



## Installation and Start-up Manual

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# Introduction



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# Introduction

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## About this Manual

This manual is intended for use by Carrier Corporation technical representatives. It provides installation, start-up, and checkout procedures for the Universal Controller.

The manual is divided into three main sections.

Section One, Introduction, describes the Universal Controller and its functions in the Carrier Comfort Network (CCN).

Section Two, Installation and Wiring, contains step-by-step instructions for mounting and wiring the Universal Controller. It also contains sample installations of sensors and other devices.

Section Three, Checkout, describes how to verify field wiring, that the power supply is operating and that the unit is communicating on the CCN. It also contains instructions for calibrating input devices and tuning analog output control loops.

Appendix A contains a wire list for the Universal Controller.

Appendix B provides instructions for clearing the Universal Controller database.

Appendix C provides a summary of product specifications and CCN product compatibility data for the Universal Controller in a quick reference guide format.

This manual is written for world-wide use. Engineering measurements are in customary U.S. and metric units.

Installation and start-up of all devices must be performed by Carrier qualified service technicians.

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## Overview

The Universal Controller provides auxiliary building control to interface with lighting, fans, pumps and other HVAC equipment in a stand-alone or Carrier-networked environment using closed-loop, direct digital controls. The Universal Controller's pre-engineered algorithms provide simple building integration for small-to-medium commercial applications with 16 field point capability (8 inputs and 8 outputs). The Universal Controller gives the Carrier Comfort Network (CCN) the capability to control and communicate with Carrier and non-Carrier HVAC equipment that do not have Product Integrated Controls (PICs).

You configure the Universal Controller to utilize a database of the algorithms, points, schedules, alarms, and system functions that are necessary to control and monitor the equipment at your site. You enter the configuration data using the following CCN operator interface devices:

- System Pilot
- CCNWeb
- ComfortVIEW
- Network Service Tool

You can connect 16 field points (8 inputs and 8 outputs) to the Universal Controller.

## 8 Inputs

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Numbers	Specifications
1 to 8	Discrete, analog, or temperature Discrete Dry Contact Pulsed dry contact Analog 4-20 mA (2 wire ) 0-10 Vdc Temperature 5K & 10K ohm thermistors

## 8 Outputs

Numbers	Specifications
1 to 8	Discrete or analog Discrete 24 Vdc@80 mA Analog 4-20 mA 0-10 Vdc

## Features

The Universal Controller supports the following features:

- Stand-alone control and monitoring of up to 16 field points, using proven algorithms
- Outdoor duty rated
- Control of non-Carrier equipment and Carrier HVAC equipment not equipped with Product Integrated Controls, using the Carrier Network
- Compatibility with all standard CCN user interface devices including the following:  
  
System Pilot, CCNWeb, ComfortVIEW, and Network Service Tool
- Two LEDs, conveniently located on the front of the module, indicate processor status (red), and CCN Communication Bus status (yellow)
- Local connection for CCN
- Total facilities management when linked to a CCN
- Three-day backup of clock and data such as Runtime and Consumable
- Simplified field wiring using “removable type” connectors
- Use of any standard, field-supplied 24 Vac, 60VA transformer

## Specifications

Power Requirements .....	60VA@24 Vac±15%
Dimensions .....	14 in H x 2.25 in W x 6.25 in D (36 cm x 5 cm x 16 cm)
Operating Temperature .....	-40°F to 158°F, Outdoor Rated (-40°C to 70°C)
Storage Temperature .....	-40°F to 185°F (-40°C to 85°C)
Operating Humidity .....	10% to 95%, non-condensing

### Discrete Out Specifications

Output Signal ..... 24Vdc@80 mA ± 3V current limited

### Analog Out Specifications

#### 4-20 mA Milliamp Type

Load Resistance .....	500-600 ohms
Resolution .....	0.04 mA
Accuracy .....	±2%

#### 0-10 Vdc Voltage Type (varies with point type)

Load Resistance .....	>500 ohms
Resolution .....	20 mV
Accuracy .....	±2%

### Discrete In Specifications

Dry Contacts ..... Switch Closure

#### Pulsing Dry Contacts

Repetition Rate .....	5 Hz max.
Minimum Pulse Width .....	100 msec

### Analog In Specifications

#### 4-20 mA Milliamp Type

Wire Type .....	2-wire
Resolution .....	0.025 mA
Accuracy .....	±1.5%

#### 0-10 Vdc Voltage Type

Resolution .....	0.0125 V
Accuracy .....	±1%

5K Thermistor Type

Nominal reading @5,000 ohms ..... 77°F (25°C)

Resolution ..... 0.2°F

Accuracy ..... ±1°F

10K Thermistor Type

Nominal reading @ 10,000 ohms ..... 77°F (25°C)

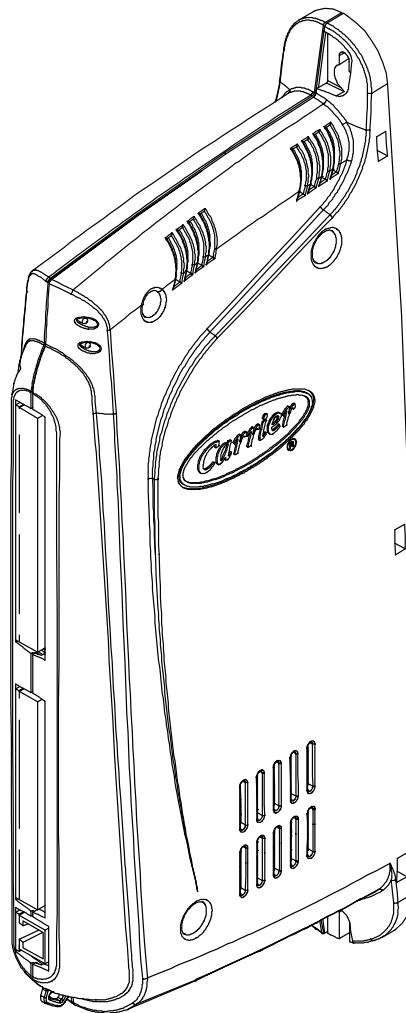
Resolution ..... 0.2°F

Accuracy ..... ±1°F

The Universal Controller is UL 873 and CE Mark Industrial listed.

Figure 1 below shows the Universal Controller Module.

**Figure 1**  
Universal Controller  
Module





# Installation and Wiring



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## Installation and Wiring

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### Required Tools and References

- Drill with a #29 bit
- Small needle-nose pliers
- Volt ohmmeter (VOM)
- Wire cutter/stripper
- 1/8" blade screwdriver
- 1/4" and 5/16" nut drivers with 6" extension
- Completed wire lists and configuration sheets for each Universal Controller
- *Universal Controller Overview and Configuration Manual* (808-346)
- Installation instructions for all enclosures, power sources, and devices

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### Module Installation

The Universal Controller can be mounted in the following locations:

- Panel mounted in a NEMA Type 1 enclosure
- Wall mounted
- DIN rail mounted in an enclosure

The Universal Controller's dimension's are 14 in H x 2.25 in W x 6.25 in D (36 cm H x 5 cm W x 16 cm D). It is recommended that the module be installed in a NEMA Type 1 enclosure for security purposes and to prevent damage.

The location of the enclosure or module is shown on the building layout drawings that have been approved by the customer. Ambient temperature in the enclosure should be -40°F to 158°F (-40°C to 70°C), and humidity should be 10% to 95%, non-condensing.

**Caution:** Do not install this module close to heaters, generators, power switching devices, or other equipment that generates electrical noise.

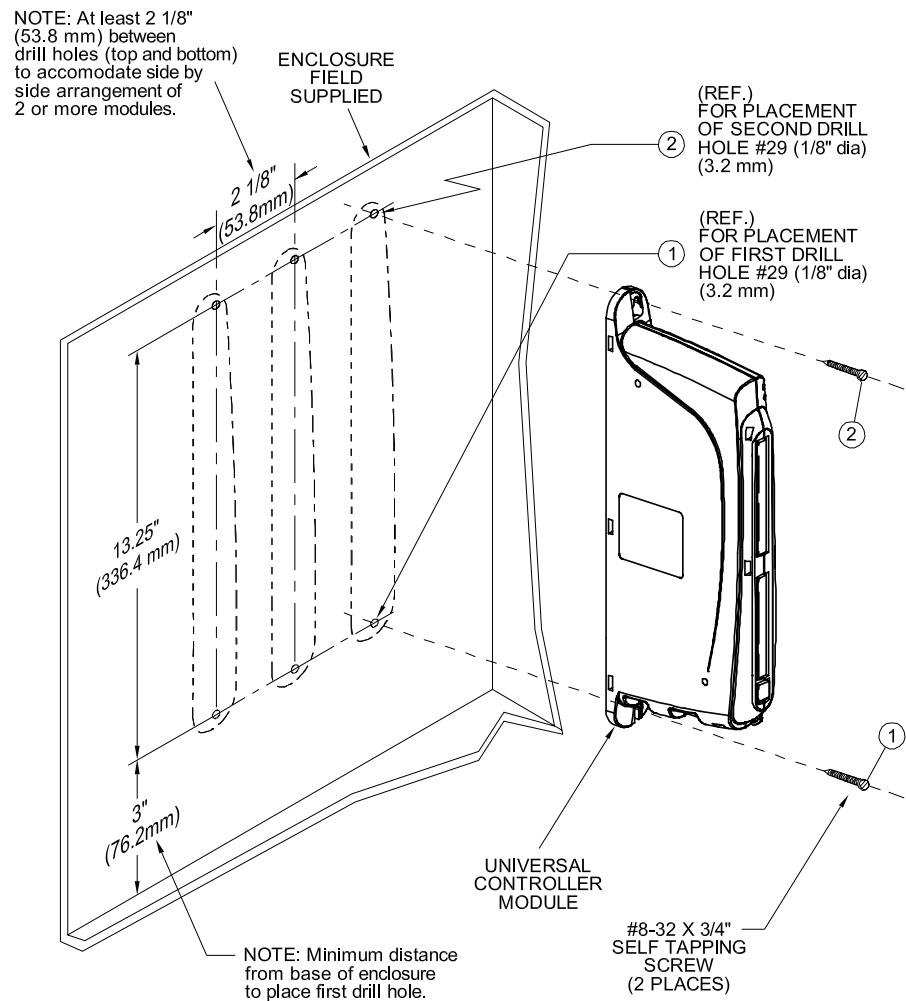
Before mounting the module, install the enclosure in the designated area using the instructions provided by its manufacturer.

## Panel Mounting

The module can be panel mounted in any field-supplied standard NEMA Type 1 enclosure with a backplate.

1. Drill two holes for the module using a #29 bit. Refer to Figure 2 for mounting hole locations.
2. Partially attach two, 3/4 in, #8-32, self-tapping screws to the mounting surface.
3. Slide the screws into the holes.
4. If necessary, tighten the screws to secure the module.

**Figure 2**  
Panel Mount Installation  
Showing Mounting Hole  
Locations



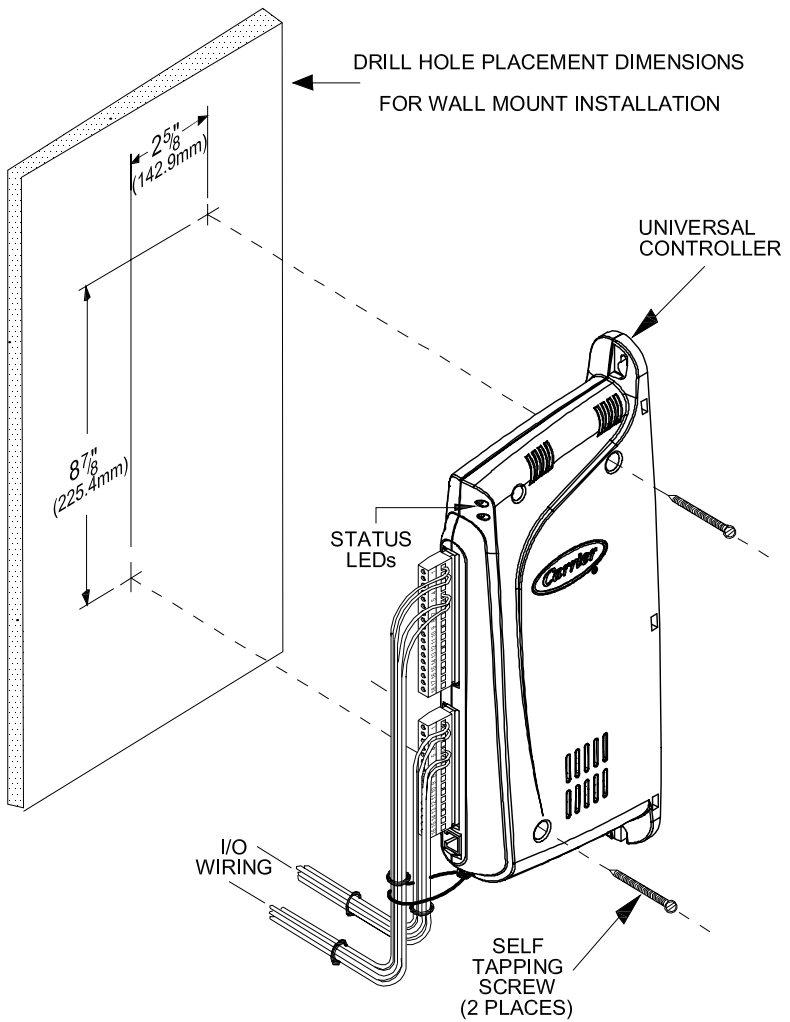
## Wall Mounting

The module should be flush mounted in a location where the enclosure depth is shallow, such as inside a control panel, or on the side of a unit, such as an air handler.

1. Using a #29 bit, drill three mounting holes as shown in Figure 3.
2. Attach the module using three, 1-1/2 in, #8-32, self-tapping screws.

**Note:** Orient the module so that you have access to the connectors and switches.

**Figure 3**  
Wall Mount Installation  
Showing Mounting Hole  
Locations

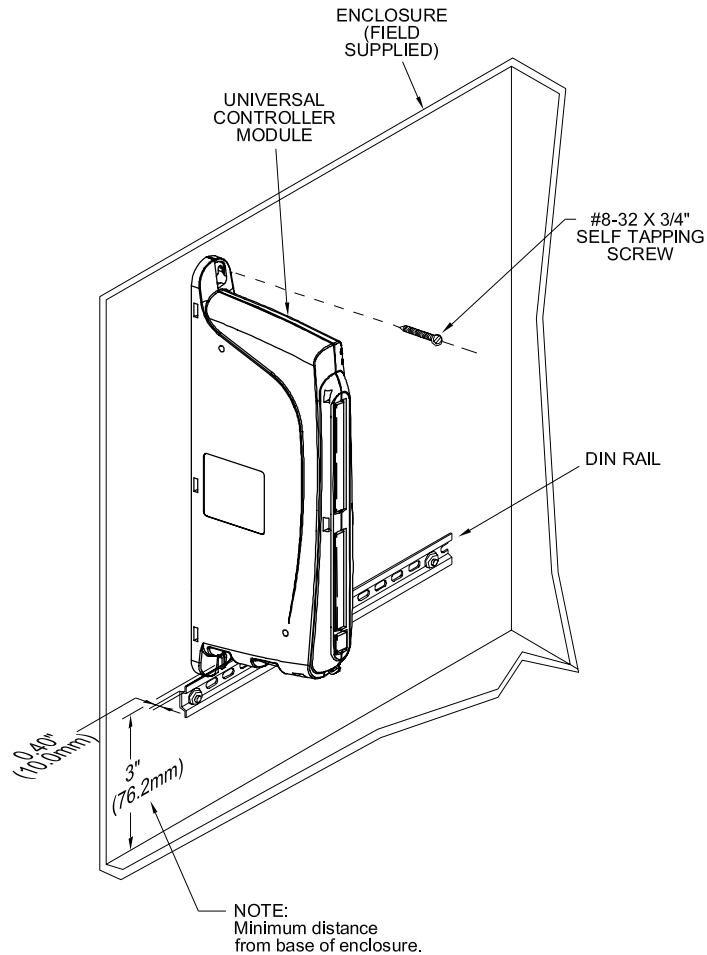


## DIN Rail Mounting

The module can be mounted on a field-supplied DIN rail in an enclosure.

1. Install the DIN rail as shown in Figure 4.
2. Place the module on the DIN rail.
3. Partially attach a #8-32 screw in the keyhole slot on the top of the module.
4. Tighten the screw to secure the module.

**Figure 4**  
DIN Rail Mounted in an Enclosure Showing Rail Spacing



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## System Pilot Installation

The System Pilot is a wall mounted device. Refer to the System Pilot Installation and Operation Instructions (Catalog # 533-30013) for instructions on mounting the System Pilot on the wall.

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## Power Supply Installation

The Universal Controller uses any standard, Class II, SELV-compatible, field-supplied 24 Vac power source. The power requirement is as follows:

$$60 \text{ VA @ } 24 \text{ Vac} + 15\%$$

All installation wiring must conform to the following requirements:

- All applicable local codes, ordinances, and regulations must be observed.
- All module power wiring must be as short as possible.
- Primary power wiring must be run in separate conduit or Electrical Metallic Tubing (EMT) from the CCN Communication Bus, sensor field wiring, and device field wiring.

The power supply must be minimum 60VA, Class II rated, with a fused secondary. A 3.3A slow blow fuse is recommended. Install it according to the manufacturer's installation instructions.

**Warning:** Do not plug in or turn on the power supply at this time.

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## Power Wiring

Module power wiring can be completed only after the module is installed in the enclosure. This section describes how to wire power connections to the Universal Controller.

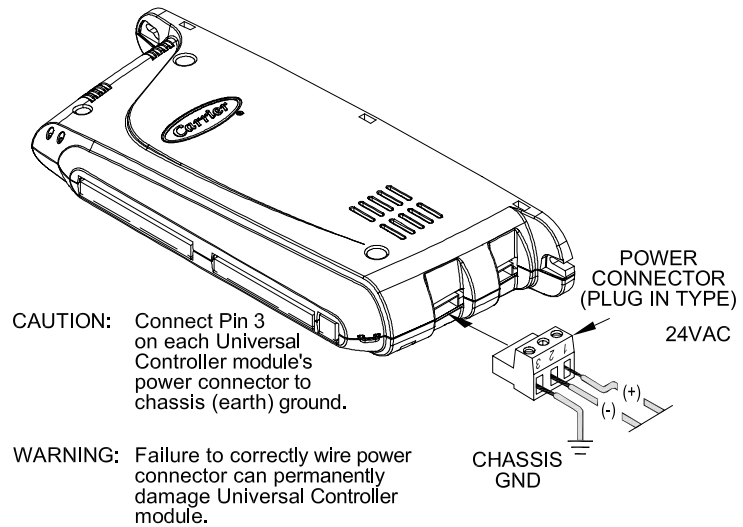
The *CCN Installation and Start-up Manual* (808-211) provides U.S. and international wire specifications for various applications and lists recommended wire vendors.

**Warning:** When using a 24 Vac power supply to power the Universal Controller, do not use it to also power non-controller type devices such as sensors and actuators. If sharing power between other CCN controllers, you must maintain phasing between devices (see Power Requirements in Appendix C).

## Universal Controller Power Connector Location

The figure below shows the location of the power connector on the Universal Controller and a detailed view of the connector.

**Figure 5**  
Power Connector Location



**Table 1**  
Power Connector Pin  
Assignments

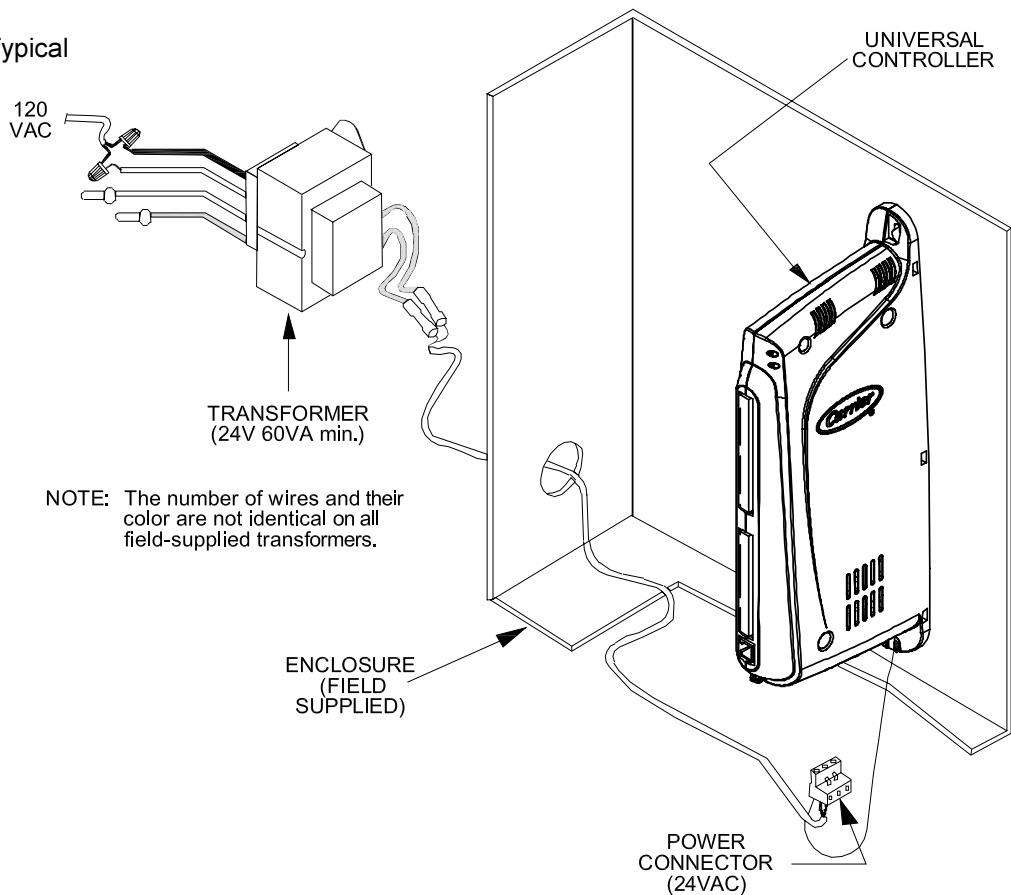
Pin Number	Power Connector
1	24 Vac
2	24 Vac
3	Chassis ground

## Wiring in a Typical Enclosure

On the Universal Controller, two pins are reserved for power and one is reserved for chassis ground.

Figure 6 shows power wiring within a typical enclosure for the power supply and the module.

**Figure 6**  
Power Wiring in a Typical  
Enclosure



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## Communication Wiring

CCN communication wiring can be completed only after all Universal Controllers are installed in their enclosures. This section describes how to wire CCN communication to the Universal Controller and ComfortVIEW.

The *CCN Installation and Start-up Manual* (808-211) provides U.S. and international wire specifications for various applications and lists recommended wire vendors.

The CCN Communication Bus conveys commands and data between the Universal Controller and any other element on the CCN. Physically, the CCN Communication Bus consists of three-conductor, shielded cable. System elements must be connected directly to the bus in a daisy chain fashion without the use of T-taps or spurs.

When connecting the CCN Communication Bus to a system element, each of the three conductors must be used for the same signal type throughout the entire CCN. That is:

- signal (+) terminals must always be wired to signal (+)
- signal ground terminals must always be wired to signal ground
- signal (-) terminals must always be wired to signal (-)

To achieve this consistency, the following “color code” system is recommended:

Signal Type	Conductor Insulation Color/Pin #	
+	Red	(1)
Ground	White	(2)
-	Black	(3)

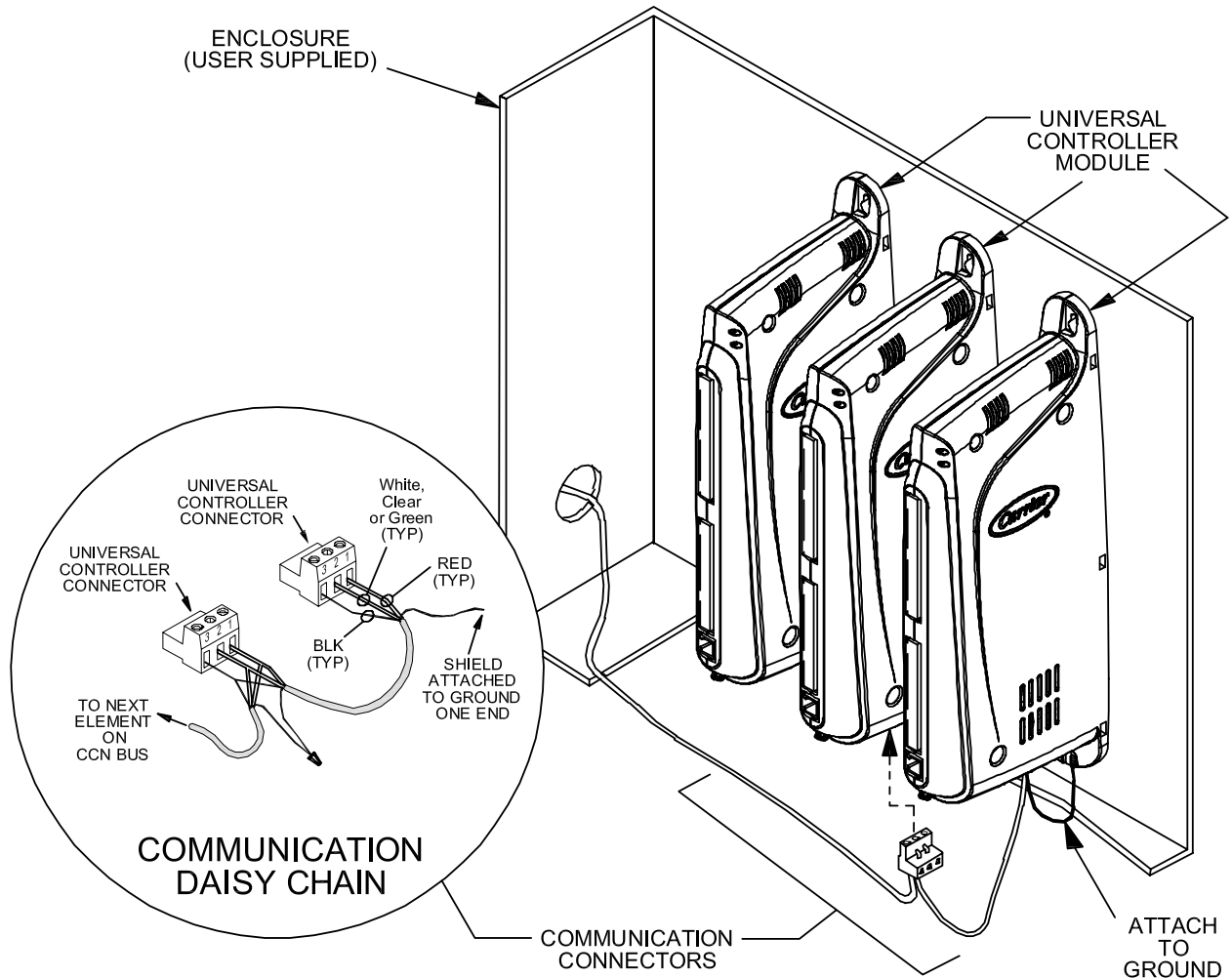
If a cable with a different color scheme is selected for the CCN Communication Bus, a similar color code system should be adopted to simplify installation and checkout.

### **Grounding of Bus Shields**

At each system element, the shields of its communication bus cables must be tied together. If the CCN Communication Bus is entirely within one building, the resulting continuous shield must be connected to ground at only one single point (refer to Figure 7). If the CCN Communication Bus exits from one building and enters another, its shields must also be connected to ground at a lightning suppressor in each building.

The specific shield connections are illustrated on the following pages in the wiring description for each system element type.

**Figure 7**  
CCN Communication Wiring

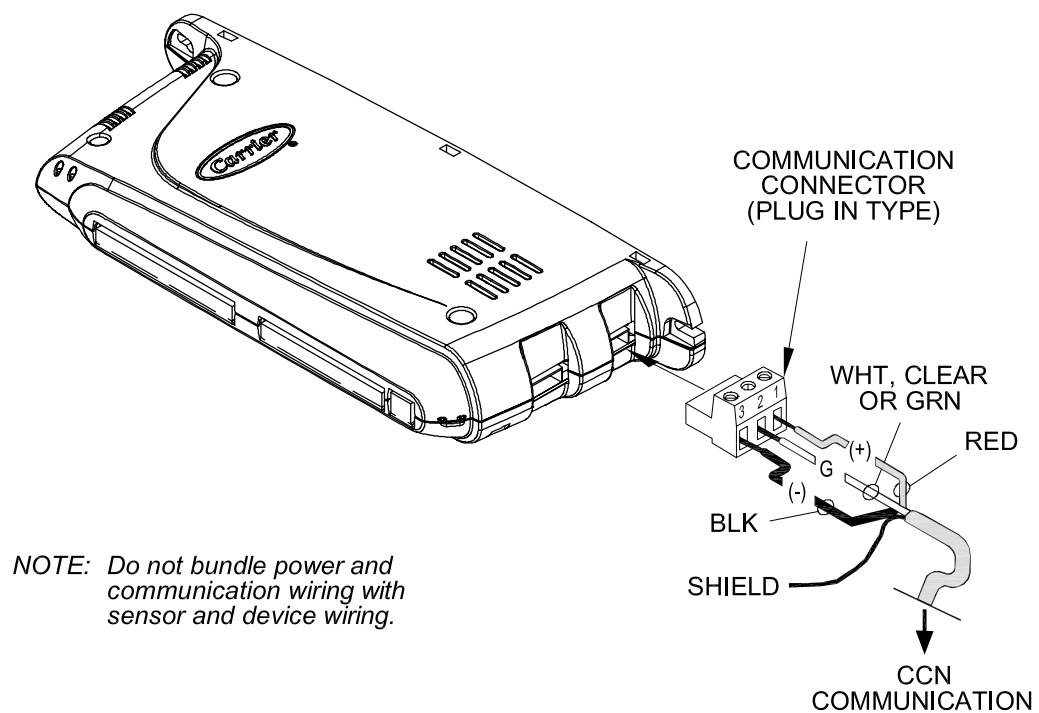


All buses, both primary and secondary, are composed of bus segments. A bus segment may be up to 1000 feet in length. A Repeater functions to join two bus segments. Up to three Repeaters can be used to form a bus, consisting of four 1000-foot segments.

## Universal Controller Communication Connector Location

The figure below shows the location of the CCN communication connector on the Universal Controller, and a detailed view of the connector.

**Figure 8**  
Communication Connector  
Location

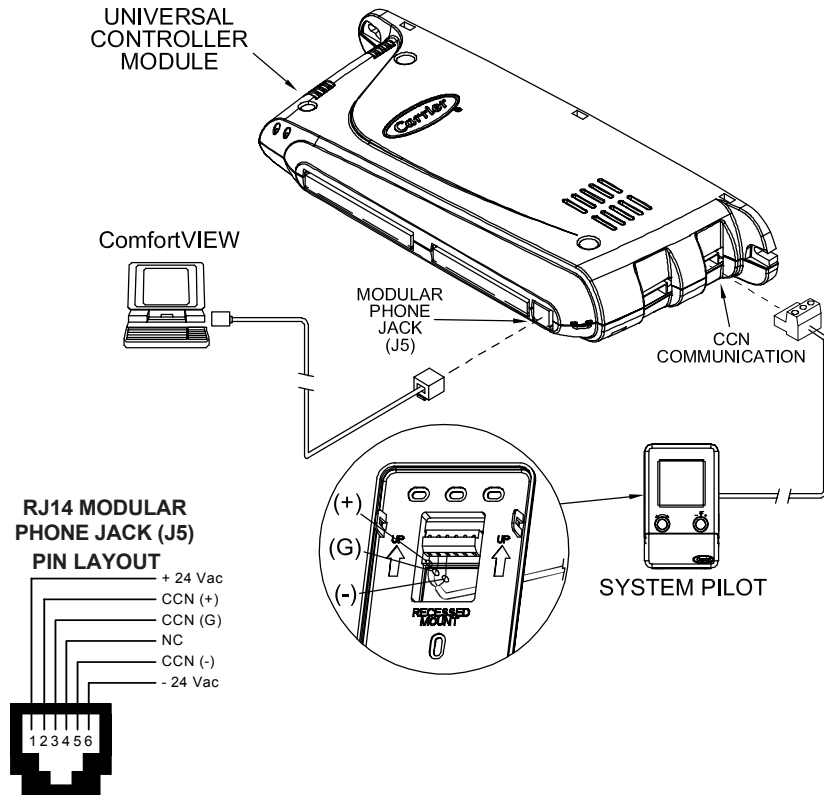


## System Pilot and ComfortVIEW Connection

The Universal Controller provides an RJ14 modular phone jack for ComfortVIEW cable connection, as shown in Figure 9. The interface cable requires a four or six conductor cable with an RJ14 or RJ11 style plug mounted at each end.

The System Pilot communicates with the Universal Controller via the CCN Communication Bus as shown in Figure 9. Refer to the System Pilot Installation and Operation Instructions (Catalog # 533-30013) for more information on connecting the System Pilot to the CCN Communication Bus.

**Figure 9**  
Connecting the System  
Pilot and ComfortVIEW



## Sensor and Device Wiring

The following section lists general procedures and guidelines for wiring sensors and output devices. The *CCN Installation and Start-up Manual* (808-211) provides U.S. and international wire specifications for various applications and lists recommended wire vendors.

Appendix B of the *Universal Controller Overview and Configuration Manual* (808-346) lists the engineering units, ranges, resolutions, and accuracy for the standard input and output devices that the Universal Controller supports.

### Wiring Guidelines

Sensor and output device wiring is usually done in two stages. First, bring the wiring to the enclosure. Then terminate the wire to the module connectors.

1. Mark each wire with the cable number specified on the module wire list. Refer to Appendix A for a sample wire list.
2. Pull the sensor and device wiring into the enclosure. Route all sensor and device wiring through either the top or bottom of the enclosure.

**Note:** Pulsed-type discrete input sensors require twisted shielded pair (tsp) wiring. Terminate the shield from the sensor to a forked type crimp connector, allowing enough wire so that this shield can be fastened under the module mounting screw.

If the Universal Controller is not already installed, leave about 2 feet of wire in the enclosure before terminating the wire to the module connectors.

3. Refer to Field Wiring in the Checkout section prior to terminating the wires.
4. Terminate the wires to the module I/O connectors, as shown in Figures 10 through 13 on the following pages.

Wire to the terminals designated on the wire list. Make final termination by stripping the end of each wire, inserting it into the connector, and tightening the adjacent screw. Refer to Figures 10 through 13 for more detailed information.

**Note:** If the Universal Controller is already installed, you can remove the connectors to facilitate wiring.

5. Bundle and dress all cables according to module and connector. Refer to Figure 14.

**Caution:** Bundle input and output cables separately.

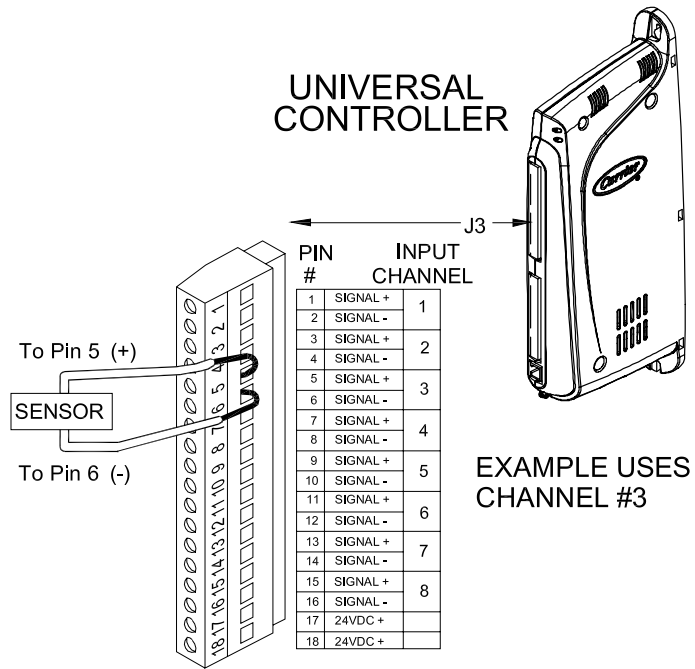
**Note:** Leave the connectors unplugged from the module until you complete wiring checkout and controller configuration.

6. Any input sensor or device located in another building structure must be equipped with a Carrier-approved lightning suppressor. It should be grounded to the Universal Controller enclosure using 14 to 16 gauge wire no longer than 6 inches.

## General Input Sensor Wiring

- Discrete Input
- Temperature Type
- 0-10 V
- 4-20 mA

**Figure 10**  
General Input Sensor Wiring

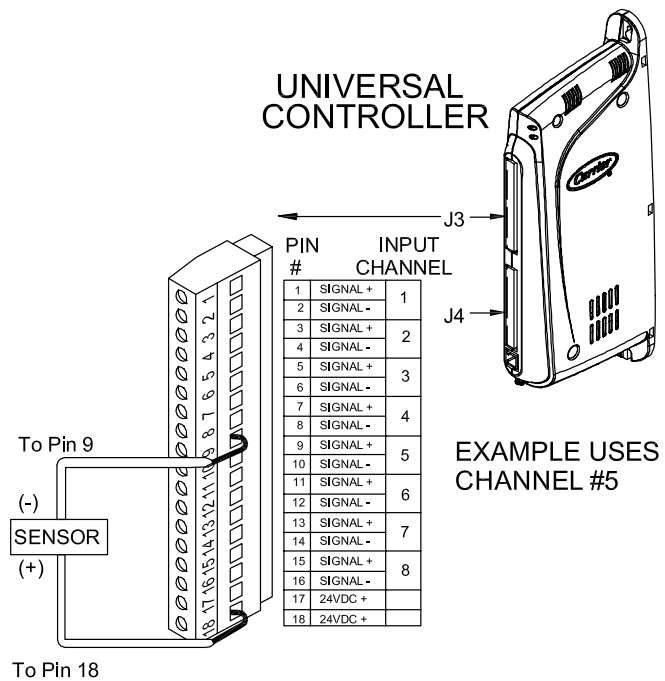


**Note:** Pin 17 is typically used for Channels 1-4,  
Pin 18 is typically used for Channels 5-8.

**Internally Powered  
4-20 mA Sensor Wiring**

Pins 17 and 18 each provide 24 Vdc current limited to 90 mA.

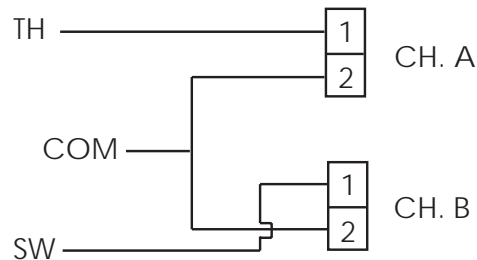
**Figure 11**  
Internally Powered 4-20 mA  
Sensor Wiring



**Note:** Pins 17 and 18 of Connector J3 are 24 Vdc sources for internally powered (2-wire) milliamp sensors. Each pin can provide power for up to four sensors maximum. Powering other devices could damage the Universal Controller.

### Wiring T-56 Space Temperature Sensor

The T-56 can be wired to any two channels.



**Note:** You should configure channel B as a setpoint offset hardware input type point.

### Wiring ACI 10K-AN and 10K-CP Sensors

When wiring the Automation Components Inc. 10K-CP (Carrier part number 33ZCT56SPT) sensor with slider, follow the guidelines below:

- The sensor requires one temperature input hardware point and one setpoint offset point on the Universal Controller, one for the thermistor and one for the slider.
- Wire both inputs to the same controller, and run a 3-wire cable to the sensor.
- The ACI sensor has four terminals. The second SEN terminal (on left), and the first (SET) terminal (on right) should be jumpered (common wire).
- Since there is a common for both signals and both inputs wired to the same module, do not jumper the signal commons on the controller (pin 2 of both channels).

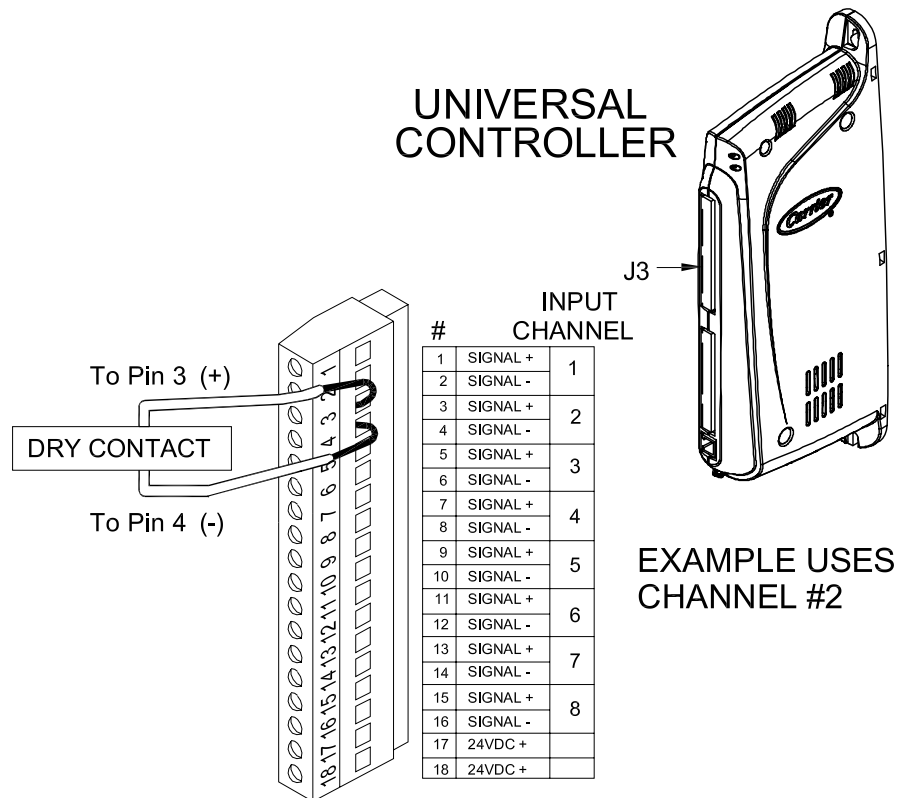
**Configuration Guidelines**

The temperature input for an ACI/10K-CP must be configured as a type 3 (10K Type II (CP/MCI)) temperature sensor. The sidebar input must always be configured as a setpoint offset type analog input.

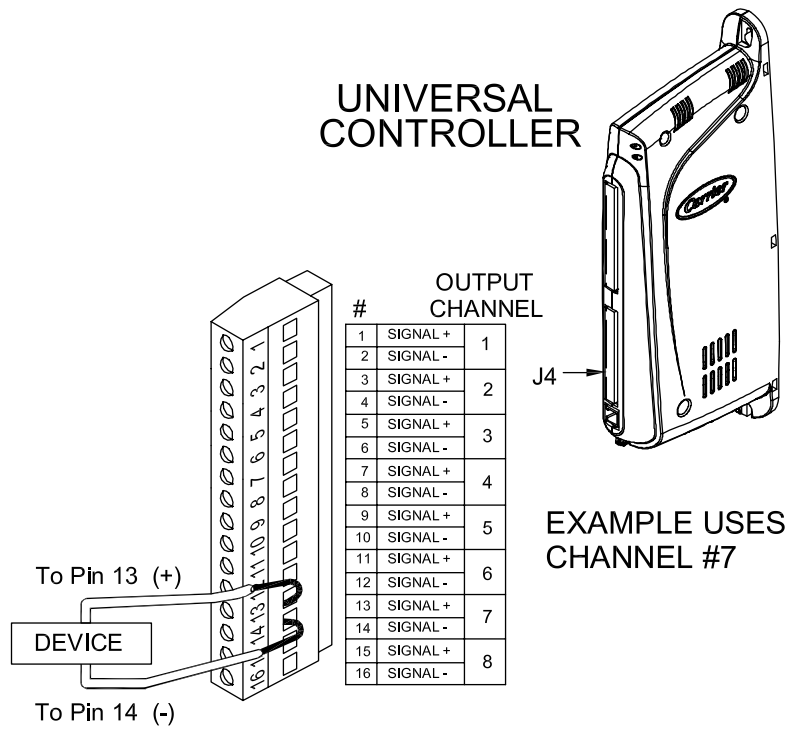
When using this sensor, you must configure the setpoint reference (Offset Low Value/Offset High Value) decisions in the setpoint offset configuration table.

The actual biased setpoints are visible in the setpoint offset maintenance table, based on the current sidebar position. The sidebar units are displayed as 0 to 100%, where 50% is the center position (no setpoint bias), 0% is the full low (minus), and 100% is the full high (plus) setpoint bias position.

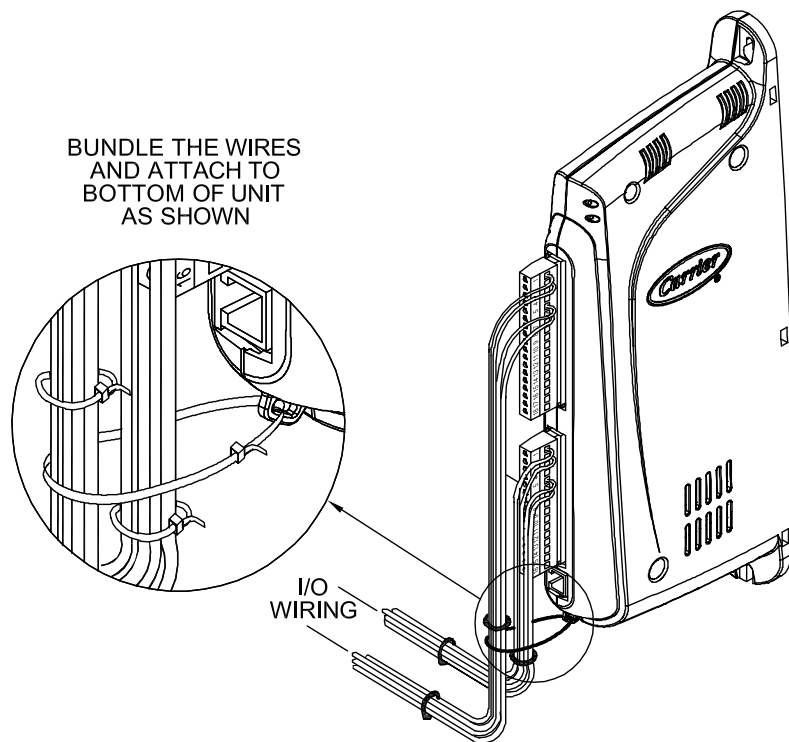
**Figure 12**  
Discrete Input Sensor Wiring



**Figure 13**  
General Output Device  
Wiring



**Figure 14**  
Bundling and Dressing  
Sensor and Device Wiring



Checkout



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## Checkout

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This section describes basic checkout procedures that you should follow before and after you complete the installation.

**Note:** Because these procedures are interdependent, you should perform them in the order in which they are presented.

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## Field Wiring

The first step in checking out an installation is to verify the field wiring by checking for stray voltage, shorts and grounds, or resistance.

1. Turn module power off.
2. Verify that I/O connectors are removed from the module.
3. Using the wire list as a guide, locate the wiring pair associated with the point to be verified.
4. For the same point, go to the sensor or controlling relay and remove the wiring pair from the device terminals. Short the two wires together.
5. Return to the module and use a VOM to measure the resistance across the wiring pair described in Step 3 above. The reading should be less than 5 ohms.
6. Go to the sensor or controlling relay and remove the short described in Step 4 above. Do not re-connect the wires to the sensor at this time.
7. Return to the module and again use a VOM to measure the resistance across the wiring pair. The reading should measure an open, or infinite ohms.
8. If either of the resistances measured in Steps 5 and 7 above was incorrect, a problem exists in the wiring. Replace the wiring pair, or repair wiring if practical.
9. If both measurements were correct, continue with the next procedure.
10. Check between each wire and ground for AC voltage, DC voltage and continuity. Correct as needed.

## Power Supply

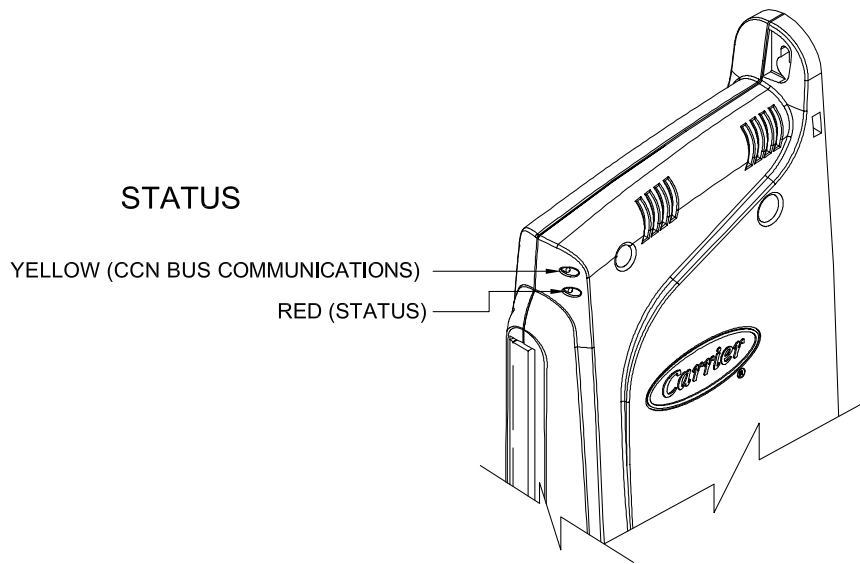
The next step in checking out an installation is to verify that the power supply is operating.

1. Apply 120 Vac or other line voltage to the primary side of the power supply.
2. Ensure that 24 Vac  $\pm$  15% is present on the power connector before you plug it into the module.

## Diagnostic LEDs

The Universal Controller features the diagnostic LEDs shown in the figure below.

**Figure 15**  
Diagnostic LEDs



The following table shows the status of the Universal Controller as indicated by the blink rate of the red LED.

**Table 2**  
Universal Controller Status

Blink Rate	Status
0.5 Hz (blink)	Normal
1.0 Hz (blink, 80% duty cycle)	Start-up Mode
On (not blinking) for less than 30 seconds	Initializing
.25 Hz (blink)	Database Error
Steady on or erratic blink	Failure

---

## Module Operation

Follow the steps below to verify module operation.

1. Before applying power to the module, be sure that the I/O connectors are disconnected from the module.
2. Power the module. The red LED should flash at the "Start-up Mode" 1.0 Hz rate (On for 4/5 second, Off for 1/5 second), for 3 seconds. Then the red LED will stay On (not blinking) for less than 30 seconds. Finally, the red LED will flash at the "Normal" 0.5 Hz rate. (On for 1 second, Off for 1 second).
3. Using the Address Change Utility or System Pilot, verify that the CCN address setting is correct.

## External Devices

1. After you have determined that the wiring between the module and the sensor or controlling relay is correct, you should then determine if the device itself is functional.
2. If the device is a temperature sensor, verify that it is properly mounted at the correct location as shown in the installation drawings. Be sure that space sensors are not located near coffee pots, copying machines, or other sources of heat or cold.
3. If the device is a thermistor, or a DO relay coil, use a VOM to measure resistance across the device terminals. Compare this measurement to Table 3. If the measurement is correct, reconnect all wiring between the device and the module. If the measurement is incorrect, replace the failed device and reconnect all wiring between it and the module.
4. If the device is a 2-wire, 4-20 mA type, there is no simple verification procedure. In this case, assume that it is functional until all device and module wiring, configuration decisions, and setpoint schedules are verified as correct. The 4-20 mA device should be replaced only after all other parameters have been checked thoroughly.

5. If the device is a motor current transducer CT-1, the verification procedure is as follows:

**Warning:** Before servicing this device or any device inside a motor control panel, be sure to disconnect the high voltage supply.

- a. Verify motor current transducer CT-1 is installed and properly wired in the correct part of the starter circuit as shown in the installation drawings.
  - b. Verify wiring from the module to CT-1 by following the External Devices procedure above, then re-connect the wiring pair at the device terminals.
  - c. Re-connect the high voltage supply to the motor control panel.
  - d. Return to the module. Do not connect the field wiring connector to the module.
  - e. Manually run the machine up to full load. Use a VOM to measure the voltage across the device wiring pair. The reading should be 1 to 5 Vdc. If the voltage is incorrect, replace motor current transducer CT-1.
6. After external wiring and devices have been determined to be functional, re-connect the field wiring connector to the module.

**Table 3**  
Temperature to Resistance  
Conversion

Temperature		Resistance (ohms)	
°F	°C	5K Thermistor	10K Type III (AN/YSI) Thermistor
-40	-40	168.3K	239.9K
-35	-37.2	140.1K	203.9K
-30	-34.4	117.1K	173.7K
-25	-32	98.19K	148.5K
-20	-29	82.60K	127.2K
-15	-26.1	69.72K	109.3K

*(continued)*

**Table 3**  
 Temperature to Resistance  
 Conversion  
 (Continued)

Temperature		Resistance (ohms)	
°F	°C	5K Thermistor	10K Type III (AN/YSI) Thermistor
-10	-23.3	59.03K	94.17K
-5	-21.0	50.13K	81.31K
0	-18.0	42.70K	70.38K
5	-15.0	36.47K	61.07K
10	-12.2	31.24K	53.11K
15	-9.4	26.84K	46.29K
20	-7.0	23.12K	40.44K
25	-3.8	19.96K	35.41K
30	-1.1	17.28K	31.06K
35	1.6	15.00K	27.31K
40	4.4	13.05K	24.06K
45	7.2	11.38K	21.24K
50	10.0	9.95K	18.79K
52	11.1		17.90K
54	12.2		17.05K
55	13.0	8.72K	16.65K
56	13.3		16.26K
58	14.4		15.50K
60	15.6	7.65K	14.78K
62	16.7		14.10K
64	17.8		13.46K
65	18.3	6.73K	13.15K
66	18.9		12.85K
68	20.0		12.27K
70	21.1	5.94K	11.72K
72	22.2		11.19K
74	23.3		10.70K
75	24.0	5.25K	10.46K
76	24.4		10.23K
77	25.0		10.00K
78	25.6		9.78K
80	26.7	4.64K	9.35K
85	29.4	4.12K	8.37K
90	32.2	3.66K	7.51K
95	35.0	3.26K	6.75K

(continued)

**Table 3**  
 Temperature to Resistance  
 Conversion  
 (Continued)

Temperature		Resistance (ohms)	
°F	°C	5K Thermistor	10K Type III (AN/YSI) Thermistor
100	37.8	2913.0	6078.0
105	41.0	2604.0	5479.0
110	43.0	2331.0	4947.0
115	46.1	2091.0	4475.0
120	49.0	1878.0	4050.0
125	52.0	1690.0	3672.0
130	54.0	1523.0	3334.0
135	57.2	1375.0	3032.0
140	60.0	1243.0	2760.0
145	63.0	1126.0	2516.0
150	65.5	1021.0	2297.0
155	68.3	927.0	2100.0
160	71.1	843.0	1921.0
165	73.8	767.8	1760.0
170	76.6	700.2	1615.0
175	79.4	639.4	1483.0
180	82.2	584.7	1363.0
185	85.0	535.3	1255.0
190	88.0	490.7	1156.0
195	91.0	450.4	1067.0
200	93.0	413.9	985.0
205	96.1	380.8	910.5
210	99.0	350.8	842.5
215	102.0	323.5	780.3
220	104.0	298.6	723.5
225	107.2	276.0	671.4
230	110.0	255.3	623.6
235	113.0	236.4	579.8
240	116.0	219.2	539.6
245	118.3	203.4	502.6
250	121.1	189.0	468.5

**Table 4**  
Additional Temperature to  
Resistance Conversions

Temperature		Resistance (ohms)
°F	°C	10K Type II (CP/MCI) Thermistor
-40	-40.0	336000.0
-31	-35.0	242700.0
-22	-30.0	177000.0
-20	-29.0	
-15	-26.1	
-13	-25.0	130402.0
-10	-23.3	
-5	-21.0	
-4	-20.0	97060.0
0	-18.0	
5	-15.0	72940.0
10	-12.2	
14	-10.0	55319.0
15	-9.4	
20	-7.0	
23	-5.0	42324.0
25	-3.8	
30	-1.1	
32	0.0	32654.0
35	1.6	
40	4.4	
41	5.0	25396.0
45	9.2	
50	10.0	19903.0
55	13.0	
59	15.0	15714.0
68	20.0	12493.0
77	25.0	10000.0
86	30.0	8056.0
95	35.0	6530.0
104	40.0	5327.0
113	45.0	4370.0
122	50.0	3606.0
131	55.0	2986.0
140	60.0	2488.0
149	65.0	2083.0
158	70.0	1752.0
167	75.0	1480.0
176	80.0	1255.0
185	85.0	1070.0

*(continued)*

**Table 4**  
Additional Temperature to  
Resistance Conversions  
(Continued)

Temperature		Resistance (ohms)
°F	°C	10K Type II (CP/MCI) Thermistor
194	90.0	915.0
203	95.0	787.0
212	100.0	680.0
221	105.0	592.0
230	110.0	517.0
239	115.0	401.0
246	118.8	450.0

## Configuration

At this point, you should refer to the *Universal Controller Overview and Configuration Manual (808-346)* for instructions on how to configure the newly installed Universal Controller.

After the Universal Controller is configured, use the System Pilot or ComfortVIEW to verify that each sensor or transducer works correctly.

## Input and Output Device Connection

The final step in the Universal Controller checkout is to connect the field devices to the module and check their operation. This requires physical inspection of the devices.

### Input Devices

1. Plug the field wiring connector into the module.
2. Display each input channel.
3. Check each input's accuracy by comparing the data displayed on the System Pilot with the actual temperature, status, pressure, etc., at the input device.

**Note:** For AI points, verify the physical location of the sensor. For example, is the discharge sensor downstream from the coil? Is the space sensor in the correct space? Is the pressure sensor in a non-turbulent area?

4. If any input does not checkout properly, verify its hardware and software configuration. Inputs that have slightly inaccurate readings can be trimmed.

## Output Devices

**Caution:** You must correct inaccurate inputs before connecting output devices.

1. Force each output to a safe position.

**Caution:** This is very important because the module will take control of the output devices as soon as you plug the field connectors into the module. The safe position ensures an orderly checkout procedure without disrupting normal building operation.

2. Plug the field connectors into the module.

## Discrete Outputs

1. Display each discrete output.
2. Force the device on (or off) and verify its operation.
3. Force the device off (or on) and verify its operation.
4. Remove the force as each discrete output passes checkout. Observe proper algorithm control of each point before proceeding.

---

## Tuning Control Loops

The following section offers a suggested procedure for control loop tuning if an application consists of a heating, cooling, or other device controlled by an analog, 4-20 mA actuator. While necessarily generic in nature, these steps can be used by any Carrier controller containing PID based analog output control loops.

The sensitivity of most HVAC processes varies with changes in air temperature, water temperature, air volume, and other environmental conditions. Therefore, HVAC control loops periodically need recalibration or tuning to maintain a steady, stable response through seasonal changes.

The most common indications that a loop requires tuning are:

- The output oscillates, in some cases from the maximum to the minimum output value, and the loop is unable to maintain setpoint.

- The controlling sensor is away from the setpoint by more than an acceptable amount, but the output to the controlling device (valve, damper, etc.) does not respond over a reasonable time period.

In some cases, the control loop tuning precision that can be attained depends on the application. For example, when controlling a mixed air damper, the proportion of outside to return air for a given commanded position varies because of mechanical looseness in the damper/actuator assembly. A mixed air damper control algorithm is considered to be well tuned if the mixed air temperature is maintained within one degree F of setpoint. Dual loop algorithms controlling space conditions can be adjusted such that the setpoint can be maintained within several tenths of a degree F.

For most HVAC situations, a somewhat sluggish response to changes in setpoint or in the value of the controlling sensor is desired. Tuning to provide rapid, knee-jerk response, while desirable in some situations, will invariably lead to tuning problems when environmental conditions change. The need for re-tuning the loop will be minimized with a slow but steady system response.

You will tune a control loop using the PID Master Loop and Submaster Loop configuration decisions. Refer to the *Universal Controller Overview and Configuration Manual* (808-346) for information on the software aspects of control loop tuning.

## Definition of Terms

### **Error**

The difference between the reference (Master or Submaster, ie., the setpoint) and the controlling sensor. (See the Equations section that follows.)

### **Master Proportional Equation**

A component of the Master Proportional, Integral and Derivative (PID) Equation (see Equations) which calculates the Submaster Reference (SubRef). Varies the SubRef based on the magnitude of the Error and the time away from setpoint.

### **Master Proportional Gain**

Used to adjust sensitivity of the Master Proportional Equation.

**Master Integral Equation**

A component of the Master PID Equation which calculates the Submaster Reference. Varies the SubRef based on the magnitude of the error and the amount of time it has existed.

**Master Integral Gain**

Used to adjust sensitivity of the Master Integral Equation.

**Master Derivative Equation**

A component of the Master PID Equation which calculates the Submaster Reference. Varies the SubRef based on the rate of change of the Error in the Master PID Equation.

**Master Derivative Gain**

Used to adjust sensitivity of the Master Derivative Equation.

**Submaster Equation**

Calculates the loop output which is proportional to the magnitude of the Error in the Submaster Equation (see Equations).

**Submaster Proportional Gain**

Used to adjust sensitivity of the Submaster Equation.

**Note:** For all single loop equations, use the master definitions above.

**Equations**

All Universal Controller analog algorithms are based on PID equations. In a dual loop algorithm, the master loop calculates the submaster reference and the submaster loop calculates the output signal. In a single loop algorithm, the output signal is calculated directly by a PID equation similar to the master loop equation. These calculations are run at intervals as defined in the respective algorithm's Block Iteration Rate configuration decision. Refer to the *Universal Controller Overview and Configuration Manual* (808-346) for information on the algorithm's configuration decisions.

These are the error calculations for the equations that follow:

$Error_1 = \text{Setpoint} - \text{Value of Controlling Sensor}$

$Error_2 = \text{Submaster Reference} - \text{Value of Submaster Sensor}$

These are the proportional (P Term), integral (I Term) and derivative (D Term) terms for the equations that follow:

$$\text{P Term} = (\text{Error}_1 * \text{Proportional Gain})$$

$$\text{I Term} = (\text{Error}_1 * \text{Integral Gain}) + \text{Previous I Term}$$

$$\text{D Term} = (\text{Current Error}_1 - \text{Previous Error}_1) * \text{Derivative Gain}$$

All single loop algorithms use the following equation:

$$\text{Output Signal} = \text{P Term} + \text{I Term} + \text{D Term} + \text{Starting Value}$$

**Note:** Output Signal will not exceed the minimum and maximum output values configured for the algorithm.

All dual loop algorithms use the following master and submaster equations.

Master PID Equation:

$$\text{Submaster Reference} = \text{P Term} + \text{I Term} + \text{D Term} + \text{Starting Value}$$

**Note:** Submaster Reference will not exceed the minimum and maximum SubRef values configured for the algorithm.

Submaster Equation:

$$\text{Output Signal} = (\text{Error}_2 * \text{Submaster Proportional Gain}) + \text{Center Value}$$

**Note:** Output Signal will not exceed the minimum and maximum output values configured for the algorithm.

## System Checkout

Before you begin tuning the loop, check out the system and verify the following:

1. There are no mechanical or electrical problems with the controls or the controlled equipment. Devices such as valves, dampers, and sensors must be operating properly.

2. Whether the valves and dampers are normally open or normally closed so that the correct display types and gains can be selected. For normally closed devices, the actual control signal (mA or Volts) would be scaled such that the low end (4 mA or 2 Vdc) will display 0%, while the high end (20 mA or 10 Vdc) will display 100%. A normally open device will invert that relationship such that 0% would equate to 20 mA or 10 Vdc while 100% would equate to 4 mA or 2 Vdc.

The polarity and value of the gain is important, because they determine the direction and magnitude of the output for a given amount of error. The master and submaster loops are mathematical formulas whose response is tailored via these gains.

If set up properly, any increase in the algorithm's output from 0 to 100% will result in an increase in output from the controlled device. As long as the output channels are set up with display types that match the controlled device, then the following will be true:

- For all dual loops, the master proportional, integral, and derivative gain will always be positive.
- Dual loop heating algorithms will use positive submaster proportional gain.
- Dual loop cooling algorithms will use negative submaster proportional gain.
- Single loop heating algorithms will use positive proportional, integral, and derivative gain.
- Single loop cooling algorithms will use negative proportional, integral, and derivative gain.

**Note:** All derivative gains have a default value of zero.

3. The system must be operating under actual load conditions. If conditions are atypical, any adjustments will be invalid when normal operating conditions return.

## Determination of Throttling Range

**Caution:** You must determine the throttling range of the controlled device prior to attempting to tune the control loop.

The throttling range of a device can be defined as the range of output over which the device produces a measurable effect. You must differentiate between the throttling range and the mechanical or electrical spring range since the range over which the device (valve, damper, etc.) produces a measurable effect (heat, cool, pressure, etc.) is almost surely to be less than the full spring range. Once the true throttling range is determined, the center value (for dual loops) or starting value (for single loops) can be determined. The Center Value (CV) or Starting Value (SV) can be defined as the center of the throttling range. This may be the mathematical center of the spring range or it may not. For systems which have a very non-linear response, such as a steam valve which opens with a great rush of heat, the CV or SV will be closer to the closed end of the spring range rather than the middle.

To make this determination, the actuator should be stroked over its entire range while monitoring the leaving conditions of the device. This procedure provides the means of determining not only the device's center, but also the point where it begins working, and finally the point where it reaches its maximum capability. You should plot the leaving conditions as a function of output, beginning at a fully closed output and continuing until the leaving conditions no longer change. To insure accuracy over a variety of conditions, this should be done when load conditions are typical for the operation of this device.

If you are tuning a dual loop algorithm, enter the center value in the Submaster Loop Center Value configuration decision. If you are tuning a single loop algorithm, enter the starting value in the PID Master Loop Starting Value configuration decision.

## Dual Loop PID Tuning

All control loops in a Universal Controller allow user adjustment of loop timing. The default for all dual loops is 120 seconds for the master loop and 2 seconds for the submaster loop. It is suggested that the defaults be maintained unless there is a compelling reason to change them.

The following steps apply only to dual loop algorithms:

1. Set the Center Value.  
Verify the correct submaster center value as outlined in Determination of Throttling Range.
2. Tune the Submaster Loop.  
Force the submaster reference to a value several degrees above or below the current value of the submaster sensor. This will cause the controlled device to operate in the middle portion of its throttling range. Since the accuracy of the center value has already been proven, any problems with the submaster loop can normally be attributed to improper settings of the submaster gain. Observe the loop response and determine if any of the following conditions are present:
  - Loop Oscillation.  
An excessive amount of submaster gain is indicated if the submaster sensor and output signal repeatedly oscillate and do not stabilize. To correct for this condition, reduce the submaster proportional gain in 50% increments until the oscillation subsides, and then bring it back up by half of the amount reduced, again verifying that the loop remains free of oscillation. Should this increase return the loop to oscillation, again reduce the gain by one half of the increased amount. The intent is to produce a steady output signal within +/- 5% of the target submaster reference.
  - Droop  
Droop is indicated if the output is stable (not oscillating) but the submaster sensor is more than +/- 5% of reference away from the target submaster reference. Assuming proper adjustment of the submaster gain, this condition normally indicates that the center value was incorrect. Increase or decrease it until the submaster sensor is within +/- 5% of the submaster reference. Again, the goal is to produce a steady output signal within +/- 5% of the target submaster reference.

- Inverse Loop Polarity  
If the output responds in reverse of what is expected, reverse the polarity of the submaster gain (+/-). An example of this condition is when the reference requires heat, but the valve goes closed or moves towards closed. After the required corrections are made, re-evaluate for the other possible conditions.
3. Set the Master Integral Gain to 0.
  4. Adjust the Master Proportional Gain.  
At this point, the submaster loop is stable and its gain has been adjusted for proper response. Adjust the setpoint to a value +/- 5% away from current conditions at the controlling sensor (normally the space sensor) and remove the submaster force to allow the master loop to calculate a new submaster reference (based on the amount of error between the master sensor and the setpoint). This will allow the equipment to operate with a legitimate load. Observe the loop response and determine if the following condition is present:
    - Loop Oscillation.  
If the submaster reference swings wildly from its maximum to its minimum allowable value, the most likely cause is an excessive amount of master proportional gain. Reduce the master proportional gain in increments of 50% until stability results, then increase its value by half of the reduced amount. Since the master loop in this example runs every two minutes, you are advised to allow a minimum of eight minutes (four loop iterations) between successive gain adjustments. The intent is to produce a steady output signal without reaching the minimum and maximum submaster values. At this point the loop should stabilize at an output that will likely not achieve setpoint. This is normal, and we will compensate for this by adjustment of the integral gain.
  5. Set the Integral Gain.  
Once the proportional gain is established, input a value of integral gain that is between 10% and 50% of the proportional

gain. This will cause the output to increase or decrease incrementally at each loop iteration until setpoint is achieved. If the output causes a setpoint overshoot, reduce the integral gain by 50% of the initial value and re-evaluate the loop's response. The goal is to cause the loop to gradually approach and achieve setpoint with minimal overshoot. Since the master loop in this example runs every two minutes, you are advised to allow a minimum of eight minutes (four loop iterations) between successive gain adjustments.

After making any necessary adjustments to the master loop, the output should be stable (not oscillating) and the controlling sensor should be at or approaching setpoint. A change in setpoint or in the value of the controlling sensor should cause the output to move steadily in the appropriate direction, and allow the loop to reach setpoint in a reasonable period of time.

6. Adjust the Derivative Term.  
Determine if the application requires a derivative term. Normally, this would only be required when, after careful adjustment of the submaster's proportional gain and the master's proportional and integral gains, excessive overshoot/undershoot is observed. The purpose of the derivative term is to reduce or eliminate overshoot in systems which have a very rapid rate of change at the controlling sensor. Most HVAC applications that use a master/submaster approach do not respond that quickly, therefore the derivative is normally not necessary or used. As such, the default value for the derivative gain is zero. The actual mathematical function of the derivative term is two-fold; it will subtract from the value of the proportional and integral calculation (thus reducing overall output) when the controlling sensor is approaching setpoint, and conversely, it will add to the proportional and integral calculation (thus increasing the overall output) in cases where the controlling sensor is drifting away from setpoint. In cases where there is no change in the value of the controlling sensor, (that is to say the change in loop error is zero), the derivative will have no effect (the calculated derivative term is zero).

If after careful adjustment of the proportional and integral gains, your application does require a derivative term (indicated by excessive overshoot), set it to a value approximately 25% of the proportional gain, and re-test and re-adjust (by +/- 50% intervals) until overshoot is reduced to a satisfactory level.

### **Single Loop PID Tuning**

As was the case with dual loop tuning, the entire system (controls, mechanical equipment, etc.) must be thoroughly evaluated before proceeding. The throttling range must also be determined using the procedure described in Determination of Throttling Range above. When those steps are completed, the actual tuning procedure may commence.

The AO—Adaptive Single Loop PID is the only single loop algorithm in the Universal Controller. The optimum loop timing (set via the Block Iteration decision) will vary based on the nature of the application. The default value of 10 seconds may not be appropriate for all applications. The user is advised to adjust this value to reflect the actual time constant of the controlled process (the time it takes to stabilize after a step change of output to the controlled device).

The following steps apply to single loops only. During the following procedure, if the output responds in reverse of what is expected, reverse the polarity of the proportional, integral, and derivative gains (+/-). In all cases, the polarity of the proportional, integral, and derivative gains must be the same. An example of the output responding in reverse of what is expected is when the reference requires heat, but the valve goes closed or moves towards closed.

1. Set the Starting Value.  
Verify the correct starting value as outlined previously in the Determination of Throttling Range section of this chapter.
2. Force the Output.  
Force the output to its minimum position.
3. Set the Master Integral Gain to 0.
4. Set the Proportional Gain.

Release the output force and adjust the setpoint to a value that will cause the output to increase. This will cause the controlled device to begin operating under automatic control. Since we have already proven the accuracy of the starting value, any problems with the loop can be attributed to improper settings of gain. Observe the loop response over several minutes time, and identify whether the following conditions apply:

- **Loop Oscillation.**  
An excessive amount of proportional gain is indicated when the controlling sensor and output oscillate. To correct for this condition, reduce the proportional gain in 50% increments until the oscillation subsides, and then bring it back up by half of the amount reduced, again verifying that the loop remains free of oscillation. Should this increase return the loop to oscillation, reduce the gain by one half of the increased amount. The intent is to produce a steady output signal within +/- 5% of the target setpoint.
- **Droop**  
Droop is indicated if the output is stable (not oscillating) but the controlling sensor is more than +/- 5% of reference away from the target setpoint. Assuming proper adjustment of the proportional gain, this condition normally indicates that the starting value was incorrect. Increase or decrease it until the controlling sensor is within +/- 5% of the setpoint. The goal is to produce a steady output signal within +/- 5% of the target setpoint.

5. **Set the Integral Gain.**

Once the proportional gain is established, input a value of integral gain that is between 10% and 50% of the proportional gain. This will cause the output to increase or decrease incrementally at each loop iteration until setpoint is achieved. If the setpoint is exceeded indicating overshoot, reduce the integral gain by 50% of the initial value and re-evaluate the loop's response. The goal is to cause the loop to gradually approach and achieve setpoint with minimal overshoot.

After making these adjustments, the output should be stable (not oscillating) and the controlling sensor should be at or approaching setpoint.

6. Adjust the Derivative Term.

Determine if the application requires a derivative term. Normally, this would only be required when, after careful adjustment of the submaster's proportional gain and the master's proportional and integral gains, excessive overshoot/undershoot is observed. The purpose of the derivative term is to reduce or eliminate overshoot in systems which have a very rapid rate of change at the controlling sensor. Most HVAC applications that use a master/submaster approach do not respond that quickly, therefore the derivative is normally not necessary or used. As such, the default value for the derivative gain is zero. The actual mathematical function of the derivative term is two-fold; it will subtract from the value of the proportional and integral calculation (thus reducing overall output) when the controlling sensor is approaching setpoint, and conversely, it will add to the proportional and integral calculation (thus increasing the overall output) in cases where the controlling sensor is drifting away from setpoint. In cases where there is no change in the value of the controlling sensor, (that is to say the change in loop error is zero), the derivative will have no effect (the calculated derivative term is zero).

If after careful adjustment of the proportional and integral gains, your application does require a derivative term (indicated by excessive overshoot), set it to a value approximately 25% of the proportional gain, and re-test and re-adjust (by +/- 50% intervals) until overshoot is reduced to a satisfactory level.

# Appendixes



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## **Appendix A**

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### **Wire List**

This appendix contains a wire list for the Universal Controller.



# Universal Controller I/O Wire List

REVISION \_\_\_\_\_

DATE \_\_\_\_/\_\_\_\_/\_\_\_\_

JOB: NAME \_\_\_\_\_ NUMBER \_\_\_\_\_  
 LOCATION: BUILDING \_\_\_\_\_ FLOOR \_\_\_\_\_ AREA \_\_\_\_\_  
 ADDRESS: BUS # \_\_\_\_\_ ELEMENT# \_\_\_\_\_ CONTROLLER# \_\_\_\_\_

POINT/ CABLE#	J3 Pin #		✓	INPUT TYPE	POINT NAME	SENSOR CODE	WIRING DWG#	SYSTEM NAME
	(+)	(-)						
	17	1		2 wire mA				
	1	2		Volt, DI, Temp, or 4 wire mA				
	17	3		2 wire mA				
	3	4		Volt, DI, Temp, or 4 wire mA				
	17	5		2 wire mA				
	5	6		Volt, DI, Temp, or 4 wire mA				
	17	7		2 wire mA				
	7	8		Volt, DI, Temp, or 4 wire mA				
	18	9		2 wire mA				
	9	10		Volt, DI, Temp, or 4 wire mA				
	18	11		2 wire mA				
	11	12		Volt, DI, Temp, or 4 wire mA				
	18	13		2 wire mA				
	13	14		Volt, DI, Temp, or 4 wire mA				
	18	15		2 wire mA				
	15	16		Volt, DI, Temp, or 4 wire mA				
POINT/ CABLE#	J4 Pin #		✓	OUTPUT TYPE	POINT NAME	SENSOR CODE	WIRING DWG#	SYSTEM NAME
	(+)	(-)						
	1	2		DO				
				mA				
				Volt				
	3	4		DO				
				mA				
				Volt				
	5	6		DO				
				mA				
				Volt				
	7	8		DO				
				mA				
				Volt				
	9	10		DO				
				mA				
				Volt				
	11	12		DO				
				mA				
				Volt				
	13	14		DO				
				mA				
				Volt				
	15	16		DO				
				mA				
				Volt				

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## Appendix B

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### How To Clear the Universal Controller Database

Follow the procedure below to completely erase the Universal Controller database and return the unit to its factory default settings.

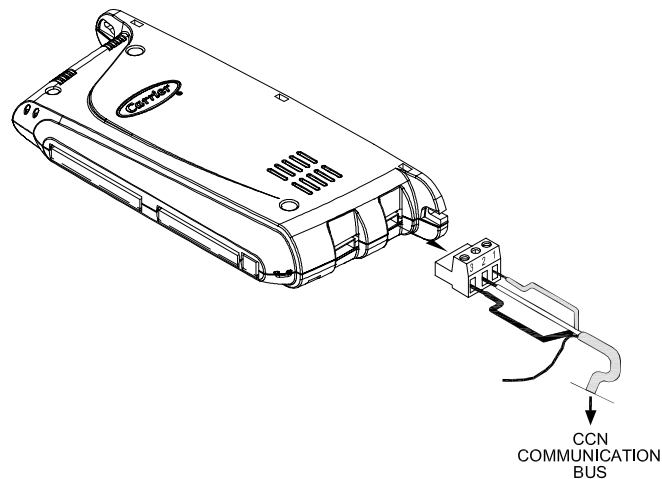
**Caution:** All data, such as 24-character names, algorithm selections, configuration decision entries, etc., as well as the module's address will be erased.

1. If the Universal Controller that is to be cleared is connected to the CCN, you must disconnect it. Refer to the figure below.

To disconnect a Universal Controller from the CCN:

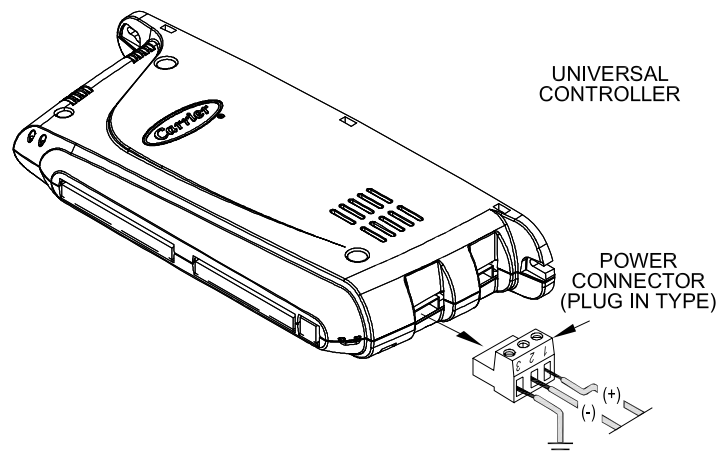
Remove the CCN communication connector from the module.

**Figure 16**  
Disconnecting the Universal Controller From the CCN

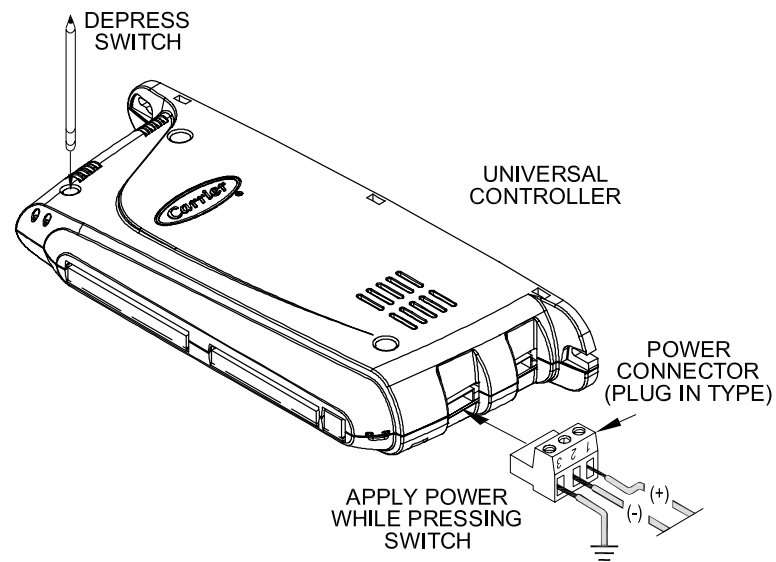


2. Disconnect power by removing the power connector from the module. Refer to the figure below.

**Figure 17**  
Disconnecting Power From the Universal Controller



**Figure 18**  
Universal Controller  
Button for Clearing the  
Database



3. Depress and hold the button at the bottom of the hole in the side of the module shown in Figure 18. Re-connect power to the Universal Controller while still depressing the button. This begins the process of clearing the database.

**Note:** The button can be depressed with any narrow object such as a pencil.

While the database is being cleared, the red LED on the Universal Controller will blink at a one-Hz rate followed by a period of steady ON. This period will vary depending on the amount of data to be cleared. Once the process is completed, the red LED will blink at a 0.5-Hz rate.

4. Release the button.
5. Re-connect the CCN Communication Bus to the Universal Controller.
6. Upload the Universal Controller and re-configure it as desired.

## Appendix C

### Quick Reference Guide

The following table is intended to be a summary of product specifications and CCN product compatibility data for the Universal Controller.

**Table C-1**  
Quick Reference Guide

Item	Value	Comments
<b>Baud Rate Data</b>		
Default Baud Rate	9600	
Range of Baud Rates	9600-38400	
<b>Address Data</b>		
Default Address	0,1	
Valid Range of Addresses	1-239	
Address Setting Method		
NST	Yes	
ESU/Address Search Utility	Yes	
DIP Switch	No	
<b>Controller Reset Procedure</b>		
By Reset Jumper?	No	
By Pushbutton?	Yes	
Software Reset by Config Decision?	No	
Address/Baud Rate Retention?	No/No	Reverts to address 0,1 @ 9600
<b>Power Requirements</b>		
AC Power		
(VA and Volts, +/- %)	60 VA@24 Vac +/- 15%	
Power Sharing	Yes	Phasing MUST be maintained
See Note at end of table		
<b>Bus Communications</b>		
38.4K Bridge Compatible	Yes	
8088 Bridge Compatible	Yes	
8052 Bridge Compatible	Yes	
Ethernet Bridge	Yes	
# of Devices per Bus/Bus Segment (>= 19,400)	239	
# of Devices per Bus/Bus Segment (< 19,400)	239	

(continued)

**Table C-1**  
 Quick Reference Guide  
 (Continued)

Item	Value	Comments
<b>User Interface Compatibility</b>		
Building Supervisor IV	No	
Network Service Tool IV	Yes	
ComfortVIEW	Yes	
ComfortWORKS	Yes	
HSIO II (color buttons, white or black casing)	No	
LID1B	No	
LID2B	No	
Chiller Visual Controller (CVC)	No	
Remote Enhanced Display (Display-only CVC)	No	
Navigator	No	
Scrolling Marquee	No	
Carrier One	Yes	
System Pilot	Yes	
<b>Option Module Compatibility</b>		
APIM	Yes	
Data Collection I	No	
Data Collection III	Yes	
Data Collection IV	Yes	
Maintenance Management	No	
Timed Force	Yes	
Tenant Billing	Yes	
Loadshed	Yes	
Facility Time Schedule	Yes	
Cleaver Brooks Interface	N/A	
Leibert Interface	N/A	
Simplex Interface	N/A	
Terminal System Manager II	N/A	
Terminal System Manager II Plus	N/A	
Chillervisor System Manager I	N/A	
Chillervisor System Manager II	N/A	
Chillervisor System Manager III	N/A	

(continued)

**Table C-1**  
Quick Reference Guide  
(Continued)

Item	Value	Comments
Flotronic System Manager	N/A	
Hydronic System Manager	N/A	
Hydro Hi-Q System Manager	N/A	
Water System Manager	N/A	
<b>Interoperability Interfaces</b>		
DataPORT	Yes	
DataPORT II (DataLINK)	Yes	
BACLink	No	
CCNWeb Server	Yes	
Carrier Translator	Yes	
<b>Product Specific Controllers</b>		
19XL	Yes	
23XL	Yes	
39L/39N	Yes	
30GTN (M-1 PIC)	Yes	
30 GX/HX	Yes	
50 BJ/BK	Yes	
48, 50 NP, 50 NB	Yes	
48, 50 DK/NK	Yes	
64 RT	Yes	
17, 19 EX	Yes	
VAV Zone Controller	Yes	Linkage, Global Schedule override broadcast
V2-VVT	Yes	Linkage
Fan Coil Controller	Yes	Global Schedule override broadcast
V05 Fan Coil Zone Controller	Yes	
CS5000 (Platform A)	Yes	
Flotronic II Phase 3 (30 GN)	Yes	
Conquest	Yes	
30 Series Global Chiller	Yes	
19/23 Series PIC II Chiller	Yes	

*(continued)*

**Table C-1**  
Quick Reference Guide  
(Continued)

Item	Value	Comments
32MP Gateway	Yes	
ProDialog	Yes	
ProDialog II	Yes	
PTAC System Manager	No	
Air Source Interface (ASI)	No	
VVT Gateway	No	
PremierLINK	Yes	Global Schedule override broadcast
<b>General Purpose Controllers</b>		
Comfort Controller	Yes	
FID Phase IV	N/A	
Comfort Thermostat	Yes	
Linkage Thermostat	Yes	Linkage compatibility

**Note:** It is strongly recommended that you use isolated, non-shared transformers to power this module. If power is to be shared with another device, you must maintain phasing of the power source between elements in question. Failure to maintain consistent phasing can result in irreparable damage to the modules.

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