Features

The following safety features are provided to protect the compressor, heat exchanger, wiring and other components from damage caused by operation out of the range of design conditions.

HPS - High Pressure Switch (NC) - Green LED

This switch opens at a refrigerant pressure of 375 PSI. The high pressure LED is lit. (NOTE: Some units may be equipped with Normally Open (N.O.) switches.)

LPS - Low Pressure Switch (NC) - Orange LED

This switch opens at pressure drops below specification. This input will be ignored for the first two minutes after a demand for heating or cooling. The low Pressure LED is lit. (NOTE: Some units may be equipped with Normally Open (N.O.) switches.)

LTS - Low Temperature Switch (NC) - Red LED

This switch opens when the temperature of the water entering the condenser bundle drops below the set point. The low temperature (freeze) LED is lit. (NOTE: Some units may be equipped with Normally Open (N.O.) switches.)

HCLS - Condensate Overflow Sensor - Yellow LED

Closure of this input activates the lock-out circuit. This input operates when the water level in the condensate pan rises to the height of the sensor. The condensate overflow LED is lit. (Optional on Revision D Units.)

Under and Over Voltage Protection

When an under or over voltage condition exists the controller locks out the unit. When the condition clears the controller releases the unit to normal operation and the compressor runs after random start and anti-short-cycle timers are met. All alarm LED's flash.

Faulty Wiring

If the thermostat is wired incorrectly or when there is a simultaneous call for heating and cooling, the 2 inner alarm LED's are lit (Green and Orange).

Reset of Lockout

The controller is reset at the thermostat or at the disconnect switch, See Dip Switch #8, settings.

The controller has an intelligent reset feature. After a safety control activates, the controller locks out the unit for 10 minutes. At the end of this period, the controller checks to verify that all faults have cleared. If faults have cleared, the controller restarts the unit. Should any fault occur within the subsequent 30 minutes, the controller locks out the unit until the unit is manually reset.

Fault Indications and Diagnostic LEDs

The "X" terminal on the thermostat connector turns on when any fault occurs. This illuminates an LED on the thermostat sub-base. On Revision E boards, a 24-volt DC relay can be connected between X and C to provide a "dry contact" fault signal. (85 mA is maximum coil load.)

The Revision D board requires the use of an adapter board to provide an alarm signal to a DDC system. This adaptor provides a 40 mA open collector signal.

Maintenance

Check the condensate sensor for operation twice a year. Clean the sensor of any dirt that may have accumulated.

Test Mode

Test mode allows the serviceman to check the operation of the controller quickly. A jumper across the test terminals on the circuit board activates test mode. All time delays are eliminated. It is important to remove the jumper upon completion of service.

Interfacing The CMC 2000 Controller

The CMC 2000 has a 10 pin terminal block for the thermostat and the optional fan speed selector as shown in Table 1. NOTE: If the controller is Revision D and an electronic thermostat other than one supplied by ClimateMaster is used, an adaptor is required.

Table 1. Ten Pin Reference Table

Term	Description	Function
R	R on Thermostat	24 VAC control power
W1	W1 on thermostat	Heat mode
Y1	Y1 on thermostat	Cool mode
G	G on thermostat	Fan only mode
L	L on thermostat	Over-Ride input
X	Fault Output	24 VDC "X" terminal on thermostat
C	Board 24 VDC	24 VAC (Common)
HI	HI on fan speed selector	High fan speed (Optional)
ME	ME on fan speed selector	Medium fan speed (Optional)
LO	LO on fan speed selector	Low fan speed (Optional)

Interfacing The CMC 2000 Series Controller To External Equipment

The controller may be interfaced to any electro-mechanical thermostat that has "R" to "Y", and "R" to "W" terminals.

Thermostat Interface: Electronic thermostats that operate on 24 VAC can be interfaced to the thermostat connector. The CMC 2000 Series Revision D requires an adaptor board. Revision E wires directly. Some electronic thermostats require a dedicated transformer. **Revision E Boards:** If the thermostat requires a dedicated transformer, connect the thermostat transformer return line to ground on the board. Up to 3 units can be controlled in parallel from one thermostat without the use of adaptors or special wiring.

Feature Activation: Unit shut down (USD), compressor shutdown (CSD) and emergency shutdown (ESD) can be connected in parallel with other controller boards. Grounding any of these terminals activates the selected feature. Opening the circuit returns the unit to normal operation.

NOTE: CMC 2000 Revision D requires the use of an adaptor board or pilot relays to set up parallel units. Revision E boards wire directly.

Test Mode: To use test mode, connect a jumper with two 1/4" quick connects to the terminals marked test. Remove the jumpers after completion of service. NOTE: Failure to remove the jumpers may reduce equipment life and invalidates product warranties.

Ambient Temperature Sensor: A 5 pin terminal block is used for ClimateMaster Electronic thermostats and for the optional ambient temperature sensor.

Water valve or damper relay contacts - Revision E only: These are dry contacts which can be connected to any external valve or damper up to 5 amps (24 VAC). For damper function, set Dip Switch #6 to "OFF". For valve operation, set Dip Switch #6 to "ON".

Fault Signal for DDC Systems by other Manufacturers :

A "fault" signal required by another manufacturer's DDC system is provided by adding an opto-coupler to the Revision D board. This opto-coupler provides a 40MA open-collector output when a fault occurs. The Revision E board provides a dry contact closure through the use of a field or factory installed 24 VDC pilot relay.

Optional DDC Communications (RS-485) Wiring Instructions

For more detailed instructions on DDC Controls, see *CMC-2000 Series Electronic DDC Application and Installation Manual*.

CMC 2000 Series incorporates an RS-485 interface with on-board programming to communicate within a local area network (LAN). This capability is optional and may only be used within a distributed control LAN system by Control Systems International, Inc., Dallas, Texas.

RS-485: RS-485 is the industry standard (EIA) communication protocol for direct digital control (DDC) systems. The RS-485 communication protocol provides a standard interface to a DDC network. CMC 2000 Revision D Controllers are designed for direct connection to RS-485 communication networks. A multiple unit communication network requires that the adapter boards on all units within the network be electrically interconnected (hard wired).

Revision E Controllers are equipped with optional RS-485 communications via an "adapter board" which may be factory or field installed onto the CMC controller board.

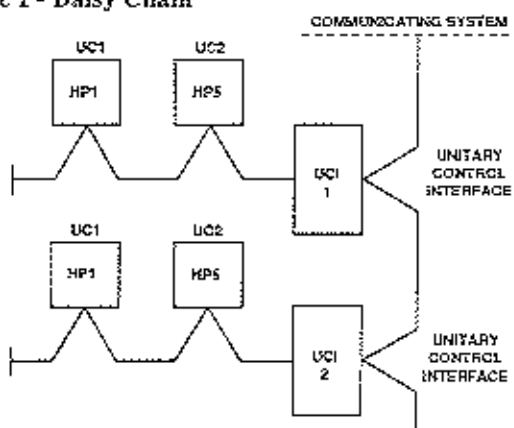
Revision Identification: Refer to Revision Identification information on page 4 to identify the Revision number of the Controller. The adapter board used with the Revision E Controller is attached piggy-back to the Controller and is stamped with ClimateMaster part number 69626501.

Revision D Applications: Consult ClimateMaster for more information on applications using Revision D controllers.

Revision E Applications: Follow the instructions below to build a communication network for CMC 2000 Revision E controllers equipped with adapter board part number 69626501. NOTE: When the following instructions cannot be precisely followed, please consult the factory for additional information. (Examples of special situations include applications where units must be installed more than 1000 feet (305 meters) apart, or applications where units must be installed in multiple facilities and cannot be hard-wired.)

Wiring: Wire units in a daisy-chain fashion as shown in Figure 1. Total cable length must not exceed 5000 feet (1524 meters) measured from the first device to the last device in the series.

Figure 1 - Daisy Chain



WARNING

All wiring must be in accordance with NEC and the regulations of ALL Authorities having jurisdiction and MUST conform to all applicable Code. When required by code, communications wiring may be installed in conduit. If conduit is utilized, a conduit designed specifically for communication systems must be used.

Interface Devices: Install a unitary controller interface (UCI) between the DDC adapter board and any higher level device on the network such as a personal computer used for communication control. When a CMC board is installed in a network it is called a unitary controller.

Each UCI may communicate with up to 32 unitary controllers (UC). Each controller must have a unique address programmed into it prior to start-up. When a single HVAC unit contains more than one UC for the control of multiple compressors, each UC used by the unit must have its own address.

WARNING

To avoid possible injury or death, disconnect power from all interconnected equipment during installation. Failure to disconnect all power may result in electrical shock, burns or fire.

Wire Termination: All UC/UCI devices employ screw-pin type terminal connections. Use a slotted 1/8" Phillips screwdriver for wiring connections. NOTE: For the convenience of the installer, UCIs are equipped with RJ11 modular jack connections. To terminate the communications cables, follow the instructions below.

Refer to Table 2 for recommended cable types and to Table 3 for wiring voltage drops.

1. Connect the shield from the communications cable to the shield terminal (SHI) of the communication adapter board on each UC.

Table 2 Recommended Cable Types for DDC Component Interconnection

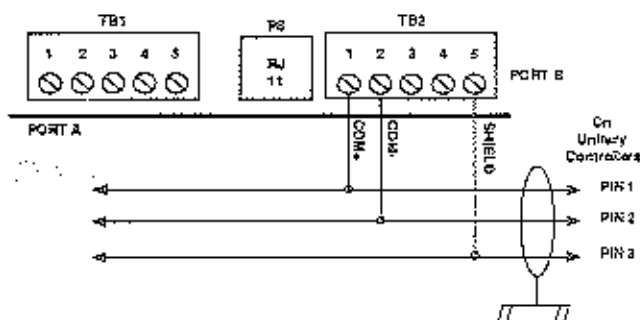
MANUFACTURER	NUMBER
Belden	9855
Belden	9184
Signal	88101

Table 3 Wiring Voltage Drops

Wire Size	18GA			16GA			14GA			AMPS
Length of Run	25'	50'	75'	25'	50'	75'	25'	50'	75'	
Transformer Load										
30VA @ 24V	0.406	0.813	1.220	0.256	0.513	0.769	0.161	0.321	0.482	1.2
40VA @ 24V	0.544	1.088	1.530	0.342	0.685	1.027	0.215	0.429	0.644	1.6
48VA @ 24V	0.651	1.302	1.953	0.410	0.840	1.230	0.257	0.514	0.771	2.0
60VA @ 24V	0.814	1.628	2.441	0.513	1.025	1.538	0.321	0.643	0.964	2.5
75VA @ 24V	1.019	2.038	3.056	0.642	1.283	1.925	0.402	0.804	1.207	3.1

2. Connect the shield to terminal #5 of Port B on the UCI as shown in Figure 2. NOTE: the shield is not a ground. Do not connect the shield to ground or to a chassis point.

Figure 2 - Shield Connection



3. Connect the positive cable lead (red) to the positive terminal (+N) on the communications adapter board.
4. Connect the negative lead (black) to the negative terminal (-N) on the communications adapter board.

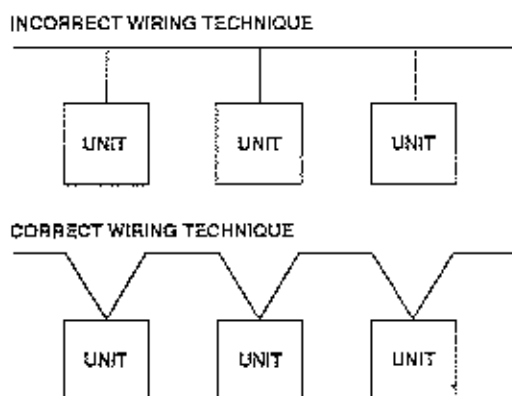
▲ WARNING

Communications are polarity sensitive. Connect positive and negative connections continuously. Do not interchange or reverse wire leads.

Wiring Considerations: Most DDC communication related problems which exist at system start-up result from improper wiring techniques. Follow the guidelines below when wiring a communications network to minimize communication system problems.

1. Do not splice communication cable or wire at any point.
2. Do not use the "T-tap" technique of routing/connecting communication cable as shown in Figure 3. This technique may generate RF or electromagnetic interference on the communication circuit.

Figure 3 - T-tap



3. Do not use wire nut devices for connecting communication cable.
4. Do not allow the shield to touch any ground point.
5. Do not route any part of the communication cable through conduit, junction boxes or other devices containing AC electrical wiring.
6. Do not strap communication cable to any conduit or other device containing AC electrical wiring, or run communication parallel to (or against) such devices.

NOTE: AC electrical devices such as transformers, disconnects, fluorescent lighting, motor-controllers, variable frequency drives or other high voltage power sources may generate radio signals or other RF interference which may disrupt communication.

Room Sensor Mounting and Wiring

An optional remote room sensor is used when an electronic thermostat is to be connected to the CMC 2010 Series Controller. The sensor may be located up to 400 feet (122m) from the thermostat (measured by the length of wiring used to connect the thermostat to the controller.)

The room sensor is available in two versions. One version is a sensor with an integral override switch, the other version is a sensor only. **NOTE:** Versions D and E use different sensor. See parts list for applicable part number.

Pressing the override switch for 0 to 5 seconds provides a two hour override.

Mounting/Location: Mount the sensor on a standard vertical junction box (2" x 4" handibox) located within the conditioned area at the code specified height above the floor. Locate sensors in the return airflow path or close to a return air grill. Mount the sensor on an interior partition wall or column and out of direct sunlight.

▲ CAUTION

DO NOT locate sensor in a dead air pocket such as a corner. DO NOT locate sensors on an exterior wall or on a wall of an unconditioned area. DO NOT locate sensors on a wall which has unconditioned air flow or drafty conditions in the wall cavity. DO NOT locate sensors near a heat source such as lights, appliances, copy machines, electric/electronic devices, or computers.

Wiring Connections: For accurate system operation, use shielded, 4-conductor cable only. Maximum cable length is 400 feet (122 meters) measured from the CMC 2010 to the sensor. Refer to Tables 2 and 3 on Page 9 for additional cable sizing information.

⚠ WARNING

To avoid bodily damage or damage to the sensor or CMC 2000 Controller board, disconnect electric power before making wire connections or connection changes.

Damage to the sensor or CMC 2000 Controller board may result if connections are incorrect, shorted or crossed.

Configuring the CMC Controller Address

To properly establish communication on the network, configure each controller with its own, unique address. Configuration must occur after communication wiring is

successfully installed, checked and tested for continuity, after each device is properly connected to its host device within the LAN system and before power is connected to the controller.

Use dip switches 1 through 5 to set the electronic address on the communication bus. Assign each controller on the network it's own unique address. Duplicate addresses will produce operating problems. Refer to Table 4 below to set CMC Controller addresses.

Table 4

ADDRESS TABLE					
CONTROLLER ADDRESS	DIP SWITCH SETTINGS				
	Switch #1	Switch #2	Switch #3	Switch #4	Switch #5
00	ON	ON	ON	ON	ON
01	OFF	ON	ON	ON	ON
02	ON	OFF	ON	ON	ON
03	OFF	OFF	ON	ON	ON
04	ON	ON	OFF	ON	ON
05	OFF	ON	OFF	ON	ON
06	ON	OFF	OFF	ON	ON
07	OFF	OFF	OFF	ON	ON
08	ON	ON	ON	OFF	ON
09	OFF	ON	ON	OFF	ON
10	ON	OFF	ON	OFF	ON
11	OFF	OFF	ON	OFF	ON
12	ON	ON	OFF	OFF	ON
13	OFF	ON	OFF	OFF	ON
14	ON	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF	ON
16	ON	ON	ON	ON	OFF
17	OFF	ON	ON	ON	OFF
18	ON	OFF	ON	ON	OFF
19	OFF	OFF	ON	ON	OFF
20	ON	ON	OFF	ON	OFF
21	OFF	ON	OFF	ON	OFF
22	ON	OFF	OFF	ON	OFF
23	OFF	OFF	OFF	ON	OFF
24	ON	ON	ON	OFF	OFF
25	OFF	ON	ON	OFF	OFF
26	ON	OFF	ON	OFF	OFF
27	OFF	OFF	ON	OFF	OFF
28	ON	ON	OFF	OFF	OFF
29	OFF	ON	OFF	OFF	OFF
30	ON	OFF	OFF	OFF	OFF
31	OFF	OFF	OFF	OFF	OFF

Replacing a Controller Board

Follow the steps below to replace a controller board.

1. Disconnect main power to the unit.
2. Label all wires or refer to the wiring diagram. Disconnect all wires from the controller.
3. Remove the controller from the control box. Use long nose pliers to "squeeze" the plastic stand offs and pull the controller board out of the box.
4. Align the six holes on the control board above the six stand offs and push the replacement controller board into place.
5. Connect all wires according to the wiring diagram or according to the wire labels.
6. Apply power to the unit.
7. Test the unit to assure proper operation.

PARTS LIST		
COMPONENT DESCRIPTION	PART NUMBER	
	CMC 2001 REVISION D	CMC 2001 REVISION E
Basic Controller Basic C/W Fan Speed Basic C/W Damper Relay Basic C/W Speed and Damper	69183000 * * *	69626500 * * *
As above but C/W RS 485 Communications RS-485 adaptor Board Basic Controller for Console Unit (with Med fan speed relay)	69183004 Not Applicable 69283001	Not Applicable 69626501 *
Dry Alarm Contact Opto-Coupler	69288200	Not Applicable
Dry Alarm Contact Auxiliary Relay Speed Relay	Not Applicable 69527400	68537942 69527400
Adaptor for Electronic Thermostats	69183002	Not Applicable
Adaptor for USD, CSD, ESD Terminals	69183003	Not Applicable
Transformers 115/24-8.5 208-230/24-8.5 277/24-8.5 380/24-8.5 460/24-8.5 575/24-8.5 115/24 208/24 230/24 277/24 380/24 460/24 575/24	68538060 68538051 68538052 68538057 68538053 68538056 Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable	Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable 68538022 68538028 68538028 68538029 68538043 68538030 68538016
Discharge Air Sensor Leaving Water Sensor Condensate Sensor kit Wall Sensor Wall Sensor Cover Wall Sensor with Override Cover with Override	Not Applicable Not Applicable 69180118 N/A 69605000 N/A N/A	69626502 69626502 69180118 69626503 69605000 69626504 69605000**

* Contact Factory for Part Number

** Customer must drill hole for overrides

CONTROL BOARD TROUBLE SHOOTING

Power Problems	Indicator	Solution
	Possible Cause	Solution
	Green LED Off	<i>Revision D Controllers:</i> Check Voltage Between L1 and L2. If voltage is correct, then check for 8.5 VAC between C2 and P2. <i>Revision E Controllers:</i> Check for 24 VAC between C1 and P1.
	4 Alarm LED's Blinking	Check 24 VAC between C1 and P1. If there is no voltage, check for primary power supply to transformer. If power supply is on, replace transformer. If voltage is less than 19 VAC or more than 27 VAC, check main power supply for over or under voltage conditions..
LTS Low Temperature Switch Lock-Out	Reduced or no Water Flow	Check pump operation and/or valve settings; adjust to proper flow rate per design
	Water Temperature Out of Range	Bring water temperature to design conditions
	Bad Low Temperature Switch	Disconnect, then reconnect main power to reset any tripped safety switches. If unit does not run, jumper the LTS terminals on the control board. If unit runs while jumper is attached, replace the LTS switch. If unit still does not run, replace board.
LPS Low Pressure Switch Lock-Out	Loss of Refrigerant Charge	Check system pressures
	Water Temperature Too Low	Increase water temperature in loop
	Low Water Flow (Heating Mode)	Check pump operation and/or valve settings; adjust to proper flow rate per design
	Inadequate Air Flow (Cooling Mode)	Check air filter and ductwork
	Bad Low Pressure Switch	Disconnect, then reconnect main power to reset any tripped safety switches. If unit does not run, jumper the LPS terminals on the control board. If the unit runs, while the jumper is attached, replace the LPS switch. If the unit still does not run, replace board.
HPS High Pressure Switch Lock-Out	Reduced or no Water Flow (Cooling Mode)	Check pump operation and/or valve settings; adjust to proper flow rate per design
	Water Temperature Out of Range	Bring water temperature to design conditions
	Inadequate Air Flow (Heating Mode)	Check air filter and ductwork
	Bad High Pressure	Disconnect, then reconnect main power to reset any tripped safety switches. If unit does not run, jumper the HPS terminals on the control board. If the unit runs, while the jumper is attached, replace the HPS switch. If the unit still does not run, replace board.

Control Board Troubleshooting (Con't)

Condensate Over-Flow Switch (Optional for Revision D)	Possible Cause	Solution
	Blocked Drain	Check for blockage and clean drain-pan
	Improper "P" Trap	Check trap, rework if required
	Overflow Sensor Shorted	Check for short and dirt on sensor pins
	Sensor Location	Move sensor to new location
	Control Board	If unit still locks-out on condensate, disconnect one wire from condensate terminal, If unit still locks-out, replace control board
Unit Short Cycles	Loose Wiring	Check wires and terminals for loose connections
	Dirty Filter	Check and clean air filter
	Water Flow	High water flow and high temperature can short cycle the unit in heating. Assure that water flow and temperature are within design conditions
	Unit Selection	Unit may be oversized for the space. Check size versus design calculations
	Compressor Overload	Check and replace if necessary
Only Fan Runs	Thermostat Position*	Ensure that thermostat is in "ON" mode. Adjust thermostat to a demand position.
	Wiring	Check "Y" and "W" terminal wiring. Jumper between "R" and "Y" or between "R" and "W". If compressor starts, check wiring and thermostat. If compressor does not start, replace board. *If test terminals are not jumpered, wait for the 5 minute anti-short cycle time delay.
Only Compressor Runs	Fan Motor Relay	Connect jumper between "R" and "G" on thermostat connector. Check voltage on both load and line side of the fan motor relay on the control board. If no voltage on load side but voltage on line side, replace control board.
	Fan Motor	If fan relay is used as a pilot relay to drive the fan contactor, check to see that the fan relay is closed. Check voltage across the fan contactor. If voltage is present but the contactor is not closed, change contactor. If contactor is closed but fan does not run, check for line voltage on load side of contactor. If line voltage is present, check wiring to fan motor. If wiring is correct, change the fan motor. If voltage is acceptable on motor terminals and fan capacitor is functioning, replace the fan motor.

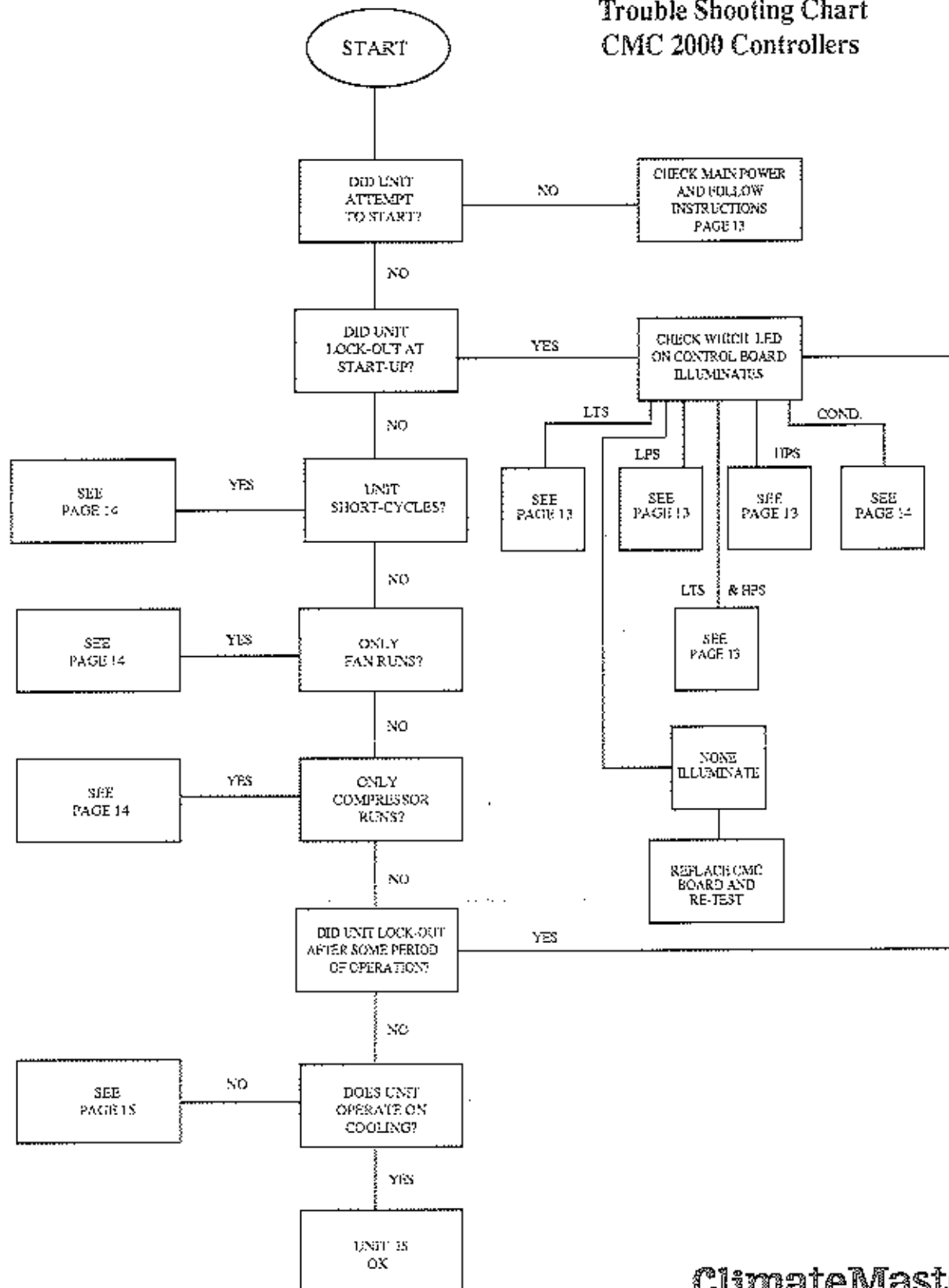
Control Board Troubleshooting (Con't)

Does Not Operate on Cooling	Possible Cause	Solution
	Reversing Valve	Set thermostat on demand for cooling. Check for 24 VAC on the Reversing Valve terminals on the control board. If 24 VAC is missing and the unit runs in heating, replace the control board.
	Defective Reversing Valve	If there is 24 VAC to the Reversing Valve solenoid, replace the solenoid
	Reversing Valve Stuck	Replace the Reversing Valve.
LTS and HPS Switches Illuminate	"R" to "Y" and "R" to "W" are closed at the same time	Disconnect the thermostat. Jump "R" to "G" and "R" to "Y". If unit runs in cooling, remove "R" to "Y" jumper and jump "R" to "W". If unit runs in heating, correct problems in the thermostat or the wiring.

Control Board Diagnostics Chart

CMC 2000 Terminals	Voltage
Between L1 & L2	Line voltage application only. 110, 208, 230 277 VAC. Single phase units less than 3 tons. Pilot-duty application. 24 VAC. (all 3 phase units and single phase units 2 tons and above)
RV	24 VAC
Water Valve/Damper (Optional - Version D)	Dry Contacts (OV) 5A @ 24VAC
Between C1 & P1	24 VAC
Revision D	
Between C2 & P2	8.5 VAC
Between C3 & P3	24 VAC
Between C4 & P4	24 VAC
Between R & C	24 VDC
Between X & C	24 VDC
Between L1 & Compressor	Application Specific, See Drwgs
Between L1 & FAN	Application Specific. See Drwgs
Revision E	
Between C2 & P2	24 VAC
Between C3 & P3	24 VAC
Between C4 & P4	24 VAC
Between R & C	24 VDC
Between X & C	24 VDC
Between L1 & Compressor	Application Specific, See Drwgs
Between L1 & FAN	Application Specific, See Drwgs

Trouble Shooting Chart CMC 2000 Controllers



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