Installation, Operating & Maintenance Instructions

Communications Options for use with
Johnson Controls Metasys and Companion Systems

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GENERAL INFORMATION

Overview

This manual is for use with ClimateMaster CMC 2000 Series Controllers supplied with a DDC adapter and is to be used in conjunction with CMC 2000 Series electronic controller Version 9.0 IOM, part number 69626515. This system is compatible with the following:

Johnson Controls Metasys, Metasys Companion and Facilitator systems.

A CMC-2010 consists of a CMC-2000 control board, a communication adaptor board, discharge air sensor and discharge water sensor.

General Operating Parameters

ClimateMaster units provided with this communication module have a discharge air and discharge water sensor supplied by the factory. These can be supplied loose for field installation and wiring by others, but are usually ordered factory installed.

NOTE: The DDC control company is required to connect an RS-485 shielded communication cable to each controller in a daisy chain fashion. The address must be preset using the 8 position dip switch provided for this purpose. The data base at the front end must include data points defined on page 7 for Metasys (and Companion).

Revision Identification

This document is for use with ClimateMaster CMC 2000 Series Controllers with the software versions 9.0, and the snap-on DDC adapter board as illustrated on the cover of this manual. ALL PREVIOUS SOFTWARE VERSIONS OF THE CMC CONTROLLER AND ALL PREVIOUS SNAP-ON DDC ADAPTER BOARDS ARE NOT COMPATIBLE WITH JOHNSON CONTROL SYSTEMS. If an earlier version software exists, an upgraded microprocessor or a new CMC 2000 Series Controller may be required. And a snap-on DDC adapter board will be required. Please contact the factory for further information.

The software revisions of the CMC board clearly appears on the label in the center of the CMC 2000 Series Controller. Also, the CMC 2000 Series Controller has a part number stamped on the board. Please refer to the CMC 2000 Series Controller Installation, Operation, and Maintenance Manual, part number 69626515, for further information on identifying the CMC 2000 Series Controller.

The snap-on DDC adapter board does not have a software revision and is compatible with all CMC 2000 Series Controllers. This manual is for use with the snap-on DDC adapter board which has the part number 69626511 stamped on it. Earlier snap-on DDC adapter board have the part number 69626501 stamped on them. Also, the earlier snap-on DDC adapter board did not have an eight position dip switch.

Addressing and Wiring

The CMC 2000 Series Revision "E" has one of three (3) levels of capability depending upon serial number. An adapter board is provided on each controller, and each controller requires a unique address.

> **CAUTION: Turn power off before changing the address of a unit.**

Controller Serial Number of "30,000" or higher with Metasys/Companion systems

Wire units as shown in DDC Wiring Instructions (pages 3 and 4).

Addressing the Unit: An eight position dip switch is located on the adaptor board (p/n 69626511) which allows addresses from 01 through 255. See address chart (Figure 4) for dip switch settings.

> ### ⚠ WARNING
> **Duplicate addresses will result in Operating Problems**

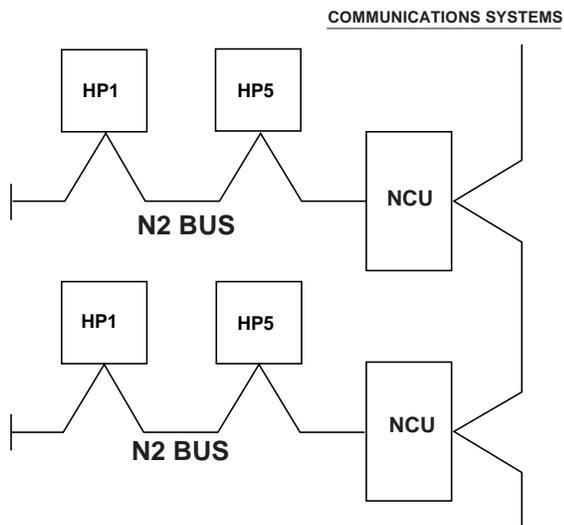## DDC Wiring Instructions

> ### ⚠ WARNING
> **All wiring must be done in accordance with NEC and the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. 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.**

Wire all units in a daisy chain fashion as shown in Figure 1 (page 4). Total communication wire length must not exceed 5000 feet (1524 meters) measured from the first device to the last device in the series.

Repeaters may be used to extend this length. Refer to control company literature for options and details.

Metasys: Johnson Controls Metasys systems require heat pumps be in groups not to exceed address number 255 and each group be connected to an NCU.

Figure 1. Daisy Chain

COMMUNICATIONS SYSTEMS

```
┌─────┐   ┌─────┐
│ HP1 │   │ HP5 │        ┌─────┐
└─────┘   └─────┘        │     │
     \    /    \         │ NCU │
  ┌──────────────┐       │     │
  │   N2 BUS      │──────└─────┘
  └──────────────┘

┌─────┐   ┌─────┐
│ HP1 │   │ HP5 │        ┌─────┐
└─────┘   └─────┘        │     │
     \    /    \         │ NCU │
  ┌──────────────┐       │     │
  │   N2 BUS      │──────└─────┘
  └──────────────┘
```

Metasys Companion and Facilitator: Johnson Controls Companion and Facilitator systems each are available in three versions: PC, Panel and Panel Ltd. Consult Johnson Controls literature for grouping of controllers on the N2 Bus.

Wire the N2 bus in accordance with Johnson Controls installation instructions.

NOTE: An end of line device may be required on Metasys/Companion Systems.

Remote Sensor/Thermostat and Wiring

An optional room sensor can be used to provide ambient room temperature. This sensor can be equipped with a 2 hour override button. The override provides 2 hours of day operation when activated.

To activate override, hold the override button for at least 1 second but not more than 5 seconds.

In lieu of a sensor, a ClimateMaster ET Series Thermostat can be connected. This thermostat connects via an RS-485 comminution link to the CMC 2000 Series Controller and acts as both a sensor and a local setpoint device. The thermostat can have the following options:

- A fault indication LED
- Hi-Med-Lo fan speed control
- Setback
- Override

For detailed features and wiring, refer to ET Series Electronic Thermostat IOM (Part Number 69197318).

When using an ET Thermostat the Johnson Controls Companion or Metasys System may command the space temperature setpoint AO1. The ET Series Thermostat commands the heat pump to heat or cool based on the space termperature and the space temperature setpoint . DO NOT USE BO2 or BO3 WHEN AN ET THERMO-STAT IS USED. The space temperature setpoint may be adjusted locally during the occupied mode (BO5 in the 0 state or OFF position). There is only one setpoint: heating begins 1.5˚F below the setpoint and cooling begins 1.5˚F above the setpoint. The ET Thermostat will accept the last setpoint input whether the command is from the front end or from a local adjustment.

During the unoccupied mode (BO5 in the 1 state of SHUTDOWN position) the ET Thermostat automatically sets the heating setpoint back and/or the cooling setpoint up a predetermined number of degrees based on the last valid occupied setpoint command. (See the ET Series Electronic Thermostat Manual part number 69197318 for the set-up/setback options available from the factory.) During the unoccupied mode, the heating setback setpoint is displayed and no local adjustment is possible.

An optional override button on the ET Thermostat may allow a two hour return to the occupied mode. During these two hours, at the front end, BO5 will display the 0 state or the OFF position. The occupied setpoint is displayed and a local setpoint adjustment may be made. At the end of the override time period, BO5 will return to the last commanded value issued from the front end. If returning to the unoccupied mode, the ET Thermostat will again display the setback setpoint and ignore local adjustments.

NOTE: The override may be canceled locally by pressing the power button on the ET Thermostat OFF and then ON again. This power button status is monitored at BI10.

Fan Operation

When continuous fan operation is desired during the occupied mode and cycling fan in the unoccupied mode and only one fan speed is available, one of three methods may be implemented:

1. Connect a jumper between the R and G terminal on the CMC 2000 Series Controller and command from the FMS the unit shutdown (BO5) to "ON" for the unoccupied mode, or

2.Command from the FMS both the unit shutdown and the fan (BO7) for the unoccupied mode, or

3. Use a ClimateMaster ET Series Thermostat instead of a space sensor.

Wire Termination

⚠ 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.

All devices employ screw-pin type terminal connections. Use a slotted 1/8" penlight screwdriver for wiring connections. To terminate the communications cables, follow the instructions below.

1. Connect the positive cable lead (red) to the positive terminal (N+) on the communications adapter board.

2. Connect the negative lead (black) to the negative terminal (N-) on the communications adapter board.

3. Connect the reference cable lead (white or drain wire) to the shield terminal (SHI) on the communications adapter board.

Refer to Table 1 for recommended cable types and to Table 2 for wiring voltage drops.

Table 1- Recommended Cable Types for DDC Component Interconnection

| MANUFACTURER	NUMBER
Belden	9855
Belden	9184
Signal	88101

⚠ 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 2. This technique may generate RF or electromagnetic interference on the communication circuit.

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.

Figure 2. T-tap
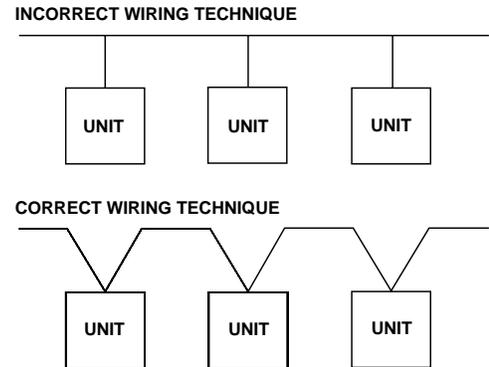
NOTE: AC electrical devices such as transformers, disconnects, fluorescent lighting, motor-controllers, variable frequency drives or other high voltage power sources may generate radio signals or other RF interference which may disrupt communication.

Room Sensor Mounting and Wiring

An optional remote room sensor is used when an electronic thermostat is not 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. See parts list (in CMC 2000 Series IOM, page 12) for applicable part number.

Pressing the override switch for 1 to 5 seconds provides a two hour override.

In place of the remote room sensor, a ClimateMaster ET Series thermostat can be connected. For details, refer to ET Series Electronic Thermostat IOM (part # 69197318).

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.

Table 2- 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

DO NOT locate sensors near a heat source such as lights, appliances, copy machines, electric/electronic devices or computers.

⚠ 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.

Wiring Connections of Sensor

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 Table 1 on page 4 and Table 2 on page 5 for additional sizing information. See Figure 3 below for detail.

Figure 3. Wiring Sensor
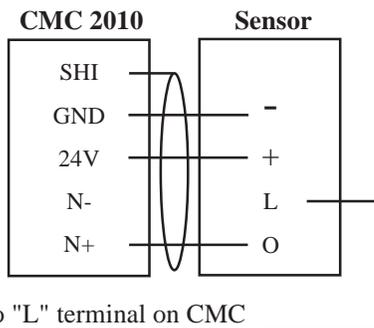
Connected to "L" terminal on CMC 2010 for override switch option

Dip Switch Settings

Setting the address on the CMC 2010 controller for Johnson Controls Metasys/Companion systems: An eight position dip switch located on the adapter board (p/n 69626511) allows an address selection from 01 through 255. Using binary code, a dip switch placed in the ON position adds to the address of the CMC 2010 Controller.

For example, all dip switches in the ON position would be address 255.

NOTE: An address of 0 with all dip switches OFF cannot be used with the Johnson Controls Metasys/Companion systems.
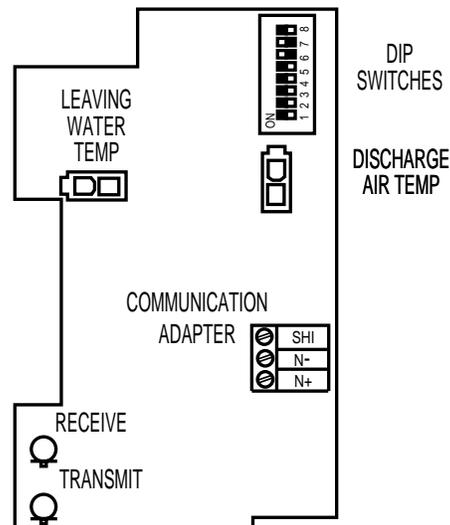
Refer to Figure 4.

Figure 4. Address 02
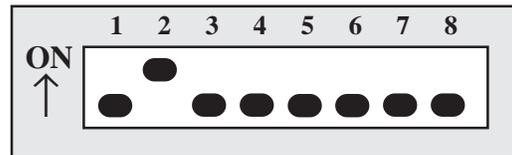
Dip Switch #	1	2	3	4	5	6	7	8
Address Value	1	2	4	8	16	32	64	128

Figure 5. DDC Communications Adapter Board

SOFTWARE CONFIGURATION INFORMATION

Johnson Controls Metasys Software: Set the data base per the following points list. The controller type is VND and the Metasys software must be at least release 6 or higher. The following is a list of the points that can be accessed in each CMC 2010 ClimateMaster controller with Johnson Controls, Inc., Metasys and Companion software.

| Network Point Type	Network Point Address	Engineering Units	Point Description	Notes
AI	1	°F*	Water leaving temperature	Shows actual water leaving temperature.
AI	2	°F*	Discharge air temperature	Shows discharge air temperature.
AI	3	°F*	Room temperature	Shows actual space temperature.
AI	4	%	Room humidity	Shows actual space humidity. Only available when "ET" Series thermostat with humidity option is connected to CMC Controller.
AO	1	°F*	Set point	As commanded by FMS. Controller will follow this point as commanded and override the thermostat setpoint.
AO	2	%	Humidity set point	As commanded by FMS. For future use.
BI(†4)	1	0-OFF/1-ON	Cool status	Indicates that a demand for cooling has occurred.
BI(†4)	2	0-OFF/1-ON	Heat status	Indicates that a demand for heating has occurred.
BI(†4)	3	0-OFF 1-Alarm	Low temperature sensor	Indicates a fault from the freeze sensor. A unit lockout will occur. The unit will try to reset after 10 minutes. If not successful, a manual reset is required.
BI(†4)	4	0-OFF 1-Alarm	Low pressure sensor	Indicates a fault from the low pressure sensor. A unit lockout will occur. The unit will try to reset after 10 minutes. If not successful a manual reset is required.
BI(†4)	5	0-OFF 1-Alarm	High pressure sensor	Indicates a fault from the high pressure sensor. A unit lockout will occur. The unit will try to reset automatically after 10 minutes. If not successful a manual reset is required.
BI(†4)	6	0-OFF 1-Alarm	Condensate sensor	Indicates a fault from the condensate sensor. A unit lockout will occur. The unit will try to reset automatically after 10 minutes. If not successful a manual reset is required.
BI(†4)	7	0-OFF 1-Alarm	Low/High Voltage	Indicates a high or low voltage. The unit will stop, restart will occur automatically once the correct voltage is restored.
BI(†4)	8	0-OFF/1-ON	Test	Test mode eliminates all time delays in the unit. Indicates if test terminals have been jumpered.
BI(†4)	9	0-AUTO 1-ON	Fan ON/AUTO	Indicates local selection of fan control. Only available when "ET" Series thermostat with switching option is connected to CMC Controller.
BI(†4)	10	0-OFF/1-ON	Thermostat power	Indicates local selection of thermostat power. Only available when "ET" Series thermostat is connected to CMC Controller.
BO	1	0-OFF 1-Shutdown	Emergency shutdown	Stops unit fan and compressor, local override disabled.
BO	2	0-OFF/1-ON	Heat	Command to run the unit in the heat mode.
BO	3	0-OFF/1-ON	Cool	Command to run the unit in the cool mode.
BO	4	0-OFF/1-ON	Reset	Resets the unit after a fault has been cleared.
BO(†3)	5	0-OFF 1-Shutdown	Unit shutdown	Stops the unit fan and compressor, local override can request 2 hours of day operation.
BO	6	0-OFF 1-Shutdown	Compressor shutdown	Stops the unit compressor, fan continues to run. Used for demand limit or load shed.
BO	7	0-OFF/1-ON	Fan Speed High	Selects high speed fan.
BO(†1)	8	0-OFF/1-ON	Fan Speed Medium	Selects medium speed fan.
BO(†1)	9	0-OFF/1-ON	Fan Speed Low	Selects low speed fan.

† *Additional Notes:*

1) When a unit is not supplied with three fan speeds or if the unit is belt driven, only the high speed fan switch is used.

2) Two stage units require two addresses, one for each stage. Only one discharge air and one water sensor is provided on a two stage unit.

3) Override of unoccupied (unit shutdown) requires a momentary closure between "R" and "L" on the board or the implementation of a ClimateMaster communicating ET thermostat and returns the unit to occupied mode and set point for two hours. During overide period BO 5 will show OFF status.

4) BI points 1-10 cannot be overridden and can be viewed only.

5) AO and BO Points can be overridden through the software.

*NOTE: For displaying temperatures in celsius, change dip switch #4 on the CMC Board to the OFF position.

Figure 6. CMC 2000 Series Controller
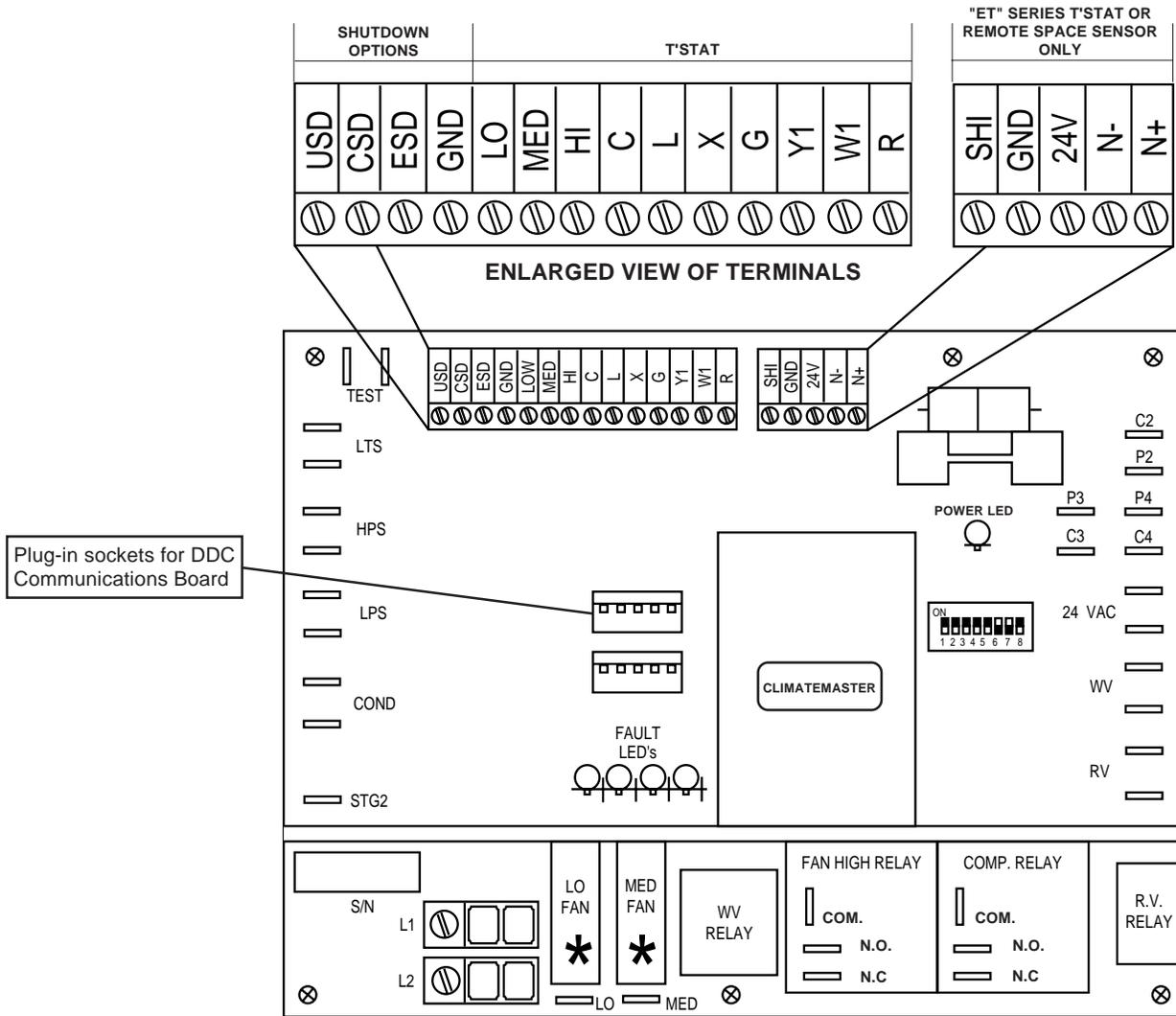
*Medium and low speed fan relays available only on part number 69626513.

NOTE: The dip switches on the main board are <u>not</u> for setting the N2 BUS address. See the CMC 2000 Series Electronic Controller Version 9.0 IOM, part number 69626515, for details regarding the main board dip switches.

Part #:69626514