Installation/Operator Programming

UCM 4.0 and Wireless VAV Communication

May 2001

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CHAPTER 1: GENERAL INFORMATION

Unit Control Module 4.0 (UCM 4.0)
The UCM 4.0 is a microprocessor-based, Direct Digital Controller (DDC) for the (Variable Air Volume) VAV terminal unit. It contains the control logic to modulate the flow of supply air through the VAV terminal in response to the load requirements within the VAV zone. The function of the UCM is to control the VAV terminal unit to vary the volumetric airflow rate to the zone. VAV units are available with either pneumatic, analog electronic, or microprocessor controls (DDC VAV). This manual discusses only terminal units with DDC/VAV controls. Factory installed DDC/VAV controls are available with all single duct terminal units, including parallel fan-powered, and series fan-powered units. Two UCMs are required for dual duct units (one for the heating duct and one for the cooling duct).

The UCM modulates a VAV’s damper blade based on a zone temperature, measured airflow, and set points to continuously control conditioned air delivery to the space. The volume of incoming air is monitored and the damper adjusts to provide accurate control independent of the duct pressure. The damper modulates between operator set points depending on space conditions. Additionally, fan and heat outputs may be energized depending on the application. Available inputs include a twisted/shielded communication link, zone sensor, auxiliary temperature sensor (optional), CO2 Sensor (optional), and OccuPy/Unoccup Sensor (optional), and 24 VAC power.

Specifications
Power Requirements
The UCM 4.0 requires 24 VAC, 50/60 Hz, and up to 50 VA, depending on the number of heat outputs (stages), which consume 10 VA each.

Operating Environments – UCM 4.0
0°–140°F (0°–60°C), 10% to 90% relative humidity, non-condensing

Storage Environments – UCM 4.0
-40°–150°F (-40°–65.6°C), 10% to 90% relative humidity, non-condensing

Mounting
Typically, the UCM 4.0 is factory installed. However, UCM 4.0 is available with retrofit kits, in which case it must be field installed. See Chapter 8 for wireless system mounting.

Tracer Summit and UCM 4.0 Communications Link Wiring
Communications Link wiring must be 18 AWG twisted shielded pair wire. Each conductor must be stranded tinned copper. The maximum total wire length is 5,000 feet (1,524 m). Refer to Chapters 2 and 3 for further information about wire selection.

UCM 4.0 Enhancements
• The enhanced VAV UCM is backward compatible with VariTrane® D VAV boxes (VXXD and VXXE) VariTrac® dampers, and VariTrac II dampers.
• UCM 4.0 adds support for operation with VariTrane Series F valves (¼-turn blade dampers) via 90-second drive time.
• UCM 4.0 adds a second, CO2 interfacing, mode of operation to the auxiliary analog input (TB3-5). This is a 1 to 10 volt DC input with a mapping of input voltage to CO2 output data value of 200 parts per million (PPM) of CO2 per volt. The use of this new auxiliary analog input as an interface to a CO2 detector is mutually exclusive with the use of the input as auxiliary temperature input. Therefore, the use of the CO2 interfacing mode of operation is not recommended for stand-alone applications requiring auto-changeover.
• UCM 4.0 adds a binary 24 VAC, dry contact input. It can be configured either as a generic input or as an occupancy detector input.
• UCM 4.0 adds a VariTrac Bypass Damper mode of operation. In this
mode, supply air temperature and supply air pressure is made available on the Com 4 link. The damper position is a COM 4-control parameter. A Com 4 configurable failsafe position was added. The supply air temperature uses a new “s” input (TB3-7). The use of this new input is mutually exclusive with the Zone temp input (TB3-1).

- UCM 4.0 now assumes the hot water valve is closed after reset. This prevents a reset during hot water override from causing the valve to stop moving. This also changes the behavior after reset, when there is a reheat demand, the hot water valve now opens (from assumed closed position) to the desired reheat position.

- In a wireless system, the hard-wired sensor can now be configured as not present. The hard-wired sensor failures will not be reported as long as at least one wireless zone sensor is reporting valid temperature values.

- For standalone units, series or parallel fan operation will use the unoccupied fan control when the local unoccupied request (** function) is received. In UCM 3.3 and prior, the fan would operate as if occupied during local unoccupied request.

- UCM 4.0 adds a local minimum heating flow set point. The use of and value of this set point is configurable.

UCM 4.0 Backward Compatibility
UCM 4.0 can be used to replace UCM I, UCM II, and UCM III with no compatibility issues. However, if the communicating device (i.e. Command Unit I or Comfort Manager™ I) is a COM 3 device (1992 or earlier), then you will need an upgrade chip. The Comfort Manager chip upgrade is Kit 1511 and the Command Unit chip upgrade is Kit 1512.

UCM 4.0 Features

Heat and Fan Outputs
All fan outputs are rated for 10 VA each. Magnetic contactors are rated for 10 VA. Mercury contactors are rated for 12 VA.

Wiring Diagram
Figure 1 shows a typical wiring diagram for the redesigned UCM hardware. The new service part number is BRD 2087.

Slaving of Zone Sensors
Up to three (3) UCM 4.0s may be connected to a single zone sensor.

Generic UCM Capability
UCM 4.0 can be configured to control non-Trane VAV boxes.

Shipping
Each VAV product and its service literature are shipped in the same package. When unpacking, make sure that the literature is not lost or discarded with the packing material. Visually inspect the individual components for obvious defects or damage. All components are thoroughly inspected before leaving the factory. Any claims for damage incurred during shipment must be filed with the carrier.

Storage
When any component of the VAV system and/or field installed accessories must be stored for a period of time prior to being installed, they must be protected from the elements. The storage location temperature should be between -40° – 150°F (-40°– 65.6°C) and the relative humidity should be 10% to 90%, non-condensing. The warranty will not cover damage to the VAV system or controls due to negligence during storage. A controlled indoor environment must be used for storage.
Chapter Overview
This chapter contains information pertaining to the following:
- Pre-power up check-out for the UCM 4.0
- UCM operational LEDs
- Zone Sensor check-out

UCM 4.0 Pre-Power Check-out
- Check the supply voltage at TB1. Proper polarity must be maintained. TB1-1 is the hot side (+) and TB1-2 is the ground side (-) of the 24 VAC input. The UCM cannot be powered from a common 24 VAC transformer that is supplying power to a device containing a full-wave rectifier bridge in its power supply. The acceptable voltage is 20 to 28 VAC (24 VAC cataloged). However, voltages at either extreme may result in increased system instability.
- Verify that communications wiring has properly been terminated at TB2-1 (+) and TB2-2 (-). Polarity is very important on the communications link.
- Verify that the zone sensor connections are correct as detailed in the UCM wiring chapter.
- Verify that the proper unit DIP switch settings have been set on each UCM.
- Verify that the tubing is properly connected to the transducer.

CHAPTER 2: VAV START-UP/CHECK-OUT PROCEDURE

Light Emitting Diode (LED) Operations
The UCM has one green LED located near TB3 and one yellow LED located near TB2 on the UCM circuit board. These LED’s are used to help diagnose communication (yellow) or circuit board problems (green).

The green LED (red on older boards) is a power indicator. It is steady on when the power is on and the software is functioning correctly. If it blinks with a 1 second on 1 second off cycle when power is applied, then the board is not functioning and must be replaced.

**Table 1 - Green LED Power Function Indication**

<table>
<thead>
<tr>
<th>LED State</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;On&quot;</td>
<td>Board functioning correctly</td>
</tr>
<tr>
<td>Blinks</td>
<td>Board malfunction (Replace Board)</td>
</tr>
<tr>
<td>&quot;Off&quot;</td>
<td>Board does not have power</td>
</tr>
</tbody>
</table>

The yellow LED functions as the communication indicator. The indication from the yellow LED is as follows:

**Table 2 - Yellow LED Communication Indicator Function**

<table>
<thead>
<tr>
<th>LED State</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;On&quot;</td>
<td>Incorrect (reversed) communication polarity, no connection, or shorted lines.</td>
</tr>
<tr>
<td>Blinks slowly approx. 1 blink/sec.</td>
<td>Communication is occurring on the link but not for that particular UCM.</td>
</tr>
<tr>
<td>Blinks quickly (multiple blinks blinks/sec.)</td>
<td>Communication is occurring on the link, specifically with that UCM.</td>
</tr>
<tr>
<td>&quot;Off&quot;</td>
<td>Polarity is correct and no communication is occurring on the link.</td>
</tr>
</tbody>
</table>

**Zone Sensor Check-out**
If an erroneous temperature is being reported to the UCM, use the Zone Sensor Temperature-Resistance Table to verify the integrity of the adjustable set point potentiometer or sensor. The resistance should be measured across the terminals to which the device is connected.

**Table 3 - Zone Sensor Temperature-Resistance Table**

<table>
<thead>
<tr>
<th>Temp. (°F)</th>
<th>Thermostat Thumbwheel Resistance (Ohms)</th>
<th>Sensor Resistance (k Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>792</td>
<td>17.0</td>
</tr>
<tr>
<td>56</td>
<td>772</td>
<td>16.5</td>
</tr>
<tr>
<td>57</td>
<td>753</td>
<td>16.1</td>
</tr>
<tr>
<td>58</td>
<td>733</td>
<td>15.7</td>
</tr>
<tr>
<td>59</td>
<td>714</td>
<td>15.4</td>
</tr>
<tr>
<td>60</td>
<td>694</td>
<td>15.0</td>
</tr>
<tr>
<td>61</td>
<td>675</td>
<td>14.6</td>
</tr>
<tr>
<td>62</td>
<td>656</td>
<td>14.3</td>
</tr>
<tr>
<td>63</td>
<td>636</td>
<td>14.0</td>
</tr>
<tr>
<td>64</td>
<td>617</td>
<td>13.6</td>
</tr>
<tr>
<td>65</td>
<td>597</td>
<td>13.3</td>
</tr>
<tr>
<td>66</td>
<td>578</td>
<td>13.0</td>
</tr>
<tr>
<td>67</td>
<td>558</td>
<td>12.6</td>
</tr>
<tr>
<td>68</td>
<td>539</td>
<td>12.3</td>
</tr>
<tr>
<td>69</td>
<td>519</td>
<td>12.1</td>
</tr>
<tr>
<td>70</td>
<td>500</td>
<td>11.8</td>
</tr>
<tr>
<td>71</td>
<td>481</td>
<td>11.5</td>
</tr>
<tr>
<td>72</td>
<td>461</td>
<td>11.2</td>
</tr>
<tr>
<td>73</td>
<td>442</td>
<td>11.0</td>
</tr>
<tr>
<td>74</td>
<td>422</td>
<td>10.7</td>
</tr>
<tr>
<td>75</td>
<td>403</td>
<td>10.4</td>
</tr>
<tr>
<td>76</td>
<td>383</td>
<td>10.2</td>
</tr>
<tr>
<td>77</td>
<td>364</td>
<td>10.0</td>
</tr>
<tr>
<td>78</td>
<td>344</td>
<td>9.7</td>
</tr>
<tr>
<td>79</td>
<td>325</td>
<td>9.5</td>
</tr>
<tr>
<td>80</td>
<td>306</td>
<td>9.3</td>
</tr>
<tr>
<td>81</td>
<td>286</td>
<td>9.0</td>
</tr>
<tr>
<td>82</td>
<td>267</td>
<td>8.8</td>
</tr>
<tr>
<td>83</td>
<td>247</td>
<td>8.6</td>
</tr>
<tr>
<td>84</td>
<td>228</td>
<td>8.4</td>
</tr>
<tr>
<td>85</td>
<td>208</td>
<td>8.2</td>
</tr>
</tbody>
</table>

**Note:** Disconnect the zone sensor from the UCM when making the checks listed in the table below.

**Table 3 - Zone Sensor Temperature-Resistance Table**

<table>
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<tr>
<td>85</td>
<td>208</td>
<td>8.2</td>
</tr>
</tbody>
</table>

**Note:** Thumbwheel resistance checks are made at terminal 2 and 3 on the zone sensor. Temperature sensor resistance is measured at terminal 1 and 2 of the zone sensor.
Figures 2 – 5 show wiring diagrams for typical applications of UCM 4.0.

Figure 2. Wiring Diagram for Single Duct Units with Field Installed Re-heat

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**CHAPTER 3: UCM 4.0 INSTALLATION AND WIRING**

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**NOTE:**
1. **FACTORY WIRING**
   - **FIELD WIRING**
   - **OPTIONAL OR ALTERNATE WIRING**

2. 1/4" QUICK CONNECT REQUIRED FOR ALL FIELD CONNECTIONS.
3. ZONE SENSOR TERMINALS 4 AND 5 REQUIRE SHIELDED TWISTED PAIR WIRING FOR COMMUNICATIONS JACK EQUIPPED ZONE SENSOR OPTION.
4. NO ADDITIONAL WIRING REQUIRED FOR NIGHT SETBACK OVERRIDE (ON/CANCEL).
5. THE OPTIONAL BINARY INPUT CONNECTS BETWEEN TB4-1 (BIP) AND 24VAC (HOT) FROM TRANSFORMER. THE BINARY INPUT CAN BE RECONFIGURED AS AN OCCUPANCY INPUT VIA THE COMMUNICATIONS INTERFACE.
6. AS SHIPPED, THE AUX INPUT IS CONFIGURED AS AN AUX TEMP INPUT. THE AUX INPUT CAN BE RECONFIGURED AS A CO2 SENSOR INPUT VIA THE COMMUNICATIONS INTERFACE.
7. S TERMINAL NOT TO BE USED WITHOUT HANTRAINE.
8. IF UNIT MOUNTED TRANSFORMER IS NOT PROVIDED, POLARITY FROM UNIT TO UNIT MUST BE MAINTAINED TO PREVENT PERMANENT DAMAGE TO CONTROL BOARD. IF ONE LEG OF 24VAC SUPPLY IS GROUNDED, THEN GROUND LEG MUST BE CONNECTED TO TB1-2.

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**WARNING**
Hazardous Voltage: Disconnect all electric power before servicing. Incorrect wiring can cause severe personal injury or death.

**CAUTION**
Use copper conductors only. Conduit nipples are not designed to accommodate types of conductors. Failure to do so may cause damage to the equipment.
Figure 3. Wiring Diagram for Single Duct Units with Factory Installed Electric Re-heat

NOTE:
1. FACTORY WIRING
   FIELD WIRING
   OPTIONAL OR ALTERNATE WIRING
2. 1/4" QUICK CONNECT REQUIRED FOR ALL FIELD CONNECTIONS.
3. ZONE SENSOR TERMINALS 4 AND 5 REQUIRE SHIELDED TWISTED PAIR WIRING FOR COMMUNICATIONS.
   JACK EQUIPPED ZONE SENSOR OPTION.
4. NO ADDITIONAL WIRING REQUIRED FOR NIGHT SETBACK OVERRIDE (ON/CANCEL).
5. THE OPTIONAL BINARY INPUT CONNECTS BETWEEN TB4-1 (BP) AND 24VAC (HOT) FROM TRANSFORMER. THE BINARY INPUT CAN BE RECONFIGURED AS AN OCCUPANCY INPUT VIA THE COMMUNICATIONS INTERFACE.
6. AS SHIPPED, THE AUX INPUT IS CONFIGURED AS AN AUX INPUT. THE AUX INPUT CAN BE RECONFIGURED AS A CO2 SENSOR INPUT VIA THE COMMUNICATIONS INTERFACE.
7. S TERMINAL NOT TO BE USED WITH VARRITRANE.
8. IF UNIT MOUNTED TRANSFORMER IS NOT PROVIDED, POLARITY FROM UNIT TO UNIT MUST BE MAINTAINED TO PREVENT PERMANENT DAMAGE TO CONTROL BOARD. IF ONE LEG OF 24VAC SUPPLY IS GROUNDED, THEN GROUND LEG MUST BE CONNECTED TO TB1-2.
9. CONTACTORS ARE 24 VAC: 120V MAX/COIL (MERCURY CONTACTORS), 10A MAX/COIL (MAGNETIC CONTACTORS).

WARNING
HAZARDOUS VOLTAGE
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.
FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

CAUTION
USE COPPER CONDUCTORS ONLY.
UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.
FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.
Figure 4. Wiring Diagram for Fan-Powered Units with Field Installed Re-heat

NOTE:
1. **FACTORY WIRING**
   - FIELD WIRING
   - OPTIONAL OR ALTERNATE WIRING
2. 1/4" QUICK CONNECT REQUIRED FOR ALL FIELD CONNECTIONS.
3. ZONE SENSOR TERMINALS 4 AND 5 REQUIRE SHIELDED TWISTED PAIR WIRING FOR COMMUNICATIONS JACK EQUIPPED ZONE SENSOR OPTION.
4. NO ADDITIONAL WIRING REQUIRED FOR NIGHT SETBACK OVERRIDE (ON/CANCEL).
5. THE OPTIONAL BINARY INPUT CONNECTS BETWEEN TBS-1 (BP) AND 24VAC (HT) FROM TRANSFORMER. THE BINARY INPUT CAN BE RECONFIGURED AS AN OCCUPANCY INPUT VIA THE COMMUNICATIONS INTERFACE.
6. AS SHIPPED, THE AUX INPUT IS CONFIGURED AS AN AUX TEMP INPUT. THE AUX INPUT CAN BE RECONFIGURED AS A CO2 SENSOR INPUT VIA THE COMMUNICATIONS INTERFACE.
7. 5 TERMINAL NOT TO BE USED WITH VARTRANE.

WARNING
HAZARDOUS VOLTAGE: DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

CAUTION
USE COPPER CONDUCTORS ONLY. UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.
Figure 5. Wiring Diagram for Fan-Powered Units with Factory Installed Electric Re-heat

NOTE:
1. FACTORY WIRING
   FIELD WIRING
   OPTIONAL OR ALTERNATE WIRING
2. 1/4" QUICK CONNECT REQUIRED FOR ALL FIELD CONNECTIONS.
3. ZONE SENSOR TERMINALS 4 AND 5 REQUIRE SHIELDED TWISTED PAIR WIRING FOR COMMUNICATIONS JACK EQUIPPED ZONE SENSOR OPTION.
4. NO ADDITIONAL WIRING REQUIRED FOR NIGHT SETBACK OVERRIDE (ON/CANCEL).
5. THE OPTIONAL BINARY INPUT CONNECTS BETWEEN TB4-1 (BIP) AND 24VAC (VOT) FROM TRANSFORMER. INPUT CAN BE RECONFIGURED AS AN OCCUPANCY INPUT VIA THE COMMUNICATIONS INTERFACE.
6. AS SHIPPED, THE AUX INPUT IS CONFIGURED AS AN AUX TEMP INPUT. THE AUX INPUT CAN BE RECONFIGURED AS A CO2 SENSOR INPUT VIA THE COMMUNICATIONS INTERFACE.
7. S TERMINAL NOT TO BE USED WITH VARTRANE.
Chapter Overview
This chapter contains information about the following:
- UCM 4.0 Power Wiring
- Zone Sensor Wiring
- Communication Wiring
- DIP switch Settingsire Selection

UCM 4.0 Power Wiring

Power Requirements
Caution: Disconnect all power external to the unit to prevent injury or death from electrical shock. Use copper conductors only. The use of aluminum or other types of wire may result in overheating and equipment damage.

Use at least 16 AWG for power wiring and connect to terminal TB1-1 (+) and TB1-2 (−). 24 VAC is required to power the UCM control and has an acceptable voltage tolerance of 20 to 28 VAC.

Replace the UCM control box cover after field wiring to prevent any electromagnetic interference.

NOTE: A dedicated 24 VAC, 50VA NEC class 2 transformer is recommended to power the UCM. When powering multiple UCM’s from one transformer, polarity must be maintained. Terminal TB1-1 is designated positive (+) and terminal TB1-2 is negative (−) to the unit casing ground. All wiring must comply with the National Electric Code (NEC) and local codes. Maximum wire lengths should be based on NEC specifications.

The power consumption for cooling only Series F Models (VariTrac and VariTrane) is 12 VA (4 VA for the air valve/actuator and 8 VA for the board). Units with fans and/or reheat outputs are rated at 10 VA maximum for magnetic contactors and 12 VA maximum for mercury contactors for each output. To determine the total UCM power requirement, add the power consumption per stage to the circuit board power requirement. For example, a Series F unit containing magnetic contactors with three stages of reheat would consume 42 VA.

NOTE: VariTrane and VariTrac cooling only Series D and E models consume 20 VA (12 VA for the actuator and 8 VA for the board). The heating output ratings remain the same.

Refer to Figure 1 for UCM terminal locations.

Zone Sensor Wiring

Location and Mounting
A zone sensor in each control zone should be located in the most critical area of the zone. Sensors should not be mounted in direct sunlight or in the area’s supply air stream. Subdivision of the zone may be necessary for adequate control and comfort.

Avoid mounting zone sensors in areas subject to the following:
- Drafts or “dead spots” behind doors or corners.
- Hot or cold air ducts.
- Radiant heat from the sun or appliances.
- Concealed pipes or chimneys.
- Unheated or uncooled surfaces behind the sensor such as outside walls.
- Air flows from adjacent zones or other units.

Wiring
Each unit must be controlled by a zone sensor that is designated specifically for use with the UCM control. Field wiring for the zone sensors must meet the following requirements:
- Must be 14 to 18 AWG.
- Refer to the sensor instructions for terminal connections.
- If local codes require enclosed conductors, the zone sensor wires should be installed in conduit. Do not route zone sensor wires in conduit with 24 VAC or other high power conducting wires.

Multiple UCM’s Per Zone Sensor
Up to three (3) UCM’s may be connected to a single zone sensor and thumbwheel set point.

- Connect terminal connections TB3-1, TB3-2, and TB3-3 in parallel (i.e. daisy chain) from the master UCM to the slaved UCM(s). NOTE: Proper polarity must be maintained.
- Cut jumper wires W1 and W2 on the slaved UCM’s (never cut jumper wires W1 and W2 on the master UCM).
**Multiple UCM’s per Auxiliary Duct**

Up to three (3) UCMs may be connected to a single auxiliary duct temperature sensor.

- Connect terminal connections TB3-5 and TB3-6 in parallel (i.e. daisy chain) from the master UCM to the slaved UCM(s). NOTE: Proper polarity must be maintained.
- Cut jumper wire W4 on the slaved UCMs (never cut jumper wire W4 on the master UCM).

**Zone Sensor Options**

Depending on the zone sensor options used, a maximum of five wires may be required to run from the UCM to the zone sensor. The zone sensor options are:

- Zone sensor only (2 wires) – Part Number X13510609-01.
- Zone sensor with external adjustable set point and communications jack (5 wires) – Part Number X13510606-01.
- Zone sensor with external adjustable night set back, timed override (TOV) on/cancel button, and communications jack (5 wires) – Part Number X13510606-02.
- Sensor with night set back, timed override (TOV) on/cancel button, and communications jack (4 wires) – Part Number X13510606-03.
- Digital zone sensor - Part Number X13511067-01

**NOTE:** All wiring from the zone sensor to the Com link must be twisted shielded pair wiring.

**Communication Wiring**

**Communication Link Wiring**

The “Communication Link” is the communication wiring between Tracer Summit and all VAV box Unit Control Modules (UCM). Tracer Summit® can be connected to the UCM communication link in a “daisy chain” configuration.

**Wire Capacitance**

Wire capacitance must comply with the following table:

<table>
<thead>
<tr>
<th>Max. Communication Link Wiring Length</th>
<th>Max. Wire Capacitance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 feet (304.8m)</td>
<td>Up to 60 pF/ft. (196.6 pF/m)</td>
</tr>
<tr>
<td>2,000 feet (609.6m)</td>
<td>Up to 50 pF/ft. (164.0 pF/m)</td>
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<tr>
<td>3,000 feet (914.4m)</td>
<td>Up to 40 pF/ft. (131.2 pF/m)</td>
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<tr>
<td>4,000 feet (1,219.2 m)</td>
<td>Up to 30 pF/ft. (98.4 pF/m)</td>
</tr>
<tr>
<td>5,000 feet (1,524 m)</td>
<td>Up to 25 pF/ft. (82.0 pF/m)</td>
</tr>
</tbody>
</table>

3. The maximum wire length should not exceed 5,000 feet (1,524 m).
4. Communication link wiring cannot pass between buildings.
5. A maximum of 63 UCMs can be connected to each COM Link. Daisy chaining is a typical configuration. “STAR” chaining is also acceptable.

**Note:** Polarity is extremely important and must be observed on communication link connections.

6. At the VAV box, communication link wires must be connected to TB2-1, 3 (+) and TB2-2, 4 (-) terminals on the UCM.
7. Verify that the UCM address is properly set (DIP switch SW1). See Table 4 for proper DIP switch settings.
DIP Switch Settings

DIP Switch SW1 contains six switches for addressing the UCM. These switches allow a user to set a unique communication address for each UCM. Each UCM on a given communication link must have a unique address in order for Tracer Summit or the CCP to communicate to it. Refer to Table 3 for UCM 4.0 DIP switch settings.

**Note:** When using Eware to communicate to the UCM, you must add 64 to the DIP switch address. For example, a UCM with the DIP switch address set to 1 would be UCM Number 65 in Eware.

### Table 4 – DIP Switch Settings for UCM 4.0

<table>
<thead>
<tr>
<th>UCM Unit #</th>
<th>Eware Address</th>
<th>Dip 1</th>
<th>Dip 2</th>
<th>Dip 3</th>
<th>Dip 4</th>
<th>Dip 5</th>
<th>Dip 6</th>
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Chapter Overview
This chapter contains information about the following:
- Typical UCM Operating Behavior
- UCM Status
- UCM Set Points
- UCM Setup

CHAPTER 4: UCM PROGRAMMING & OPERATION

Typical UCM Operating Behavior

VariTrac Bypass Damper Mode of operation
In the VariTrac Bypass Damper mode of operation, the decisions of damper position are made by a higher-level system controller, e.g., the VariTrac 4.0 Central Control Panel (CCP). The VariTrac bypass mode supports the reporting of supply air temperature (SAT), supply air static pressure (SAP), and supply air CO₂ concentration (CO₂). This mode supports the following:

- Control of damper position from the higher-level system controller.
- The control of the damper to a failsafe bypass position upon lack of communication to the VAV UCM for a period of one minute.
- Damper calibration from the fully open position while the system fan is off.
- Upon power up, damper calibration and then damper movement to its failsafe bypass position.
- By convention of the VariTrac 4.0 system, DIP switch setting of 63 has been reserved for the VariTrac Bypass Damper. Note: DIP switch setting 63 can be used for non-VariTrac systems.

VariTrac and VariTrane (zone damper, not bypass damper) Modes of operation

Unoccupied Mode:
Zone temperature is controlled to the unoccupied set points. If the AHU system fan is off the valve will be operating in a pressure dependent mode.

Normally the minimum flow set point is not enforced. This allows the control algorithm to close the valve in response to zone temperature and set points. If the minimum flow set points are being enforced the valve will position itself at a percentage equivalent to the minimum flow set point.

Morning Warm Up:
Tracer Summit places the UCM in heat mode and drives the UCM to maximum flow. The AHU system fan is turned on and the UCM operates in pressure independent mode and controls the airflow to the maximum flow set point. 

NOTE: VariTrac units always operate in pressure dependent mode.

Morning Cool Down:
Tracer Summit places the UCM into cool mode and drives the UCM to maximum flow. The AHU system fan is turned on and the UCM operates in pressure independent mode and controls the airflow to the maximum flow set point. 

NOTE: VariTrac units always operate in pressure dependent mode.

Occupied:
Zone temperature is controlled to the occupied set points. Set points are determined from the local thumbwheel if enabled.

Cooling:
Zone temperature is controlled to the cooling set point. Both types of reheat (hot water and electric) are available if needed to keep the zone from cooling below the heating set point.

Heating:
Zone temperature is controlled to the heating set point. Hot water reheat will always be available if needed to keep the zone from cooling below the heating set point. Electric reheat may be permitted to turn on if using auto changeover and the supply air temp (or auxiliary temperature for stand-alone units) is not too high.

The following table briefly describes the typical behavior of various UCM configurations during normal operating modes.
The following table briefly describes the typical behavior of various UCM configurations during normal operating modes.

<table>
<thead>
<tr>
<th></th>
<th>Unoccupied</th>
<th>Transition to occupied</th>
<th>Occupied</th>
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<td><strong>Single Duct</strong></td>
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<tr>
<td><strong>Reheat</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>All types of local reheat available to keep zone above heating setpoint.</td>
<td>Electric reheat is available if using auto changeover and the supply air temperature (or auxiliary temperature) is below 70°F. Local hot water reheat is always available to keep the zone above the heating setpoint.</td>
<td>Electric reheat is available if using auto changeover and the supply air temperature (or auxiliary temperature) is below 70°F. Local hot water reheat is always available to keep the zone above the heating setpoint.</td>
<td>All types of local reheat available to keep zone above heating setpoint.</td>
</tr>
<tr>
<td><strong>Fan Series</strong></td>
<td>Fan runs until valve is fully closed AND reheat is off.</td>
<td>Fan on.</td>
<td>Fan on.</td>
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<tr>
<td><strong>Fan Parallel (temp.)</strong></td>
<td>Fan off unless local reheat is on.</td>
<td>Fan off unless local reheat is on.</td>
<td>Fan off unless local reheat is on.</td>
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<tr>
<td><strong>Fan Parallel (flow)</strong></td>
<td>Fan off unless local reheat is on.</td>
<td>Fan off unless local reheat is on.</td>
<td>Fan off unless local reheat is on.</td>
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UCM Programming and Operation

Calibration of Flow Sensor and Position of Valves (Air and Water)
Calibration that is initiated via a reset is staggered to prevent duct over pressurization. The calibration process consists of 2 steps:

1. Establishing the true valve position.
   This is done by overdriving the valve closed (open in the case when UCM4 is configured for VariTrac Bypass Damper Mode of operation) for 30 seconds beyond the configured stroke time (water valve stroke time plus 15 seconds).

2. Adjusting the D/A output to correct any transducer offset.
   The D/A output is fed into an op amp along with the signal from the transducer to remove any zero offset voltage from the pressure transducer.

Communication Protocol Selection
UCM 4.0 can communicate using either COM 3 or COM 4 protocols. The UCM will automatically determine whether the front-end system is a COM 3 or COM 4 device.

Adjustable Air Valve Stroke Times
Stroke times are adjustable for all units over the communication link as long as the communication protocol used is COM 4. If the UCM is in COM 3 mode, the stroke time is only configurable for generic and VariTrane Series F configurations. Stroke times for non-generic, non-series F COM 3 systems are hard coded into the UCM for the following valves:
- Series F All sizes 90 seconds
- Series D & E Sizes 3, 6, and 11 6 min. 24 sec.
- Series D & E Sizes 12, 24, 32, and 42 6 minutes
- VariTrac Round 57 seconds
- VariTrac Rectangular 60 seconds
- Series C Sizes all but 20, 40 7 min. 12 sec.
- Series C Sizes 20, 40 9.25 min.

Timed Override (TOV) Button Functions
There are two buttons that the user can access. Pushing the timed override button (on) in an unoccupied period provides two hours of occupied control. The UCM will switch into occupied mode and control to the occupied set points for two hours. The cancel button stops a timed override sequence and returns to unoccupied control. The UCM will revert back to unoccupied mode immediately.

Timed override (TOV) and cancel buttons are recognized if they have been pushed for at least 0.5 seconds and no more than 15 seconds. Pushing the buttons for longer than 15 seconds will simulate a zone temperature sensor failure. The failure is non-latching and ceases as soon as the button is released.

"*" And "***" Functions
Also in conjunction with the thumbwheel, the timed override button can cause an override to maximum flow or unoccupied. The TOV button must be pushed for at least 2 seconds and no more than 15 seconds with the thumbwheel in one of the override positions to recognize an override condition. With the thumbwheel in the "*" position an override to maximum flow is generated. With the thumbwheel in the "***" position an override to unoccupied is generated. The maximum flow and unoccupied overrides are held until the thumbwheel is moved into the normal operating region.

Note: If the thumbwheel is not enabled, locally generated overrides ("*" or "***") are not possible.

Local Occupancy detector
Local occupancy detection was added with UCM4 on input TB4-1. TB4-1 is a 24 VAC input operated in a negative logic mode wherein the absence of signal indicates occupancy and the presence of 24 VAC indicates non-occupancy. The occupancy detector’s interface is two dry relay contacts. Relay closure (short between two dry relay contacts and presence of 24 VAC at TB4-1) shall indicate unoccupancy. The VAV UCM has a COM 4 configuration bit to indicate if the VAV UCM has an occupancy sensor connected.

When configured for an occupancy sensor and communications are active, an occupancy input state will be reflected by the UCM to an upper level system controller. When configured for generic mode, loss of COM 4 communications will result in the UCM defaulting back into occupied mode.

Reheat Control
Reheat operation is allowed provided the following conditions are satisfied:
1. The unit is not calibrating.
2. Flow overrides (open or closed) are not in affect.
3. Reheat lockout is not enabled.
4. If maximum flow override or fan lockout is present then parallel fan with any electric heat is not allowed.
5. If the zone temperature sensor has failed cold (open), reheat is not allowed.
6. While in the heat mode only hot water heat can be used. If using auto changeover, UCM 3.3 and later will enable electric heat in the heat mode if the auxiliary air temperature is greater than the electric heat off set point.

Modulating Hot Water Reheat
When the zone temperature reaches the heating set point + 0.5°F the reheat is turned completely off. The modulating hot water valve is over driven closed (by 15 seconds) any time reheat is no longer required.
Pulse Width Modulation (PWM)
Pulse Width Modulation (PWM) modulates 2 stages 0 to 100% with a 3-minute time base. The first stage (J9) of PWM modulates 0 to 100% to supply 0 to 50% of the reheat need. The second stage (J10) modulates 0 to 100% to supply 51% to 100% of the reheat need.

Hot Water Heat Maximum Override (Maximum Heat Required)
A UCM with hot water outputs can be commanded to override the water valve position to maximum position. For units with 1 - 3 stages hot water will turn on all of its water outputs (possible fan is not affected). For units with proportional hot water the hot water valve will be driven open, and if no fan is present, output 3 (J11) will energize. The hot water override can be commanded via communications and can be used to assist in water balancing. See Chapter 7 for Water Balancing Procedure.

Auto Changeover
Auto changeover is based on zone temperature and the supply air temperature as communicated or measured by the auxiliary temperature sensor.
1. When the supply air temperature is 10 degrees above the zone temperature the control action will be Heat.
2. When the supply air temperature is below equal to the zone temperature the control action will be Cool.
3. If the supply air temperature is between the zone temperature and the temperature of 10°F (zone temperature < supply air temperature < zone temperature + 10°F), the control action remains the same and the UCM controls the minimum flow set point.

Flow Overrides
During flow overrides of drive to minimum or maximum the flow is controlled to the appropriate set point. With UCM 3.3 and prior during flow overrides of open or closed, the valve is continuously driven in that direction forever. UCM 3.3 and prior rely on the limit switches to protect the drive train. UCM 4.0 drives for the stroke time, then stops.

Enforce Minimum Flow Set Points
The UCM can be told not to enforce the minimum flow set point (energy saver) via communications. This allows the control algorithm to choose any value from 0 to the maximum flow set point. The primary use of this is VariTrac systems, but it is available for any configuration.

Calculated Cool Ventilation Ratio (Z Factor)
As a measurement of zone ventilation, a “Z” factor is computed and available over communications (only if using the COM 4 protocol). The UCM does not use this value for any control purposes. It is computed as follows:

\[ Z = \frac{\text{Ventilation Target}}{\text{Sensed Flow}} \]

Where the ventilation target is dependent on occupancy and ranges from 0 to 100.

If position control is being used the sensed flow is replaced with the valve position.

The Z factor may then be used by BAS equipment to satisfy ASHRAE 62-89 and calculate the outside air flow set point.

IAQ Set Point Modification
Ventilation rate change for IAQ purposes is accomplished by setting the active minimum flow set point to the edited cooling minimum flow set point * IAQ multiplier when no heat is being supplied to the zone. When heat is being supplied (heat mode or reheat active) the active minimum flow set point is the greater of heating minimum flow and cooling minimum flow * IAQ multiplier. The result of cooling minimum flow * IAQ multiplier is limited to the maximum flow set point. Reheat continues to stage on/off based upon the heating minimum flow set point. The IAQ multiplier range is from 0.0 to 10.0 in tenths.

Wireless Compatibility
Up to five wireless sensors may be assigned to a UCM. Four sensors may be classed as “averaging”; one sensor can be classed as “backup.” The hardwired sensor is optional and can be classified as:

“Averaging” (A peer with the averaging wireless sensors)
“Primary Backup” (Supersedes any backup wireless sensor)
“Secondary Backup” (Used only if the wireless backup sensor is not functional)
“Not Present” (UCM 4.0 only, UCM 3.3 and prior treated this selection the same as Secondary Backup)

The backup sensors are optional. Backup sensors for temperature and set point inputs only affect the UCM if all averaging sensors are failed. Backup button functions are always used. Any combination of backup strategies is permitted.

Although the hardwired sensor is optional in a wireless system, having one provides valid set point and zone temperature values for the UCM to use during the time between a reset (power cycle or via communication) and the reception of the next wireless data update. During this time, if there is no hardwired sensor the zone temperature used by the UCM is 0°F and the global and hardwired set point and zone temperature will be indicated as failed. In a wireless system with a hardwired sensor enabled and configured as averaging, primary backup or secondary backup after a reset the UCM will use the hardwired sensor values until the wireless sensor values are received.

Button pushes from any sensor assigned to a UCM will be accepted and used without regards to source, (i.e., any assigned sensor can cause any button function). The priority of button pushes is: 1. Override to maximum flow, 2. Override to unoccupied, 3. Timed override, and 4. Cancel. Any sensor that is generating a local override will not be used to calculate the local thumbwheel setting.

The UCM must receive an update from a wireless sensor at least every 24 minutes for that sensor to continue to affect the zone control. Sensors that do
not update at least every 24 minutes will be viewed as failed.

Composite zone temperatures and thumbwheel settings are derived from the transmitted data and the hardwired sensor if applicable. Data for the zone temperature and thumbwheel value comes first from the averaging sensors then the primary backup, then the secondary backup. Zone temperature is the simple average of the available sensors. The thumbwheel setting is the weighted average of the available sensors.

\[
\text{zone temperature} = \frac{\text{measured temperature} + \text{zone temperature correction}}{\text{Number of sensors}}
\]

\[
\text{thumbwheel setting} = \frac{\text{(thumbwheel setting} + \text{thumbwheel correction)} \times \text{weighting factor}}{\text{weighting factor}}
\]

Flow (or Supply Pressure in the case of bypass damper mode)
Each VAV valve contains a “flow ring.” It is a multi-ported Pitot tube. The differential flow transducer connects to the flow ring. One side of the flow ring is exposed to the duct static pressure, the other is exposed to static and velocity pressure. The difference is velocity pressure. By knowing the air velocity in the duct and the size of the air valve, the air volume can be calculated. See Chapter 7 for Air Balancing Procedures.

UCM STATUS
The status display does not contain any editable data. If Communications are down (UCM NOT COMMUNICATING is shown), the rest of the status display will not appear. Note: The following screen shots are taken from Trane EveryWare™ Software (Eware). When communicating with a UCM 4.0 or greater via Eware, you must have Eware software revision 1.35 or greater. The display will be similar when using a CCP. However, when communicating to VAV UCM using Tracer Summit, although the display will be completely different, the various functions of the UCM perform the same. Please reference the VariTrac Operators Guide or the Tracer Summit System Programming Guide (BMTW-SVP01A-EN) for exact CCP and Summit (respectively) displays.

When viewed from the Eware, the UCM status display appears as follows:

Following are descriptions of each line on the UCM status screen.

Zone Temperature
This line displays the temperature as recorded by the zone sensor. If the zone sensor has failed, this line will read FAIL.

Active Cooling Set Point and Active Heating Set Point
These set points are the active (actual) cooling and heating set points currently used by the UCM. If the zone sensor is enabled, the zone sensor set point will be used as the Active Cooling set point during occupied mode.

Control Mode
This line shows whether the UCM is in the occupied or unoccupied mode. The control mode determines which heating and cooling set points to use.

Control Action
This line shows the heat or cool control action of the UCM. The cool control action will modulate the air valve as if the supply duct air is colder than the space temperature. The heat control action will modulate the air valve opposite the cool control action (supply duct air is warmer than the space temperature).

Flow
This line displays the unit's airflow rate expressed in the flow units selected in the setup menu. This line will not be shown if the UCM is using position control instead of flow control. The UCM will use position control if the flow sensor is failed or not installed. The UCM will also use position control if the unit's airflow rate is less than 5% or greater than 110% of the unit's cataloged CFM. For example, the UCM will use position control for a size 600 CFM unit if the flow is less than 30 CFM (5%) or greater than 660 CFM (110%). NOTE: Although the UCM will read flow down to 5% of cataloged and up to 110% of cataloged, the range of MIN FLOW settings is 0%, or 10% to 100% of cataloged. The range of MAX FLOW settings is 100% of cataloged. In the example above, the lowest allowable MIN FLOW set point is 60 CFM (zero is also permissible) and 600 CFM is the highest allowable MAX FLOW set point.

Flow Control
This line displays the actual flow control override of the UCM. These overrides can be AUTO, OPEN, CLOSED, MIN, and MAX.

Position
This line displays the UCM's air valve position.
UCM Programming and Operation

Present Minimum
If the UCM is using flow control, this line will show the present minimum expressed in the flow units selected in the setup menu. If the UCM is using position control, the minimum will be expressed as the percentage open.

Ventilation Ratio
The ventilation ratio is equal to the “outside air requirement” divided by the air valve flow. The UCM set points screen provides entry for the occupied and unoccupied outside air requirement.

Zone Sensor Set Point
This line will not be shown if the zone sensor thumbwheel functions have been edited to DISABLE on the UCM setup menu nor on zone sensors without the thumbwheel.

The following describes what may be displayed on this line:
- **Zone sensor set point 70.1**
  This text displays the current zone sensor set point.
- **Zone sensor set point MAX**
  This text will be displayed if "**" appears on the zone sensor thumbwheel and has been overridden to MAX ("**" means the high limit and TOV pushbutton have been depressed).
- **Zone sensor set point UNOCC**
  This text will be displayed if "***" appears on the zone sensor thumbwheel and has been overridden to UNOCC ("***" means the low limit and TOV pushbutton have been depressed).
- **Zone sensor set point FAIL**
  Displayed if no zone sensor module is supplying the UCM with a valid set point.

Unit Type, Heat Type, and Fan Type
These lines show the different types of units, the type of heat and the type of fan. Further descriptions of these types are found under the UCM setup section.

Auxiliary Temperature
The displayed value will reflect the auxiliary sensor temperature. This field will not be shown if the unit does not have an auxiliary sensor.

Software Revision
This line shows the version of the UCM firmware that is being used.

The following lines will only appear if the condition exists:
- **UCM Memory Failure**
  This text will be displayed if the UCM’s EEPROM has failed.
- **Calibrating**
  This will be displayed if the UCM is calibrating. The UCM will calibrate after a power-up or as commanded by an ICS device.
- **Control Offset Active**
  This line will be shown if the control offset is currently being used. It will only be shown if the edited occupied set points are being used and the control offset is active for the UCM.
- **Max Hot Water Override**
  This line will be shown if Max hot water override is edited to YES on the UCM setup menu.

NOTE: Occupied cooling and heating set points must be set within the cooling set point high limit and the heating set point low limit in order to control to the proper set points.

Unoccupied Cooling Set Point
Unoccupied Heating Set Point
Both set points have a range of 30.0°F – 100.0°F (-1.1° – 37.8°C). These set points are used when the UCM is unoccupied. The unoccupied cooling set point must be greater than or equal to the unoccupied heating set point plus 2.0°F (1.1°C).
NOTE: Unoccupied cooling and heating set points must be set within the cooling set point high limit and the heating set point low limit in order to control to the proper set points.

Cooling Set Point Low Limit

Heating Set Point High Limit

These limits apply to both occupied and unoccupied modes of operation. Both limits have a range of 30.0° – 100.0°F (-1.1° – 37.8°C). The set point limits will be applied to the active set points by the UCM but will not restrict operator entry of set points.

NOTE: These limits are allowed to cross (i.e. the cooling set point low limit can be greater than, less than, or equal to the heating set point high limit).

The UCM will enforce these limits regardless of the source of the active set points.

Cooling Set Point High Limit

Heating Set Point Low Limit

These limits apply to both occupied and unoccupied cooling and heating set points are subject to high and low limits. The cooling set point high limit and the heating set point low limit “cap” your unoccupied set points, which directly impacts energy savings. The upper level device is responsible for preventing the resulting set points from being crossed. This may happen if the heating set point low limit is above the cooling set point high limit. Having the cooling set point high limit and the heating set point low limit set to the factory defaults (cooling high limit = 102°F, heating low limit = 43°F) should prevent them from impacting field operation.

Heat Offset

The set point has a range of 2° – 10°F (1.1° – 5.5°C). When a zone sensor thumbwheel set point is being used, the cooling set point will equal the zone sensor thumbwheel set point and the heating set point will equal the zone sensor heating set point minus the Zone Sensor Heating Set Point Offset. The offset will always be displayed and will always be editable even if a zone sensor set point is not being used.

Control Offset Value

The Control Offset has a range of 0° – 5°F (0° – 2.8°C). When Control Offset is active, this value will be added to the edited occupied cooling set point and subtracted from the edited occupied heating set point to determine the active set points.

Note: The control-offset value will not effect a zone sensor thumbwheel set point.

Fan Control Set Point

The entry on this line determines when a parallel fan will be turned ON and OFF. If “Parallel fan control” has been edited to “DEG” the fan control offset will be entered as a temperature offset (2° – 10°F) which will be added to the heating set point. If “Parallel fan control” has been edited to “FLOW” this line will be entered as a percent (0 to 100%) if the unit is a VariTrane unit. The entry field on this line will appear as “—” if the unit does not have a parallel fan.

BP Failsafe Position

This setting only applies to VariTrac Bypass mode of operation. If the CCP stops communicating with the Bypass Damper UCM for more than 60 seconds, the UCM will drive to the failsafe position.

BP Command Position

This setting only applies to VariTrac Bypass mode of operation. The CCP uses this parameter to set the proper position of the Bypass damper.

Maximum Flow/Position

This range is 10% to 100% of the unit’s cataloged CFM size. Cooling and heating flow can be edited to zero.

Minimum Flow/Position

Although the UCM will read flow down to 5% of cataloged, the range of MIN FLOW settings is 0%, or 10% to 100% of cataloged.

Min Heating Flow

The UCM will not drive its position/flow below this value under normal operating conditions while in the HEAT mode (warm air in the supply duct) or while it is using local heat. The Min Heating Flow value must be less than or equal to the Maximum Flow value. If the Min Local Heat Flow is enabled, then the Min Local Heat Flow is used to determine the minimum position/flow instead of the Min Heating Flow when local heat is on.

Min Local Heat Flow

This input allows a separate heating minimum flow set point to be used for local reheat. When local reheat is on, your active minimum flow can not be less than your minimum local heat flow set point.
UCM SETUP
In Eware, the UCM SETUP display appears as follows:

The following are descriptions of each line on the UCM setup screen.

Unit Type
The possible Unit Types are, VariTrac Rectangular, VariTrane F Rectangular, VariTrane F Round, Bypass-Damper Rectangular, Bypass Damper Round, Generic, VariTrane D, VariTrac Round, and VariTrane C.

Editing the unit type will affect the following:
- Heat type (defaults to NONE)
- Fan type (defaults to NONE)
- Unit size (defaults to the smallest unit size)
- Air Valve drive time
- Control algorithm gains (KP, reset times, valve flow constant) for air valve and water valve.

Note: This means that the unit type should be edited before any of the items in the list are edited.

Heat Type
The heat type assignment identifies what kind of heat control algorithm is to be used by the UCM. Possible selections include the following:
- NONE – No heat available
- 1-3 stages electric
- Slow pulse width modulation – Electric (3 min. time base)
- Prop hot water and aux. output
- 1-3 stages hot water/perimeter

If the unit type is edited, the heat type will automatically be changed to NONE. If the heat type is edited or changed automatically, all 3 of the UCM outputs will be set to Normally Open and the “Max hot water override” will be canceled if it is active.

Fan Type
This entry identifies the fan type to be controlled by the UCM (None, Series or Parallel) and shows whether the unit’s fan has been enabled or disabled. The enable/disable field on this line will not appear if the unit has a series fan and only indicates if the parallel fan has been disabled. The UCM may lockout the fan on its own if any of the following apply: control action HEAT; flow override to drive OPEN, CLOSE, or MAX; or if the zone temperature sensor has failed.

NOTE: This line will not appear if the unit does not have a fan.

BIP Configuration (Default is Generic)
The BIP Configuration interface is for dry relay contacts. There are two modes of operation available at TB4-1, Generic BIP and OCC Detector. In generic mode, the state of the input is only passed on from the UCM to Summit. CPL code must be written in order for Summit to utilize any signal received from this generic input. When configured as a generic input and communications are active, an occupancy input state will be reflected by the UCM to the upper level system controller. The upper level system controller shall be responsible for causing any system changes necessary to provide occupied control. When configured for generic mode, loss of communications will result in the UCM defaulting back into occupied mode.

In occupancy detector mode, the absence of a 24 VAC signal at TB4-1 indicates occupancy and the presence of 24 VAC indicates non-occupancy. When configured for an occupancy sensor and communications are active, an occupancy input state will be reflected by the UCM to an upper level system controller. The upper level system controller shall be responsible for causing any system changes necessary to provide occupied control. When configured for an occupancy sensor and communications are not active and occupancy is detected, the UCM shall transition to the occupied mode of operation. Upon loss of the occupancy indication from the...
occupancy detector, the VAV UCM will revert back to unoccupied mode. However, when configured for an occupancy sensor and communications are active, loss of communications does not result in the VAV UCM defaulting to occupied mode.

**Unit Size**
The unit size range is dependent on the unit type selected.

**Use Local Heat Set Point (Default is No)**
When “No” is selected, the UCM will use the Min Heating Flow. When “Yes” is selected, the UCM will use the Min Local Heat Flow Set Point. See UCM set points for more information regarding Min Heating Flow and Min Local Heat Flow Set Points.

**Thumbwheel Set Point**
If DISABLE is selected, the following features of the UCM’s zone sensor thumbwheel functions will be disabled: set point; ability to generate a “drive to max” command; ability to generate a “go unoccupied” command.

**Aux Temp Calibration**
This line allows an auxiliary temperature calibration offset to be entered with a range of -10.0°F – 10.0°F (-5.6°C – 5.6°C). The UCM will add the offset to the value being read by the UCM’s auxiliary temperature sensor. For example, if the auxiliary temperature sensor is indicating that the temperature is 74.0°F (23.3°C), and the auxiliary temperature calibration offset is -1.5°F (-0.8°C), the actual temperature used by the UCM and reported to the ICS will be 72.5°F (22.5°C).

**Wired Zone Temperature**
This is the temperature being reported by the zone sensor. The temperature will be displayed with the temperature calibration offset applied. If the temperature sensor has failed or been disabled, “—” will be displayed instead of the temperature.

**Wired Zone Temp Calib**
The zone sensor calibration offset has a range of -10° – 10°F (-5.6° – 5.6°C). The temperature will be displayed with the temperature calibration offset applied. The UCM will add the offset to the value being read by the UCM’s zone temperature sensor. For example, if the temperature sensor is indicating that the temperature is 74.0°F (23.3°C) and the temperature calibration offset is -1.5°F (-0.8°C), the actual temperature used by the UCM and reported to the ICS will be 72.5°F (22.5°C).

**Max Hot Water Override**
Entering YES for this line forces the UCM to turn on all of its hot water outputs or drive open its proportional hot water valve. This may be useful for water system balancing (see Chapter 7 for water balancing information).

**Note:** Disabling thumbwheel functions does not disable the ON/Cancel pushbutton feature.

**Aux Input Select (Defaults to AuxTmp Sensor)**
This entry determines the configuration of the A/CO2 input on terminal TB3-5 of the UCM. Selecting AUXTMP SENSOR configures the input to use an auxiliary temperature sensor. Selecting CO2 SENSOR configures the input to use a CO2 sensor.

**Parallel Fan Control**
This entry will determine if a parallel fan will be controlled based on zone temperature or on flow conditions. If “Parallel fan control” has been edited to “DEG” the fan control offset will be entered as a temperature offset (2°F – 10°F) which will be added to the heating set point. If “Parallel fan control” has been edited to “FLOW” this line will be entered as a percent (0 to 100%) if the unit is a VairTrane unit. The entry field on this line will appear as “—” if the unit does not have a parallel fan.

**Flow Override**
The flow override entered on this line has the highest priority of all the flow overrides (group, binary inputs, or upper level system functions). Possible entries include AUTO, OPEN, CLOSED, MIN, and MAX. When a non-auto flow override is entered from the UCM level, the flow override will be maintained over power failures. See Sequence of Operations for more information.
Wired Thumbwheel Calib
The thumbwheel calibration offset has a range of -10° – 10°F (-5.6° – 5.6°C). The set point will be displayed with the set point calibration offset applied. The UCM will add the offset to the value being read by the UCM’s thumbwheel.

Cooling Flow Correct
Present Cooling Flow
Measured Cooling Flow
This Present Cooling Flow shows the current flow being reported by the UCM. If the Present Cooling Flow is incorrect, the operator can enter the Measured Cooling Flow and the Cooling Flow Correct calibration factor will automatically be recalculated. For example, if a measured flow indicates 330 CFM, and the UCM’s flow sensor reports 300 CFM, the measured flow (330) can be entered, which will calculate a calibration factor of 1.10. If the UCM is using position control, the current flow reported by the UCM should be 0 and any entry on the line will generate an “Entry too large.” See Chapter 7 for more information.

Wired Sensor Type
This line is used to edit the type of temperature sensor being used. The sensor type can be selected as either Thermistor or RTD. Note: Factory supplied sensors are Thermistors.

Wired Sensor Use
This input determines the function of the wired zone temperature sensor. Select Averaged to use the sensor as part of a wired system OR to use the sensor as an averaging sensor in a wireless system. Average will use the sensed temperature in the temperature averaging calculation and set point temperature will be averaged according to the set point vote. If this is the only sensor the average will be the sensed temperature. Backup means the UCM will use this temperature only if the primary sensor assigned to the UCM has stopped communicating. First backup means the UCM will look for a wired sensor first if the wireless sensor fails. Second backup means the UCM will look for a wireless backup sensor first if the wireless sensor fails. Select not used if no sensor is present or to ignore the wired zone sensor.

Wired Set Point Vote
Set point vote determines the weighting of the set point vote. The range is 0-9. This number represents the number of votes the sensor gets when the set points are averaged. If “0” is selected the sensor gets no vote.
Sequence Of Operations

CHAPTER 5: SEQUENCE OF OPERATIONS

Single Duct Units
When the UCM control action is COOL, the UCM controls the modulation of the air valve as a cooling source to maintain the “active cooling set point”. Airflow is varied between the minimum and maximum flow set points to maintain temperature set points. A PI control algorithm is utilized to minimize the measured difference between the active zone set point and the actual zone temperature.

It is possible for units to utilize electric or hot water heating coils to maintain temperature set points. After the temperature loop calls for minimum cooling flow and the zone temperature is at or below the heating set point, these units shall control to their respective “Minimum Heating Flow”.

Once this “Minimum Heating Flow” is established, heat is allowed to operate according to the “Heat Control Type” specified for the controller. For electric heat units, this heating minimum flow set point must be at or above 20% of the unit cataloged airflow. Electric heat may be pulse width modulation or staged electric heat. Staging has the following ON and OFF switch points. UCM 3.3 and later allow hot water to turn on regardless of flow/position.

<table>
<thead>
<tr>
<th>Stage</th>
<th>ON Switch point</th>
<th>Off Switch point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>At the heating set point</td>
<td>0.5°F above the heating set point</td>
</tr>
<tr>
<td>2</td>
<td>1°F below the heating set point</td>
<td>0.5°F below the heating set point</td>
</tr>
<tr>
<td>3</td>
<td>2°F below the heating set point</td>
<td>1.5°F below the heating set point</td>
</tr>
</tbody>
</table>

Hot water heat control may be either ON/OFF or proportional. ON/OFF hot water is activated on the same schedule as staged electric heat.

Utilization of the “Heating Minimum Flow” set point allows separate minimum flows to be active depending on whether or not the unit heat is active.

Override Conditions
(Single Duct)
The UCM occupied controls can be overridden by the following override commands:

Unoccupied
If the control mode is unoccupied (either as edited by software or as determined by the binary input), the unoccupied cooling and heating temperature set points are used for temperature control. Heat outputs remain active.

Heating
If the control action is edited to HEAT, the UCM controls the air valve as a heating source rather than cooling. Electric reheat is available the supply air temperature (or auxiliary temperature) is below 70°F. Local hot water reheat is always available to keep the zone above the heating set point. The “Heating Minimum Flow Set Point” will set the minimum flow.

Flow Control Override
Flow control may be overridden by any of the following commands:

- Drive Air Valve Fully Open
  The air valve will be fully open and heat outputs disabled.
- Drive Air Valve Fully Closed
  The air valve is driven fully closed and heat outputs disabled.
- Drive Air Valve to Minimum Flow
  The air valve is driven to the minimum airflow set point. The heat outputs remain operational.
- Drive Air Valve to Maximum Flow
  The air valve is driven to the maximum airflow set point. The heat outputs remain operational.

Heat Control Override
Heat control can be disabled, locking out heat outputs.

Control Offset
Control offset may be enabled, which adjusts the edited cooling and heating set points.

Recalibrate (Reset)
The recalibrate function can be enabled. If enabled, the unit will perform a recalibration.
**Sequence Of Operations**

**Fan-Powered Units**

**Fan Actuation Schedule**

<table>
<thead>
<tr>
<th>FAN TYPE</th>
<th>OCCUPIED</th>
<th>UNOCCUPIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Cool mode: ON if zone temp &lt; heating set point + fan offset; fan off unless reheat is on</td>
<td>Cool mode: OFF if zone temp &gt; heating set point + Heat mode: fan off unless reheat is on</td>
</tr>
<tr>
<td></td>
<td>OFF unless local reheat is on</td>
<td>OFF unless local reheat is on</td>
</tr>
</tbody>
</table>

- **Parallel Fan-Powered Units**
  - **Occupied Units**
    - Air valve control for parallel fan-powered units is the same as for single duct units.
    - The first heat output is utilized to control the fan. The remaining outputs are utilized to control heat. Fan energization is a function of the "Parallel Fan Control Offset." The parallel fan control can be specified as an offset temperature in degrees above the heating set point or as a flow offset in CFM. The fan will be energized above the fan control offset if reheat is required.

  
  **Note:** The fan control offset is entered in CFM when used on a VariTrane unit.

  - If the fan control is based on flow, the unit fan will be energized whenever primary airflow is below this set point. For this parallel fan configuration, the fan control point, if specified in a percentage of unit airflow, must be set between 15% and 30% of the units cataloged airflow to assure proper operation. A differential of 5% exists to avoid excessive fan cycling.
  - Whenever the fan is energized, the primary airflow is controlled at the "Heating Minimum Flow" set point.

- **Override Conditions (Parallel Fans)**
  - The UCM occupied controls can be overridden by the following override commands:
    - **Unoccupied**
      - If the control mode is unoccupied, the unoccupied cooling and heating temperature set points are used for temperature control. Fan and heat outputs are activated.
      - **Heating**
        - If the control action is HEAT, the UCM controls the air valve as a heating source rather than cooling. Fan and heat outputs are disabled for parallel units with electric heat. If the heat type is hot water heat, then the fan will remain on if the heat is on during the heating control action.
      - **Flow Control Override**
        - Flow control may be overridden by any of the following commands:
          - **Drive Air Valve Fully Open**
            - The air valve will be driven fully open. Fan and heat outputs are disabled.
          - **Drive Air Valve to Minimum Flow**
            - The air valve is driven to the minimum airflow set point. The fan and heat outputs remain operational.
          - **Drive Air Valve to Maximum Flow**
            - The air valve is driven to the maximum airflow set point. The fan and electric heat outputs are disabled (hot water heat remains enabled).
    - **Heat Control Override**
      - Fan control can be disabled, locking out heat outputs.

- **Series Fan-Powered Units**
  - **Occupied Units**
    - Air valve control for series fan-powered units is the same as both single duct and parallel fan-powered units.
    - During the occupied mode of operation, the series fan is continuously energized. Heat stages are energized on the following schedule:
      - **Stage**
        - **ON Switch point**
          - 1 At the heating set point
          - 2 1°F below the heat set point
        - **OFF Switch point**
          - 0.5°F above the heating set point
          - 0.5°F below the heat set point

      - Whenever the fan is energized, the primary airflow is controlled at the "Heating Minimum Flow" set point.

- **Override Conditions (Series Fan)**
  - The UCM occupied controls can be overridden by the following override commands:
    - **Unoccupied**
      - If the control mode is edited to unoccupied, the unoccupied cooling and heating temperature set points are used for temperature control. The series fan and heat outputs will be activated as

  
<table>
<thead>
<tr>
<th>Stage</th>
<th>ON Switch point</th>
<th>OFF Switch point</th>
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<tbody>
<tr>
<td>1</td>
<td>At the heating set point</td>
<td>0.5°F above the heating set point</td>
</tr>
<tr>
<td>2</td>
<td>1°F below the heat set point</td>
<td>0.5°F below the heat set point</td>
</tr>
</tbody>
</table>

  
  - **Drive Air Valve Fully Closed**
    - The air valve is driven fully closed. Fan and heat outputs are disabled.
  - **Drive Air Valve to Minimum Flow**
    - The air valve is driven to the minimum airflow set point. The fan and heat outputs remain operational.
  - **Drive Air Valve to Maximum Flow**
    - The air valve is driven to the maximum airflow set point. The fan and electric heat outputs are disabled (hot water heat remains enabled).
Sequence Of Operations

The zone sensor has the following options:

**Zone Temperature**
Each zone sensor module includes a zone temperature sensor.

**Set Point**
A UCM will only use the zone sensor thumbwheel set point (during occupied time) if “Zone sensor thumbwheel functions” is edited to ENABLE on the UCM setup screen.

**ON Timed Override (TOV) and CANCEL Timed Override (TOV)**
The ON (TOV) and CANCEL (TOV) commands can be issued by pressing the ON or CANCEL buttons on any of the UCM zone sensor modules.
- When an ON button on a zone sensor is pressed (shorting the zone temperature sensor circuit), the UCM will set a TOV signal, clear the TOV cancel signal if it is set, and start the two hour timed override timer. The TOV signal will be maintained for two minutes.
- When a CANCEL button on a zone sensor module is pressed for at least two seconds, the UCM must set a TOV cancel signal, clear the TOV signal if it is set, and set the timed override timer to zero.
- Pressing any zone sensor module’s ON or CANCEL button will not affect the zone temperature reported from the UCM.

**Flow Control Override**
Flow control may be overridden by any of the following commands:
- **Drive Air Valve Fully Open**
The air valve will be driven fully open. Fan operation is unaffected, but heat outputs are locked out.
- **Drive Air Valve Fully Closed**
The air valve is driven fully closed. The fan and heat outputs are locked out.
- **Drive Air Valve to Minimum Flow**
The air valve is driven to the minimum airflow set point. The fan and heat outputs remain operational.
- **Drive Air Valve to Maximum Flow**
The air valve is driven to maximum airflow set point. The fan and heat outputs remain operational.

**Heat Control Override**
Heat control can be disabled looking out heat outputs.

**Fan Control Override**
Fan control override does not affect fan operation on series fan-powered units.

**Control Offset**
Control offset may be enabled which adjusts the edited cooling and heating set points.

**Recalibrate (Reset)**
The recalibrate function can be enabled.

**Zone Sensor Functions**
The zone sensor utilizes a thermistor element to measure zone temperature.

Notes:
- The UCM will not generate a TOV signal when a Drive Max or Unoccupied command is initiated.
- Pressing the ON button will not affect the zone temperature reported from the UCM.
- The UCM will not send these commands if “Zone sensor thumbwheel functions” is edited to DISABLE on the UCM setup screen.
- When an ICS is connected to the UCM, the UCM will pass the commands to the ICS without taking any control action of its own. Since this is true, it may take a minute or so after the command is initiated before the UCM actually goes unoccupied or is driven to maximum.
- The UCM will remain in the Drive Max or Unoccupied status over power failures IF "*" or "**" (respectively) have been initiated prior to the power failure.

Note: TOV pushbuttons should be pressed for at least 2 seconds and not more than 15 seconds.

**Flow Sensor**
The flow control is pressure independent utilizing the VariTrane flow-sensing ring. The flow ring provides one of the most accurate differential pressure flow measurements in the industry by averaging pressure differentials across 16 sensing points. These sensing points, arranged in a ring configuration to compensate for various inlet duct configurations, provide a signal accurate to within +/-5% of cataloged CFM provided there is 1½-inlet diameters of straight ductwork upstream of the VAV box.

The pressure differential signal from the flow ring is then converted to an electrical signal, which is utilized in the control algorithm of the unit controller. It is recommended that the recalibrate sequence be initiated on a weekly basis. Assuming ½ inlet diameters of straight duct work and proper system recalibration, total system flow
measurement accuracy (flow ring, transducer, and UCM controller) during the occupied mode should be +/- 8% of cataloged airflow over the typical operating range of 20% to 100% of unit cataloged airflow.

**Failure Modes**

Each UCM has diagnostic capabilities, which allow it to sense various failure conditions. This diagnostic capability aids in maintenance and trouble shooting of the system. Along with reporting these failure conditions, the UCM will follow a pre-programmed operating sequence designed to maintain zone comfort during a failure. The failure conditions and backup operating sequences are explained below.

**Temperature Sensor Failure**

Failure of a zone temperature sensor (open or below low limit of 0°F (-17.8°C)) will cause fan and heat outputs to be disabled and airflow to be controlled to the minimum cooling flow set point. If the measured temperature fails above the high limit (short or above 100°F (37.8°C)), the airflow shall be controlled to the maximum flow set point.

**Flow Sensor Failure**

If a flow sensor failure is reported (open, short, fails calibration, or is out of the normal range of 5% to 110% of box cataloged), the UCM will immediately revert to a position-based, pressure dependent control algorithm. This allows full operation of the unit and maintains the ability to control the zone temperature. If a flow sensor has failed, it is periodically checked for proper operation. If found to be operating properly, the UCM will be switched to the standard pressure independent control. Otherwise, position control is used as long as the flow signal remains out of range.

**Local Thermostat Set Point Failure**

Failure of a local thermostat set point adjustment potentiometer will cause the UCM to revert to the edited occupied cooling and heating set point.

**Communications Failure**

A fifteen-minute failure in communications between the UCM and Tracer Summit will cause the UCM to:

- Operate in the occupied mode (provided that no occupancy sensor is present on input TB4-1).
- Set the IAQ multiplier to 1.0.
- Disable the control offset.
- Use the control action as determined by the auxiliary sensor. The auxiliary temperature is compared to the zone temperature. If the supply air temperature is 10°F greater than the zone temperature, then the control action will be heat. If the supply air temperature is less than or equal to the zone temperature, the control action will be cool. If the supply air temperature is between the zone temperature and the zone temperature + 10°F (zone temperature < supply air temperature < zone temperature + 10°F), the control action remains the same and the UCM controls to the minimum flow set point.

If an auxiliary sensor is not installed and the VAV unit is not under Tracer Summit control, the UCM will retain the last control action in effect.
Air Balancing and Water Balancing

CHAPTER 6: AIR BALANCING & WATER BALANCING

Air Balancing

After the unit has been mounted and all electrical and duct connections have been made, the air distribution system should be balanced. The proper variable air volume balancing procedures depend on the type of VAV system used and the options specified on the VariTrane unit. This section will cover the basic balancing procedures and calibrations needed to balance an air distribution system using VariTrane units. This section suggests only one balancing procedure. Since there are many possible air balancing procedures, keep in mind that these procedures are only suggestions.

Note: Before performing these balancing procedures, the calibration command should be initiated at least 15 minutes prior to the balancing procedure.

1. System Checkout
   - Check the VAV system installation for conformity to design.
   - Walk the entire system from air handling equipment to the terminal unit to determine variations of installation from the plans.
   - Check for inadvertent obstructions in the ductwork (such as closed fire dampers).
   - Insure that any turning vanes, filters, and dampers (both volume and fire) are installed in the correct position.
   - There should be a 1.5 duct diameter long run of straight ducting into the valve.
   - Set the outside air dampers to their minimum position.
   - Start the supply and return air fan(s).

2. Before we can balance the system, we need to ensure that there is enough CFM for all zones.
   A. Drive all VAV boxes MAX.
      - Starting with each individual branch duct, open all the VAV units in that branch duct to the maximum cooling position.
      - This can be done using EveryWare by giving each UCM a “Drive Max” command or by rotating the Zone sensor set point knob to the “*” position, and hold the TOV ON button for two seconds.
      - The damper will remain at its maximum set point until the zone sensor knob is moved back into the normal operating range.
   B. Read airflow at the most remote unit.
      - In most systems, this will be the VAV unit located furthest from the fan.
      - This will be the unit in the system that will be critical from an air delivery set point.
      A. If airflow is not adequate, increase the supply fan CFM to achieve adequate airflow.
      B. Make the required adjustments to pulley sizes, motor sizes and electrical connections to accommodate fan-speed changes.

3. With all VAV boxes fully open, take a measurement of the total CFM.
   - CFM is determined by using this flow signal and the chart on the side of the unit (different size units have different charts).
   - If the CFM is at or above design, the system can now be balanced. If the measured CFM is below design, insure the VariTrane unit is in full cooling position.
   - If the air delivery through this VariTrane unit is still below the design requirements, the supply fan rpm should be increased until the correct design airflow is obtained or the fan reaches its maximum capacity.
   - If after adjusting the fan to its maximum capacity there is still a shortage of airflow, shut off part of the system to provide enough airflow to balance the other part of the system. This can be done using the “Override to Unoccupied” command (“**”) at the zone sensor.

4. After determining that there is enough CFM for all zones, drive all the VAV boxes to MIN.
Air Balancing and Water Balancing

Note: If the VAV boxes have already been assigned to groups and these groups are separate thermal zones, then the balancing can be done on a group basis.

5. Select a group to balance and give that group a flow override Drive MAX command.

Note: If the VAV boxes have not been placed in a group, each individual UCM can be overridden to Drive MAX in the UCM Setup Menu. However, this will be more time consuming.

6. Adjust each VAV box maximum flow set point required for its zone using the UCM set points menu.

7. After balancing a group/box, return that group/box flow override to AUTO.

• Continue to the next group/box repeating steps 6 through 8 until each unit is delivering the correct CFM.

8. Upon completion of the VAV air balancing:

• Remove all overrides.

• Initiate a recalibrate command.

Water Balancing

Each VAV UCM can have its hot water valve overridden to drive fully OPEN (2-position and proportional). This can be done in the UCM setup menu and can be used to assist in water balancing.

1. Log on to the UCM with EveryWare software.

2. Select a VAV box to balance, and drive its hot water valve open (max hot water override).

3. Using hydraulic pressure gauges, measure the flow across the high and low ports. Convert this data from a pressure differential to gallons per minute (GPM).

4. Adjust the circuit setter until it is within design specifications.

5. Once achieved, lock the circuit setter in place. Mark the position with a permanent indicator.

6. Remove all gauges and software overrides.

7. Initiate a recalibrate command.
CHAPTER 7: WIRELESS VAV SYSTEMS

General Information

Spread Spectrum
Trane Wireless VAV Systems apply spread spectrum technology to accomplish wireless communication. Spread spectrum technology is a technique for spreading a data signal's information over a frequency range that is substantially larger than is required, thus increasing the redundancy of the communication. Upon reception, the receiver “unspreads” the signal and reads the information. Any receiver that does not have a matching encoding sequence cannot unspread the signal and sees the transmission as RF noise. This spreading and unspreading enhances the security of the system and its ability to operate in the same environment as other systems using the same frequencies.

The sensor/transmitter simultaneously broadcasts identical information over two separate frequencies (911 and 918 MHz), making interference even less likely.

Purpose of the Wireless System
The wireless system is a method for eliminating the problems associated with a wired sensor such as having to run wire through solid or decorative walls or having to move the sensor after the occupant has redecorated the space. The benefits are the flexibility in system design and sensor location.

Zone sensor operation with wireless offers some new capabilities. The first feature is averaging. If more than one sensor is assigned as an averaging sensor to a UCM their temperature readings are averaged. This gives the ability to get a more accurate sample of a large space supplied by one VAV box. It also provides better control when 1 VAV box serves multiple zones such as small offices. Under the averaging scheme, the local set point requests are also averaged. The set point average can be weighted by changing the set point Vote value from 0 to 9. The number assigned represents the number of votes the sensor gets. A Value of “0” removes this sensor from the set point voting scheme.

For example:

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Set Point Value</th>
<th>Set Point Vote</th>
<th>Extended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>75</td>
<td>3</td>
<td>225</td>
</tr>
<tr>
<td>T2</td>
<td>65</td>
<td>1</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>290</td>
<td>4</td>
<td>290</td>
</tr>
</tbody>
</table>

Calculation: 290/4 = 72.5°F Final Set Point Value

This allows someone who is more affected by the temperature or in an area that has a varying load such as cold or hot outside walls to have more impact on the set point.

An additional capability of the system is the ability to use a sensor as a backup to another sensor. If the primary sensor stops communicating for some reason the UCM automatically begins using the backup sensor input.

Another added feature is the ability to assign one sensor to multiple boxes. This is a function of the way the sensor transmits its information.

When the sensor broadcasts its temperature it also sends the serial number, the set point and the battery...
status. Each receiver that receives this signal checks to see if any of the UCMs on its VAV link needs that sensor's value. If a UCM needs the value the receiver sends the information down the link and the UCM reads it. This process means all UCM's could use the same sensor.

Specifications

Wireless Receiver Power Requirements
Input Voltage Connections: The receiver requires 24 VAC and 60 HZ from a dedicated 40 VA transformer (not provided with the receiver).
Blue Wire: 24VAC (HOT wire)
Yellow Wire: 24VAC (NEUTRAL wire)
Green Wire: Earth GROUND
Red Wire: To Positive (+) Communication Link
Black Wire: To Negative (-) Communication Link

NOTE: A dedicated 24 VAC, 40VA class 2 transformer is required to power the Wireless Receiver. Failure to comply will result in malfunction of the Receiver due to electrical noise.

All wiring must comply with the National Electric Code (NEC) and local codes. Use 16 AWG for power wiring. Maximum wire lengths should be based on NEC specifications.

Zone Sensor Power Requirements
The zone sensors require two 3-volt “2/3 A” lithium batteries. Each sensor ships with two batteries, and the average expected battery life is approximately 1.5+ years.

NOTE: Excessive transmissions will shorten the battery life span. See Frequently Asked Questions for more details.

Both batteries must be installed for sensor/transmitter to operate properly. Acceptable replacement battery model numbers are Varta 123A, Panasonic CR123A, or Duracell 123A.

Wireless Receiver Mounting
The receiver will work best if mounted below the ceiling grid with the antennae pointing down. The receiver is to be hung from the roof structure like a light fixture. A hook on the back is provided for connection of a chain. A threaded nipple is provided for attaching a handy-box when the wiring must be run in conduit.

Ideally, the receiver should be located an equal distance from all its assigned zone sensors.

NOTE: Do not mount the wireless system near RF barriers such as elevators. Failure to do so may result in wireless system malfunction.

Zone Sensor Mounting
Zone sensors are installed in areas where temperature control is to be maintained. The sensor mounts directly to the wall by either using Velcro or by attaching the backplate and then snapping the sensor body into place.

Dimensions

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure:</td>
<td>Sheet metal/Plastic Plastic</td>
</tr>
<tr>
<td>Height:</td>
<td>2.3” (64 mm) 4.0” (102 mm)</td>
</tr>
<tr>
<td>Width:</td>
<td>8.5” (216 mm) 5.0” (127 mm)</td>
</tr>
<tr>
<td>Depth:</td>
<td>9.0” (229 mm) 1.5” (38mm)</td>
</tr>
</tbody>
</table>

Product Specifications
- At least one (1) wireless receiver is required per com link
- Receivers per CCP: 6
- Receivers per Tracer Summit: 31
- Total Zone Sensors per CCP or Tracer Summit: 255
- Backup Zone Sensors per VAV box: 1
- Averaging Zone Sensors per VAV box: 4
- Zone Sensors associated with one VAV box: 5
- Maximum number of VAV UCMs per link: 63
- Maximum Distance from Receiver to Sensor: 1000ft.(304 m)
- MinimumTime between Transmission: 30 sec
- Loss of Sensor Communications Alarm: 24 min
- Average Battery Life: 1.5 years
- Use 18 gauge twisted shielded pair communications wire for the ICS communication link to the receiver. The communications link is polarity sensitive.
Wireless VAV Systems

NOTE: A dedicated 24 VAC, 40VA NEC class 2 transformer is required to power the Wireless Receiver. Failure to comply will result in malfunction of the Receiver due to electrical noise.

All wiring must comply with the National Electric Code (NEC) and local codes. Use 16 AWG for power wiring. Maximum wire lengths should be based on NEC specifications.

General Information
Zone Sensor Range:
Cataloged 1000 feet (304 meters) line-of-sight, indoors
Receiver Setup/Normal Switch:
DIP switch 8.
Receiver RJ11 Jack:
Jack for temporary connection of an external sounder for test purposes.
Receiver Sounder:
Built-in Piezo sounder
Receiver VAV Link Wiring:
The Receiver must be daisy-chained into the VAV link wiring that connects all of the UCMs and Tracer Summit. As specified in Chapter 2, the VAV link wiring must be twisted shielded pair. A pigtail is provided for wiring. The red wire is positive, the black wire is negative, and the green wire is shielded ground. Polarity must be maintained throughout the VAV link.

Wireless System Architecture
Wireless Zone Sensor
The wireless zone sensor is designed for use in a temperature control system, operating in conjunction with a centrally located Wireless Receiver. Zone sensors are installed in areas where temperature control is to be maintained and are responsible for transmitting temperature, set point, and the On/Cancel command to the receiver. The zone sensor measures temperature and periodically transmits that information via RF signals to its assigned receiver.

Wireless Receiver
The receiver is designed for use in a temperature control system, operating in conjunction with wireless zone sensors, which are installed in areas where temperature control is to be maintained. The receiver functions as a communications translator between the spread spectrum radio communications and the VAV communications link. As a Spread Spectrum Receiver, the device receives, correlates and decodes a spread spectrum coded transmission. The serial number of the transmitting device is checked against a list of valid serial numbers field programmed into the Translators by the Tracer BAS system user. The receiver maintains this list of valid serial numbers. If the transmission is valid, the message will be transmitted over the Trane VAV link.

RF signals from wireless zone sensors are received by the receiver, which then sends appropriate messages via communication wires to specific heating and air conditioning equipment assigned to it. This information is also sent to a central controller for system monitoring.

Note: A minimum of one receiver per communication link is required.

Unit Control Module (UCM)
After the zone temperature is received by the Receiver from the wireless zone sensor module and broadcast over the VAV Communication link, the UCM receives the message packet. The UCM accepts only those messages having a sensor serial number that matches the serial number field programmed into it. Zone sensor serial numbers are maintained by the UCM.

Upon receipt of the zone temperature value, local set point, or On/Cancel requests, the UCM will take the...
appropriate action. In addition, a twenty-four minute timer is initiated. If a new zone temperature value is not received within this time, a sensor failure indicator is generated.

If all the averaging sensors have failed and a backup zone sensor serial number was programmed into the UCM, the zone temperature value, set point, and On/Cancel status from that sensor will then be used for control. The UCM will continue to monitor the link for the averaging sensor information. If received, normal operation is restored and the sensor failure indicator cleared.

While in many cases a single sensor and backup sensor are programmed in the UCM, it is also possible to define up to three additional optional zone sensor serial numbers. The UCM will then use the average of all of the programmed sensors (except the backup sensor) as the value representing the space temperature. Values from sensors that have been flagged as not reporting within the last fifteen minutes will not be used in the calculation. While an averaging scheme is used to determine the space temperature when multiple sensors are used, a weighted average scheme is used to determine the set point. This scheme allows the user to select the relative priority of each zone sensor for the purpose of determining the desired set point. However, any of the sensors may be used to initiate On/Cancel requests.

**Wireless System Installation**

**Building Location**

The receiver should be located centrally to all of the zone sensors. Large ductwork, metal covered walls or reinforced concrete can block the signal and should be avoided. Elevator shafts are typically sources of interference and therefore should also be avoided. Maximum range is 1000 feet (304.8 m) line of sight indoors (a maximum of 500 feet (152.4 m) total is recommended).

**Setting the Receiver Address**

The address is set using the DIP switches mounted on the receiver. The receiver is a “COM 4” master and does not replace a UCM address. Up to 6 receivers may reside on a Communication Link when using a CCP and up to 31 receivers may reside on a Communication Link when using a Tracer Summit.

DIP switches 6 and 7 are not used and should be set to their “ON” position. DIP switch 8 is the setup/normal switch and is only used when the unit is being assigned sensors using the set-up tool. When assigning zone sensors to the receiver using the set-up tool, set DIP switch 8 to the Off (Down) position. During normal operation, DIP switch 8 should be in the ON (Up) position. The following chart shows the switch positions for addresses 1 through 31.

<table>
<thead>
<tr>
<th>Table 5 – VAV Wireless Receiver DIP Switch Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UCM</strong></td>
</tr>
<tr>
<td>1</td>
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<td>3</td>
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<tr>
<td>29</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>31</td>
</tr>
</tbody>
</table>

**Power Checkout**

The receiver has three (3) LEDs.

- Green (Power/operational)
- Yellow (Radio communication activity)
- Red (VAV Link activity)

The green LED will remain on to indicate steady power. The yellow LED will flash to indicate the receiver is receiving radio communication for the sensors. The red LED will flash to indicate the receiver has passed the information to the VAV link.

The zone sensor has one (1) LED. It is located next to the service tool connection at the bottom of the sensor. Pressing the ON or Cancel buttons causes a transmission to occur and the green LED should flash. This indicates the sensor has power and should be transmitting.
Programming and Operation

**Wireless Receiver Setup Using Tracer Summit**

1. To setup the Receiver, go to the Main Menu of the Tracer Summit.
2. From the Main Menu, select the Setup Pull Down Menu and select the Site Configuration option.
3. Highlight the site name to be configured to enter the site configuration editor
4. Select the Devices tab.
5. Highlight the BCU to be modified and select the Create UCM Editor. See Figure 8.
6. Select the Non-Isolated link, which has the receiver connected to it. See Figure 9.
7. Change the UCM Type from Absorption Chiller (UCP2) to Wireless Receiver. See Figure 9.
8. Give the receiver a unique name, address, and specify how many receivers are going to be added to the network. See Figure 9.
9. Click the create button.
10. Click the save button to save the changes to the BCU.

**Figure 8: Site Configuration, Devices Tab**

<table>
<thead>
<tr>
<th>Device</th>
<th>UCM Name</th>
<th>UCM Type</th>
<th>Link</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCM-01</td>
<td>PCH-01-03</td>
<td>PCM</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PCM-01</td>
<td>PCH-01-05</td>
<td>PCM</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TCM-01</td>
<td>TCM-01-03</td>
<td>TCM</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TUC-01</td>
<td>TUC-01-03</td>
<td>Terminal Unit Controller</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>UPN-01</td>
<td>UPN-01-03</td>
<td>Universal PCM</td>
<td>1</td>
<td>32</td>
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<tr>
<td>VAV-01</td>
<td>VAV-01-06</td>
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<td>VAV-01-06</td>
<td>VAV II / III</td>
<td>1</td>
<td>67</td>
</tr>
</tbody>
</table>
Wireless VAV Systems

Figure 9: Create UCM's Dialog

Select a Non-Isolated Com 4 Link.

Wireless Receiver Summary Using Tracer Summit

This option only shows up after the wireless receiver has been setup as described above. This option will show the summary of the information that the receiver is receiving, including zone sensor number (the serial number), TR Time Sec. (Time since the last transmission was received in seconds) and RSSI (Receiver Signal Strength Indication). TR Time should not exceed 420 and RSSI should be between 30 and 255. If TR exceeds 1440, the 24-minute timer has expired and the sensor will show a failure.

1. From the Main Menu, select the Setup Pull Down Menu
2. Highlight the Unit Controllers option and select the VariTrane UCM II/III/IV... Editor
3. Select any UCM that is connected to the receiver and press the "OK" button
4. In the UCM II/III/IV... Editor, open the wireless folder
5. Change the Wireless Receiver Name from Not Assigned to the correct name of the receiver and wait approximately 15 seconds.

The receiver summary will include all sensors from which the receiver is receiving information and should look like the following:

<table>
<thead>
<tr>
<th>#</th>
<th>Zone Sensor SN</th>
<th>Receiver Signal Strength Indicator</th>
<th>Zone Temp</th>
<th>Time Since Last Transmission (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>00004F</td>
<td>125</td>
<td>75.4</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>000017</td>
<td>135</td>
<td>71.5</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>00005F</td>
<td>75</td>
<td>76.2</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>0000163</td>
<td>140</td>
<td>73.8</td>
<td>170</td>
</tr>
<tr>
<td>5</td>
<td>00004B</td>
<td>110</td>
<td>72.0</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>00014A</td>
<td>120</td>
<td>70.6</td>
<td>90</td>
</tr>
</tbody>
</table>

Notes:
1. Average will use the sensed temperature in the temperature averaging calculation. If this is the only sensor the average will be the sensed temperature.
2. Backup means the UCM will use this temperature only if the primary sensor assigned to the UCM has stopped communicating.
3. Set point vote determines the weighting of the set point vote. The range is 0-9. This number represents the number of votes the sensor gets when the set points are averaged. If "0" is selected the sensor gets no vote. This is used to disable the thumbwheel.

[Diagram of Create UCMs Dialog]
Wireless Zone Sensor Setup Using Tracer Summit

1. From the Main Menu, select the Setup Pull Down Menu
2. Highlight the Unit Controllers option and select the VariTrane UCM II/III/IV... Editor
3. Select the UCM to be modified and press the “OK” button
4. In the UCM II/III/IV... editor, open the wireless folder. See Figure 11.
5. Change the Wireless Receiver Name from Not Assigned to the correct name of the receiver. Click on the first available “Edit Average Zone Sensor” or “Edit Backup Zone Sensor” menu, depending on if the sensor is to be an Averaging sensor or a Backup sensor. See Figure 11.
6. Open the plastic cover of the zone sensor, and type the serial number from the ID tag into the “Average Zone Sensor Serial Number” field. The valid range is 000000 to FFFFFF.
7. Adjust the value desired in the “Set Point Weight” field.
8. Click the “Add this Sensor” button to add to the UCM’s database. See Figure 11.
9. Repeat steps 5 through 8 to add additional sensors. You may add up to four (4) Average Zone Sensors per VAV UCM.
10. Once complete, press the exit button to return to the UCM editor.
11. Click the “Save” button to save the changes to the UCM.

Notes:
1. Average will use the sensed temperature in the temperature averaging calculation. If this is the only sensor the average will be the sensed temperature.
2. Backup means the UCM will use this temperature only if the primary sensor assigned to the UCM has stopped communicating.
3. Setpoint vote determines the weighting of the set point vote. The range is 0-9. This number represents the number of votes the sensor gets when the set points are averaged. If “0” is selected the sensor gets no vote. This is used to disable the thumbwheel.
Wireless VAV Systems

Wired Zone Sensor Setup Using Tracer Summit
If a wired sensor is also attached to the UCM, the next step will be to make the wired sensor a backup or an averaged input. This can be done as follows:

1. From the Main Menu, select the Setup Pull Down Menu
2. Highlight the Unit Controllers option and select the VariTrane UCM II/III/IV... Editor
3. Select the UCM to be modified and press the “OK” button
4. In the UCM II/III/IV... Editor, open the wireless folder
5. Change the Wireless Receiver Name from Not Assigned to the correct name of the receiver. Open the first available “Edit Wired Zone Sensor” menu.
6. Averaged1, Primary Backup2, or Secondary Backup3.
7. Adjust the value desired in the “Set Point Weight”4 field.
8. Once complete, press the okay button to return to the UCM editor.
9. Press the “Save” button to save the changes to the UCM.

Notes:
1. The Averaging choice means the sensed temperature will be averaged with the wireless sensors and set point temperature will be averaged according to the set point vote selected in option 20.
2. First backup means the UCM will look for a wired sensor first if the wireless sensor fails.
3. Second backup means the UCM will look for a wireless backup sensor first if the wireless sensor fails.
4. Wired Set Point Weight determines the weighting of the set point vote. The range is 0-9. The number chosen is the number of votes the sensor gets in the determination of the set point. If “0” is selected the sensor gets no vote. This is used to disable the thumbwheel.

Wireless Zone Sensor Setup Using the Setup Tool:
The setup tool has a Green LED to indicate power and red LED to signal a transmission.

1. The first step is to move DIP switch 8 on the receiver to the setup mode.
2. To setup the sensor, remove the front cover of the zone sensor, insert the plug into the keyed socket at the bottom of the circuit board.

The display reads:
Trane Setup Tool
Press Any Key
Pressing any key produces the following display
UCM Address? 00
Add Average 1
To assign the sensor as an averaging sensor to a specific UCM enter the UCM Address (1-63) and press send. The receiver will beep 3 times to indicate a successful assignment.

The setup tool provides additional capabilities as well. The sensor can be added as an averaging sensor or as a backup to another Wireless sensor. A maximum of four (4) averaging sensors and one (1) backup may be assigned to a UCM. The set point vote can be changed from 0-9 by pressing the “Set Point Vote” button. The sensor use is toggled by pressing the “AVERAGE/BACKUP” button on the setup tool. The send button executes the command. The receiver will beep 3 times to indicate a successful assignment.

In addition to adding a sensor the setup tool allows the user to delete an assigned sensor or purge all sensors assigned to a particular UCM. These options are selected by pressing the “ADD/DELETE/PURGE” button. The send button executes the command.

The receiver will beep 3 times to indicate a successful assignment.
The service tool can be used to check if the receiver is receiving the RF transmissions. While in the default screen:

UCM Address? 00
Add Average 1
Press “Send.” The receiver will beep twice to indicate it received the signal.
The “BATTERY/SERIAL#” on the setup tool reads and displays the sensor’s serial number and battery level.
To return to the main screen at any time press the “Clear Screen” button.
The setup tool has an energy saver mode that initiates after approximately 1 minute of inactivity. Pressing any key twice will wake up the setup tool. While in the energy saver mode the LCD blanks and the red and green LED’s flash.
CHAPTER 8: TROUBLE-SHOOTING

UCM 4.0 Problems

In the event that the UCM does not communicate, properly inspect the following:

1. Incorrect supply voltage
   - The green LED indicates power and should be “steady” ON.
   - Measure the power input to TB1-1 (common) and TB1-2 (ground) of the UCM board. The supply voltage should be between 20 and 28 VAC (24 VAC cataloged). However, voltages at either extreme may result in system instability.

2. Communication link polarity is reserved.
   - The yellow LED will be ON indicating a reversed polarity. Switch the communication link connection.

3. UCM is not addressed correctly
   - Verify the DIP switch settings on the UCM.

4. Communication link signal has interference
   - Communication link should not be routed near or with any voltage source.

5. Incorrect wire used
   - Recommended wire is twisted shielded pair. See Chapter 2 for the wiring specifications for the UCM.

6. Defective UCM board
   - Be sure all other recommended actions listed above have been taken. Disconnect the communication link from the board and check the board’s ability to communicate with the Trane EveryWare Software. If communications do not exist, the board is assumed defective.

In the event that the UCM will not display data, properly inspect the following:

1. UCM not correctly addressed or two UCM’s addressed the same
   - Check the DIP switches on the first VAV box and remove the communication link from the second VAV box.

2. Communication wiring error (shorts, open, or reversed polarity)
   - Remove the communication link past the first VAV box and verify the polarity. Check resistance across the communication wires for possible shorts or open circuitry.

3. UCM has no power
   - Check the green power LED and check the 24 volts AC supply at TB1 on the UCM board. Voltage should be between 20 volts AC and 28 volts AC (24 VAC cataloged). However, voltages at either extreme may result in system instability.

4. Failed UCM on the communication link
   - One UCM failure can bring down all UCM communications.

In the event that the UCM reports an incorrect zone temperature or set point, properly inspect the following:

1. Zone sensor wired incorrectly
   - Check wiring for the correct connections. See Chapter 2 for further details on zone sensor wiring.

2. Defective zone sensor
   - Disconnect the zone sensor terminal plug from the UCM and using an Ohmmeter, measure the resistance across the plug terminals TB3-1 and TB3-2 for the set point. Compare the resistance to temperature using Table 8 in Chapter 5.

   - Additionally, measure these values at terminals 2 and 3 on the zone sensor. These values should be near those measured above. If not, the connecting wire is faulty.

In the event that the zone sensor is reading incorrectly, properly inspect the following:

1. Zone sensors open or shorted out
   - Check the resistance across the wires at the UCM and compare the resistance to the values shown in Table 8.

2. Actual room temperature is higher or lower than what the UCM reads
   - Check the location and installation of the zone sensor. Change the calibration factor in the UCM setup screens.
## Trouble Analysis

1. **The tubing or flow ring is off, reversed, plugged, or has a leak**
   - Check with a manehelic gauge and compare with the delta pressure (DP) chart located on the VAV box.
   - Check the tubing for reversal and/or leaks.
   - Check the flow ring for plugged holes.

2. **Wrong unit size downloaded into the UCM setup menu**
   - Verify that the actual unit size matches the unit's nameplate.

3. **Poor inlet configuration**
   - Trane recommends 1½-duct diameters of straight duct before the inlet of the box (a 12-inch box should have 18 inches of straight run duct before the inlet).

4. **UCM going through a recalibrate**
   - Check the recalibrate override and wait for the unit to finish the calibration.

5. **Measured flow reading from flow hood differs from UCM’s flow reading**
   - After verifying that none of the above conditions exist, follow the steps for calibration listed under the Air Valve Reading Position Instead of Flow section. If a discrepancy between the flow hood CFM and the UCM CFM still exists, change the flow calibration factor by entering the actual CFM as the “Measured Cooling Flow” in the UCM setup menu.

6. **More than one UCM connected to a single zone sensor**
   - Cut jumper wires (W1 and W2) on all slave units.

### In the event that the UCM is not reading or incorrectly reading the set point knob, properly inspect the following:

1. **Cut jumper wires (W1 and W2) on all slave units**

2. **UCM is going through a recalibrate**
   - Wait for calibration to finish.

### In the event that the fan and/or heat outputs are not energizing, properly inspect the following:

1. **UCM downloaded incorrectly**
   - Check fan and heat type parameter.

2. **Minimum heating CFM is not being met, airflow is too low**
   - Increase the airflow or lower the minimum heating flow.

3. **Fan/Heat relays have failed**
   - Remove fan/heat wires from UCM and apply 24 VAC directly.

### In the event that the measured flow reads incorrectly (i.e., different from the balance report), properly inspect the following:

1. **The tubing or flow ring is off, reversed, plugged, or has a leak**
   - Check fan and heat type parameter.

2. **Minimum heating CFM is not being met, airflow is too low**
   - Increase the airflow or lower the minimum heating flow.

3. **Fan/Heat relays have failed**
   - Remove fan/heat wires from UCM and apply 24 VAC directly.

### Note: UCM Outputs are switched to ground. Do not jumper 24 VAC to J1-3 or J1-4 because damage will occur.

4. **Zone temperature is at or above the heat set point or less than the cool set point**
   - Change the heat and/or cool set points.

### In the event that the air valve is reading position instead of flow, properly inspect the following:

1. **Airflow is below 5% or above 110% cataloged**
   - The UCM reverts to pressure dependent mode (position control) and position is displayed rather than CFM.

2. **Unit type is not VariTrane nor Generic**
   - Change the unit type to VariTrane or Generic.

### Transducer has failed

- Pressure transducers are responsible for reading the airflow across the flow ring and converting it to an electronic signal. This signal is sent back to the UCM board and flow is read at the UCM status and setup screens. When a pressure transducer fails, the air valve will assume pressure dependent mode (position control) and reverts to position control. To determine whether or not the transducer has failed, perform the following steps:
  1. Check the 24 volts AC supply at TB1 on the UCM board. Voltage should be between 20 volts AC and 28 volts AC.
  2. Read the input voltage to the transducer from the UCM controller between the green and red wires on J3 of the UCM board. The voltage should be between 4.50 volts DC and 5.50 volts DC (5 volts DC cataloged).
  3. Remove the high and low tubes from the transducer (to simulate no flow). Read the transducer output voltage on J3 of the UCM board between the green and black wires with a voltmeter. The voltage should be between 0.20 volts DC and 0.30 volts DC (0.25 volts DC is the null voltage output of the transducer indicating zero flow).
  4. Replace the tubes on the transducer.

### Analysis

- **Tracer Summit or UCM has enabled an override function**
  - The overrides are Open, Closed, Min, or Max. Disable all overrides.
  - UCM is going through a recalibrate (reset) command
  - Wait for calibration to finish.
  - Air valve motor has failed
  - Check motor by applying 24 VAC directly.

- **Tracer Summit has the fan/heat outputs disabled**
  - Check group, global, and/or Tracer overrides.

- **A flow override exists looking out the fan/heat outputs**
  - Check group, global, and/or Tracer overrides.

- **Outputs on the UCM are configured as normally closed**
  - Verify the output configuration in the UCM setup menu.

- **Zone temperature is at or above the heating set point**
  - Increase the UCM heating set point.

- **In the event that the air valve is not modulating, properly inspect the following:**
  - Pressure transducers are responsible for reading the airflow across the flow ring and converting it to an electronic signal. This signal is sent back to the UCM board and flow is read at the UCM status and setup screens. When a pressure transducer fails, the air valve will assume pressure dependent mode (position control) and reverts to position control. To determine whether or not the transducer has failed, perform the following steps:
   1. Check the 24 volts AC supply at TB1 on the UCM board. Voltage should be between 20 volts AC and 28 volts AC.
   2. Read the input voltage to the transducer from the UCM controller between the green and red wires on J3 of the UCM board. The voltage should be between 4.50 volts DC and 5.50 volts DC (5 volts DC cataloged).
   3. Remove the high and low tubes from the transducer (to simulate no flow). Read the transducer output voltage on J3 of the UCM board between the green and black wires with a voltmeter. The voltage should be between 0.20 volts DC and 0.30 volts DC (0.25 volts DC is the null voltage output of the transducer indicating zero flow).
   4. Replace the tubes on the transducer.

- **In the event that more than one UCM is connected to a single zone sensor:**
  - Cut jumper wires (W1 and W2) on all slave units.

- **Zone temperature is at or above the heat set point or less than the cool set point**
  - Change the heat and/or cool set points.

- **Unit type is not VariTrane nor Generic**
  - Change the unit type to VariTrane or Generic.
Trouble Analysis

Steps for Calibration:
1. Log on to the UCM with EveryWare software.
2. Turn the central air handler “off.” If this is not possible, Trane recommends pulling the transducer tubes off during the calibration process to simulate this.
3. Select the “calibrate unit” option by pressing command function 6 (F6). EveryWare software will indicate that calibration is taking place.
4. When calibration is complete, the box will release to auto.
5. Drive the box open to make sure that the box is not below 5% of its cataloged CFM. The controller is accurate in reading flow from 5% to 110% of cataloged CFM. For example, a size 17 air valve is accurate between 85 CFM and 1870 CFM.
6. Release the box to auto and perform any necessary balancing work.

Wireless Receiver Trouble Analysis

Wireless Zone Sensor Functional Electrical Test
This check should be performed after a zone sensor has been mounted and the batteries have been installed. The cover must be off.
If the sensor is equipped with a temperature control, set the control dial with “70” in the 9 o’clock position. Press either one of the two push button switches on the upper left side of the sensor. The green LED near the bottom of the circuit board should flash each time the push button is pressed. If it does not, check that both batteries are good and are properly seated in the holders.
In normal use, the green LED will flash each time the zone sensor transmits a message, usually several minutes apart.

Checking Receiver Operation
This check should be performed after all zone sensors for the receiver have been installed. When power is applied, check the operation of the three LED’s on the receiver as follows:
Green LED (Power Indicator): Indicates 24 VAC power to receiver. Should be lit continuously. If not lit, check 24-volt transformer connections. If 24 VAC is present but Green LED is off, return receiver for service.
Red LED (VAV Link Activity Communications Indicator): Will be lit for a few seconds after power is applied; when initialization is completed, this LED will blink when a RF signal is being received from a sensor.
Yellow LED (Radio Communication Activity Signal Indicator): Will be lit for a few seconds after power is applied: when initialization is completed, this LED will blink when a RF signal is being received from a sensor.

Receiver will not upload from Receiver Summary
1. Verify power to the receiver.
2. Verify the address on the receiver.
3. Verify polarity of the VAV Link.
4. Verify that the receiver is grounded.

Receiver uploads but no sensors are reporting
1. The receiver/translator polls all of the UCM’s periodically to see if a new sensor has been assigned then the receiver/translator adds the serial number to its list of sensors to monitor. This process can take approximately 8 minutes.

2. Verify that the sensor is transmitting by pressing the On or Cancel buttons on the sensor and observing the green LED on the sensor’s circuit board next to the setup tool connection. It should flash to indicate a transmission.

3. If the sensor is transmitting, move it within 20-30- feet, line of sight, of the receiver and press the On or Cancel buttons. The yellow LED on the receiver should flash indicating that the signal was received and immediately afterwards the red LED should flash indicating the message has been translated and sent on the VAV link.
4. To check for a completed transmission, plug the service tool into the sensor and perform the RF transmission test by pressing the “Send” key from the default menu. The receiver will beep twice to indicate a successful transmission.

RSSI’s are too low
1. Verify the antenna is properly installed and making good contact with the socket. The antenna must be vertically oriented.
2. Check the location. Place the receiver in an ideal location for radio reception to verify it is working properly and then move it to a more aesthetically pleasing location while maintaining adequate reception. An ideal location would be central to all transmitters and not close to any electrical equipment or large metal structures.

attached. With flow going across the flow ring, read the transducer output voltage between the green and the black wires. The difference between this voltage and the zero flow voltage should be 0.100 volts DC minimum (1” Delta P equals 1.0 DVC, and voltage should increase as flow increases). If a 0.100 volts DC minimum is not present, check the transducer tubing with a Magnehelic differential pressure gauge and compare it with the delta pressure (Delta P) chart located on the VAV box to ensure that there are no clogs or plugs. In order to see if the flow ring is clogged or leaks, check with a Magnehelic differential pressure gauge to see if there is flow going across the flow ring.

Note: Cycling power to the VAV board will automatically cause the unit to calibrate, however, following the procedure outlined below will provide a more accurate calibration. It is only necessary to perform this procedure in instances where you are experiencing incorrect flow readings or if the unit reverts to pressure dependent mode despite being above 5% and below 110% of cataloged CFM. For example, a size 17 air valve is accurate between 85 CFM and 1870 CFM.

E. Calibrate the transducer. Calibration is issued from EveryWare software revision 1.35 by command function 6 (F6) (see the following procedure). This will take effect immediately.

Steps for Calibration:
1. Log on to the UCM with EveryWare software.
2. Turn the central air handler “off.” If this is not possible, Trane recommends pulling the transducer tubes off during the calibration process to simulate this.
3. Select the “calibrate unit” option by pressing command function 6 (F6).
4. EveryWare software will indicate that calibration is taking place.
5. When calibration is complete, the box will release to auto.
6. Drive the box open to make sure that the box is not below 5% of its cataloged CFM. The controller is accurate in reading flow from 5% to 110% of cataloged CFM. For example, a size 17 air valve is accurate between 85 CFM and 1870 CFM.

7. Release the box to auto and perform any necessary balancing work.
Frequently Asked Wireless Receiver Questions

What is the life expectancy of the battery?
The battery life is expected to be 1.5+ years depending on the environment in which the sensor is installed. The sensor is designed to minimize the frequency of communication while maintaining space temperature control. The sensor transmits on demand, such as when the temperature changes, the On/Cancel button is pushed, or the thumbwheel is turned. The more frequently the sensor transmits its information the shorter the battery life. A sensor in an entry will transmit the temperature swing every time the door opens but a sensor in an interior office will transmit much less frequently. The battery life of wireless zone sensors is primarily due to the number of times that the sensor reports to the receiver. The sensor “senses” the temperature every 10 seconds. The maximum time a sensor will go without reporting to the receiver is 420 seconds. The minimum time the sensor will go before reporting is 30 seconds. Obviously, the more times the sensor reports to the receiver, the shorter the battery life will be.

What causes the sensor to report its “sensed” readings? There are two things that cause the sensor to report: 1) changes or adjustments to the thumbwheel set point, and 2) temperature fluctuations greater than 1 degree F. The more the sensor reports, the shorter the battery life will be. To reduce the number of reports and thus increase the battery life, avoid placing the sensor in locations where temperatures frequently fluctuate. Trane recommends avoiding placing the sensor in locations where “drafting” is an issue such as lobby’s, walkways, and near computers. Also, sensors should be placed at least at eye level to reduce the effects of “drafts” created by people walking by.

What if I have other wireless systems such as for security systems or telephones? Can they interfere? Trane Wireless VAV Systems apply spread spectrum technology to accomplish wireless communication. Spread spectrum technology enhances system security and allows the system to operate in the same environment as other systems using the same frequencies. Upon reception, the receiver “unspreads” the signal and reads the information. Any receiver that does not have a matching encoding sequence can not unspread the signal and sees the transmission as RF noise. This spreading and unspreading enhances the security of the system and its ability to operate in the same environment as other systems using the same frequencies. The sensor simultaneously broadcasts identical information over two separate frequencies (911 and 918 MHz) with a 5 MHz bandwidth, making interference even less likely.

What about interference due to building construction? The spread spectrum technology is very good at finding a way through the building. However, if a building or an area is enclosed in metal, the signal will most likely not find a clean path to the receiver. A large metal plane is the most detrimental source of interference and will most likely block the signal. The signal will also have problems penetrating steel reinforced concrete. This means that unless there is a large opening in the floor the signal may not pass from floor to floor and a receiver should be used on each floor. If a system is configured using the minimum amount of receivers and the transmissions are getting lost the obvious fix is to add a receiver.

Are there any environmental concerns? The major environmental concern, regarding batteries is mercury. The battery that Trane uses contains no mercury and thus is considered environmentally friendly.
### Commonly Used Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>AHU</td>
<td>Air Handling Unit</td>
</tr>
<tr>
<td>AIP</td>
<td>Analog Input</td>
</tr>
<tr>
<td>AOP</td>
<td>Analog Output</td>
</tr>
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<td>AVG</td>
<td>Average</td>
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<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
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<tr>
<td>BCU</td>
<td>Building Control Unit</td>
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<td>Binary Input</td>
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<td>Building Management System</td>
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<tr>
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<td>Binary Output</td>
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<td>Cubic Meters per Second</td>
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<td>CO₂</td>
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<td>COM</td>
<td>Communication</td>
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<td>Custom Program Language</td>
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<td>Input/Output</td>
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<tr>
<td>PROM</td>
<td>Programmable Read Only Memory</td>
</tr>
<tr>
<td>PWM</td>
<td>Pulse Width Modulation</td>
</tr>
<tr>
<td>RSSI</td>
<td>Receiver Signal Strength Indicator</td>
</tr>
<tr>
<td>RTD</td>
<td>Resistance Temperature Detector</td>
</tr>
<tr>
<td>SAP</td>
<td>Supply Air Pressure</td>
</tr>
<tr>
<td>SAT</td>
<td>Supply Air Temperature</td>
</tr>
<tr>
<td>TB</td>
<td>Terminal Block</td>
</tr>
<tr>
<td>TOV</td>
<td>Timed Override</td>
</tr>
<tr>
<td>TR</td>
<td>Time since last transmission was received</td>
</tr>
<tr>
<td>UCM</td>
<td>Unit Control Module</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriter's Laboratories</td>
</tr>
<tr>
<td>VA</td>
<td>Voltage Ampere</td>
</tr>
<tr>
<td>VAC</td>
<td>Voltage Alternating Current</td>
</tr>
<tr>
<td>VAV</td>
<td>Variable Air Volume</td>
</tr>
<tr>
<td>ZSM</td>
<td>Zone Sensor Module</td>
</tr>
</tbody>
</table>
Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. Only qualified, experienced personnel should perform installation and servicing of the equipment referred to in this booklet.