Controls By Others (All Unit Types)

Unit Heat	Control	Description	Page #
	DD00	Trane Actuator for Field-Installed DDC Controls	C 8
	FM00	Factory Installation of Customer Supplied Actuators and DDC Controls	C 9
	FM01	Trane Actuator w/ Factory Installation of Customer-Supplied DDC Controls	C 9
	ENON	No Controls or Actuator—Field-Installed DDC or Analog Controls	—

Single-Duct Terminal Unit (VCCF, VCWF, and VCEF)

Unit Heat	Control	Description	Page #
Cooling Only (VCCF)	DD01	Cooling Only	C 10
	DD02	Cooling With Remote Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)	C 10
	DD03	Cooling With Remote Proportional Hot Water Valve with Optional Spare On/Off Output	C 10
	DD04	Cooling With Remote Staged On/Off Electric Heat	C 10
	DD05	Cooling With Remote Pulse-Width Modulation Electric Heat	C 10
	DD07	Cooling With Remote Normally-Open On/Off Hot Water Valve (Normally-Closed Output)	C 10
Hot Water (VCWF)	DD02	Cooling With Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)	C 11
	DD03	Cooling With Proportional Hot Water Valve with Optional Spare On/Off Output	C 11
	DD07	Cooling With Normally-Open On/Off Hot Water Valve (Normally-Closed Output)	C 11
Electric (VCEF)	DD04	Cooling With Staged On/Off Electric Heat	C 12
	DD05	Cooling Wlth Pulse-Width Modulation Electric Heat	C 12

Dual-Duct Terminal Unit (VDDF)

Unit Heat	Control	Description	Page #
None (VDDF)	DD00	Trane Actuator for Field-Installed DDC Controls	C 8
	DD01	Cooling (No Remote Heat) and Heating Control	C 13
	DD08	Cooling (No Remote Heat) and Heating—Constant-Volume Control	C 14

Fan-Powered Terminal Units *with PSC Motor* (VPCF, VPWF, VPEF, VSCF, VSWF, and VSEF)
Low-Height Fan-Powered Terminal Units *with PSC Motor* (LPCF, LPWF, LPEF, LSCF, LSWF, and LSEF)

Unit Heat	Control	Description	Page #
Cooling Only (VPCF, VSCF, LPCF, LSCF)	DD01	Cooling Only	C 15
	DD02	Cooling With Remote Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 16
	DD03	Cooling With Remote Proportional Hot Water Valve	C 16
	DD04	Cooling With Remote Staged On/Off Electric Heat	C 15
	DD05	Cooling With Remote Pulse-Width Modulation Electric Heat	C 15
	DD07	Cooling With Remote Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 16
Hot Water (VPWF, VSWF LPWF, LSWF)	DD02	Cooling With Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 16
	DD03	Cooling With Proportional Hot Water Valve	C 16
	DD07	Cooling With Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 16
Electric (VPEF, VSEF LPEF, LSEF)	DD04	Cooling With Staged On/Off Electric Heat	C 15
	DD05	Cooling With Pulse-Width Modulation Electric Heat	C 15

Fan-Powered Terminal Units *with ECM* (VPCF, VPWF, VPEF, VSCF, VSWF, and VSEF)

Unit Heat	Control	Description	Page #
Cooling Only (VPCF, VSCF)	DD01	Cooling Only	C 17
	DD02	Cooling With Remote Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 17
	DD03	Cooling With Remote Proportional Hot Water Valve	C 17
	DD04	Cooling With Remote Staged On/Off Electric Heat	C 17
	DD05	Cooling With Remote Pulse-Width Modulation Electric Heat	C 17
	DD07	Cooling With Remote Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 17
Hot Water (VPWF, VSWF)	DD02	Cooling With Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 17
	DD03	Cooling With Proportional Hot Water Valve	C 17
	DD07	Cooling With Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 17
Electric (VPEF, VSEF)	DD04	Cooling With Staged On/Off Electric Heat	C 17
	DD05	Cooling With Pulse-Width Modulation Electric Heat	C 17

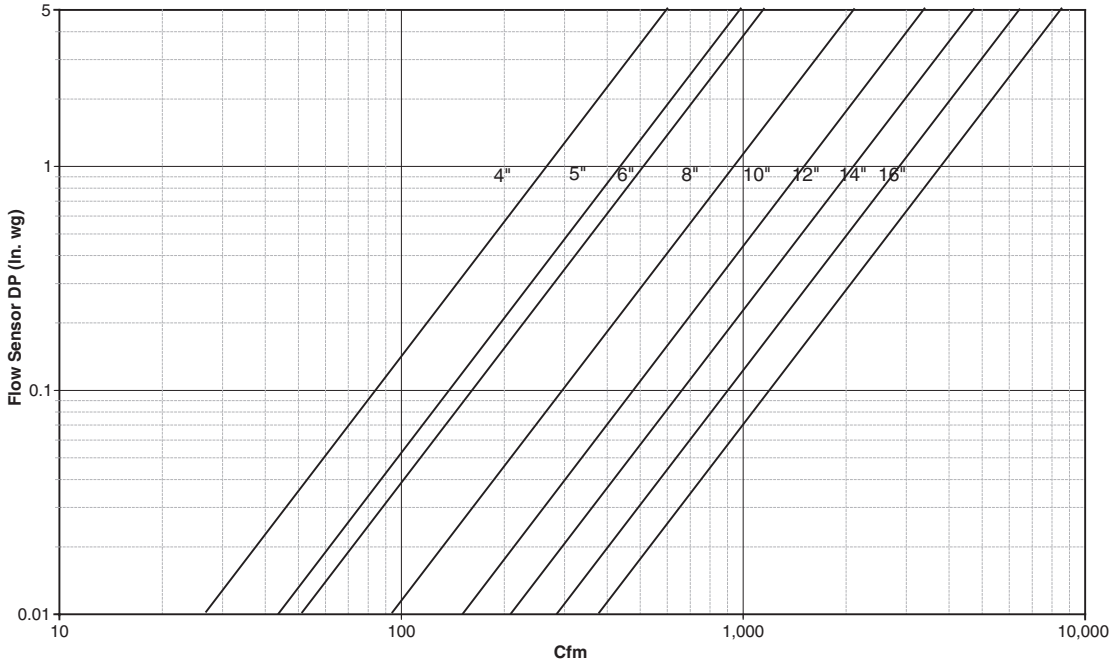
Trane DDC–UCM Control Logic—

DDC controllers are today's industry standard. DDC controllers provide system-level data used to optimize system performance. Variables such as occupied/unoccupied status, minimum and maximum airflow setpoints, temperature and temperature setpoints, valve position, fan status (on or off, and mode of operation: series or parallel), reheat status (on or off), box type and air valve size, temperature correction offsets, flow correction values, ventilation fraction, etc. are available on a simple twisted-shielded wire pair.

Trane DDC controllers provide Trane-designed, solid-state electronics intended specifically for VAV temperature control in space comfort applications. DDC control capabilities include:

- Proportional plus integral control loop algorithm for determining required airflow needed to control room temperature. Airflow is limited by active minimum and maximum airflow setpoints.
- Pressure-independent (PI) operation, which automatically adjusts valve position to maintain required airflow. In certain low-flow situations or in cases where the flow measurement has failed, the DDC controller will operate in a pressure-dependent (PD) mode of operation.
- Cooling and heating control action of air valve. In cooling control action, the DDC controller matches cooling airflow to cooling load. In heating control action, the DDC controller matches the heating airflow to control heating load. The DDC controller will automatically change over to cooling control action if the supply air temperature is below the room temperature and will automatically change over to heating control action if the supply air temperature is 10°F or more above the room temperature. If the supply air temperature is between the room temperature and the room temperature plus 10°F, then the DDC controller will provide the active minimum airflow. The DDC controller first chooses the Tracer Summit-supplied supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor. If this is also not available, it uses the heating/cooling mode assigned by Tracer Summit or the DDC controller's service tool (Everyware ™ or Rover™ V4).
- Multiple reheat control options including staged electric, staged hot-water (normally on or normally off), proportional hot-water, and slow pulsed width modulation. Modulating reheat options utilize a separate reheat proportional-plus-integral control loop from that controlling airflow into the room. Staged reheat options utilize a control algorithm based on heating setpoint and room temperature.
- 24 VAC binary input that can be configured as a generic input or as occupancy input. When the DDC controller is operation with Tracer Summit, the status of the input is provided to Tracer Summit for its action. In stand-alone operation and when configured for an occupancy input, the input will control occupancy status of the DDC controller.
- Auxiliary temperature analog input that can be configured for an auxiliary temperature sensor or a 2-to-10 VDC CO_2 sensor. When configured for temperature, the value of the input is used as status-only by Tracer Summit if Tracer Summit is providing a supply air temperature to the DDC controller. Otherwise, the input will be used for determining control action of the DDC controller. When configured for a CO_2 sensor, the value of the input is used as a status-only input by Tracer Summit.
- Dual-duct support with two DDC controllers. One DDC controller controls the cooling air valve and the other controller controls the heating air valve. With constant-volume sequences, the discharge air volume is held constant by controlling discharge air volume with the **heating** UCM.

Flow Sensor Signal vs. Airflow Delivery



Note: Flow sensor DP (in. wg) is measured at the flow ring to aid in system balancing and commissioning. See "Valve/Controller Airflow Guidelines" in each section for unit performance.

DDC Remote Heat Control Options

When heat is added to the primary air at the VAV unit before it enters the zone, the air is said to be reheated. The operating characteristics of the four basic types of VariTrane DDC terminal reheat are discussed.

Single-Duct: On/Off Hot Water Reheat—Three stages of on/off hot water reheat are available. The water valves used are 2-position and are either fully-opened or fully-closed. The heating minimum airflow setpoint is enabled during reheat.

Stage 1 energizes when the space temperature is at or below the heating setpoint. When the zone temperature rises above the active heating setpoint by 0.5°F (0.28°C), stage 1 is de-energized. Stage 2 energizes when the space temperature is 1°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. Stage 3 energizes when the zone temperature is 2°F (1.11°C) or more below the active heating setpoint, and de-energizes when the space temperature is 1.5°F (0.83°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Single-Duct: Proportional Hot Water Reheat—Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enabled during reheat.

The water valve opens as space temperature drops below the heating setpoint. Water valve position is dependent on both the degree that space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). An additional on/off remote heat output is available and energized when the proportional valve is driven 100% open and de-energized when the proportional valve reaches 50% open. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Single-Duct: On/Off Electric Reheat—Three stages of staged electric reheat are available. The heating minimum airflow setpoint is enabled during reheat.

Stage 1 is energized when the space temperature falls below the active heating setpoint and minimum airflow requirements are met. When the zone temperature rises above the active heating setpoint by 0.5°F (0.28°C), stage 1 is de-energized. Stage 2 energizes when the space temperature is 1°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. Stage 3 energizes when the zone temperature is 2°F (1.11°C) or more below the active heating setpoint, and de-energizes when the space temperature is 1.5°F (0.83°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Single-Duct: Pulse-Width Modulation of Electric Heat—Electric heat is modulated by energizing for a portion of a three-minute time period. The heating minimum airflow setpoint is enabled during reheat. This allows exact load matching for energy efficient operation, and optimum zone temperature control. One or two stages can be used.

The amount of reheat supplied is dependent on both the degree that space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the zone temperature rises more than 0.5°F (0.28°C) above the heating setpoint.

The Stage 1 "on" time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same "on" time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

VCEF

Fan-Powered Terminal Units: On/Off Hot Water Reheat—Two stages of on/off hot water reheat are available. The water valves used are 2-position and are either fully-opened or fully-closed. The heating minimum airflow setpoint is enabled during reheat.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series configured fan-powered terminal units utilize continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

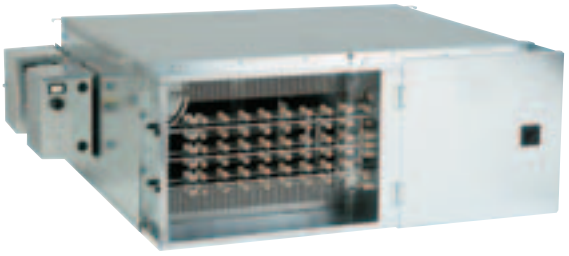
Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the zone temperature is 1°F (0.56°C) or more below the active heating setpoint, and de-energizes when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-Powered Terminal Units: Proportional Hot Water Reheat—Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enabled during reheat.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series-configured fan-powered terminal units utilize continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

VPEF



VSEF

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

The water valve opens as space temperature drops below the heating setpoint. The degree to which the hot water valve opens is dependent on both the degree that space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: On/Off Electric Reheat—Two stages of staged electric reheat are available. The heating minimum airflow setpoint is enabled during reheat.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset).

Series-configured fan-powered terminal units utilize the continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the space temperature is 1.0°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: Pulse-Width Modulation of Electric Heat—Electric heat is modulated by energizing for a portion of a three-minute time period. The heating minimum airflow setpoint is enabled during reheat. This allows exact load matching for energy efficient operation, and optimum zone temperature control. One or two stages can be used.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

DDC Reheat Control

Series-configured fan-powered terminal units utilize the continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

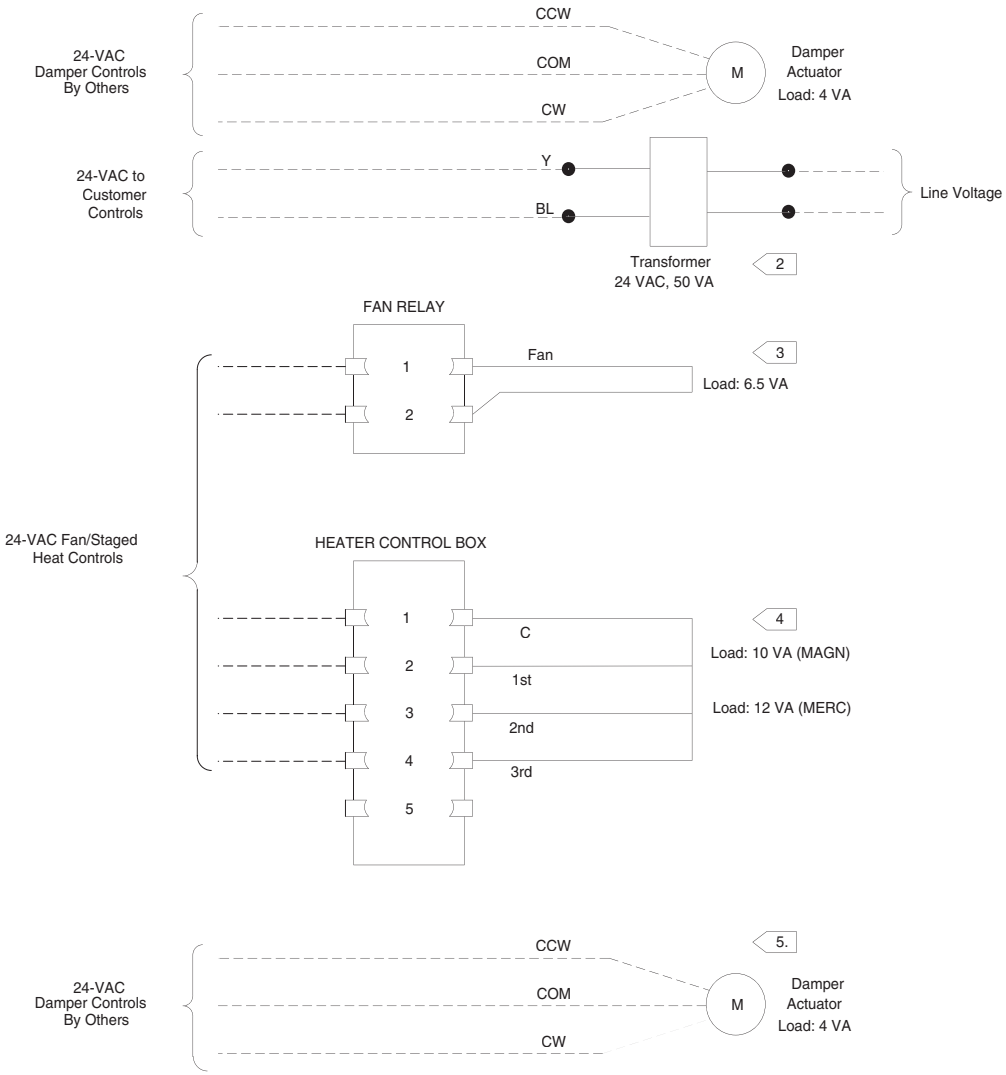
The amount of reheat supplied is dependent on both the degree that space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. The Stage 1 "on" time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same "on" time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated. When reheat is de-energized, the cooling minimum airflow setpoint it activated.

DD00—Available for all VariTrane Units

(Trane actuator for field-installed DDC controls)

A unit controller is not provided. The air damper actuator is provided with an integral screw terminal block. The fan contactor (fan-powered units), 24-VAC control power transformer (optional for single- and dual-duct units), and factory-installed electric heater contactor wires are attached to the outside of the unit for field connection of controls. A second actuator is provided with an integral screw terminal for dual-duct units.



NOTES:

1. Factory-installed
   Field Wiring
   Optional or installed by others

2. Located in Heater Terminal Box for electric heat on single-duct units.
   Located in Control Box for cooling only and hot water heat on single-duct units.
   Located in Control Box on all fan-powered units.

3. Only available with fan-powered units.

4. Located in Heater Terminal box.

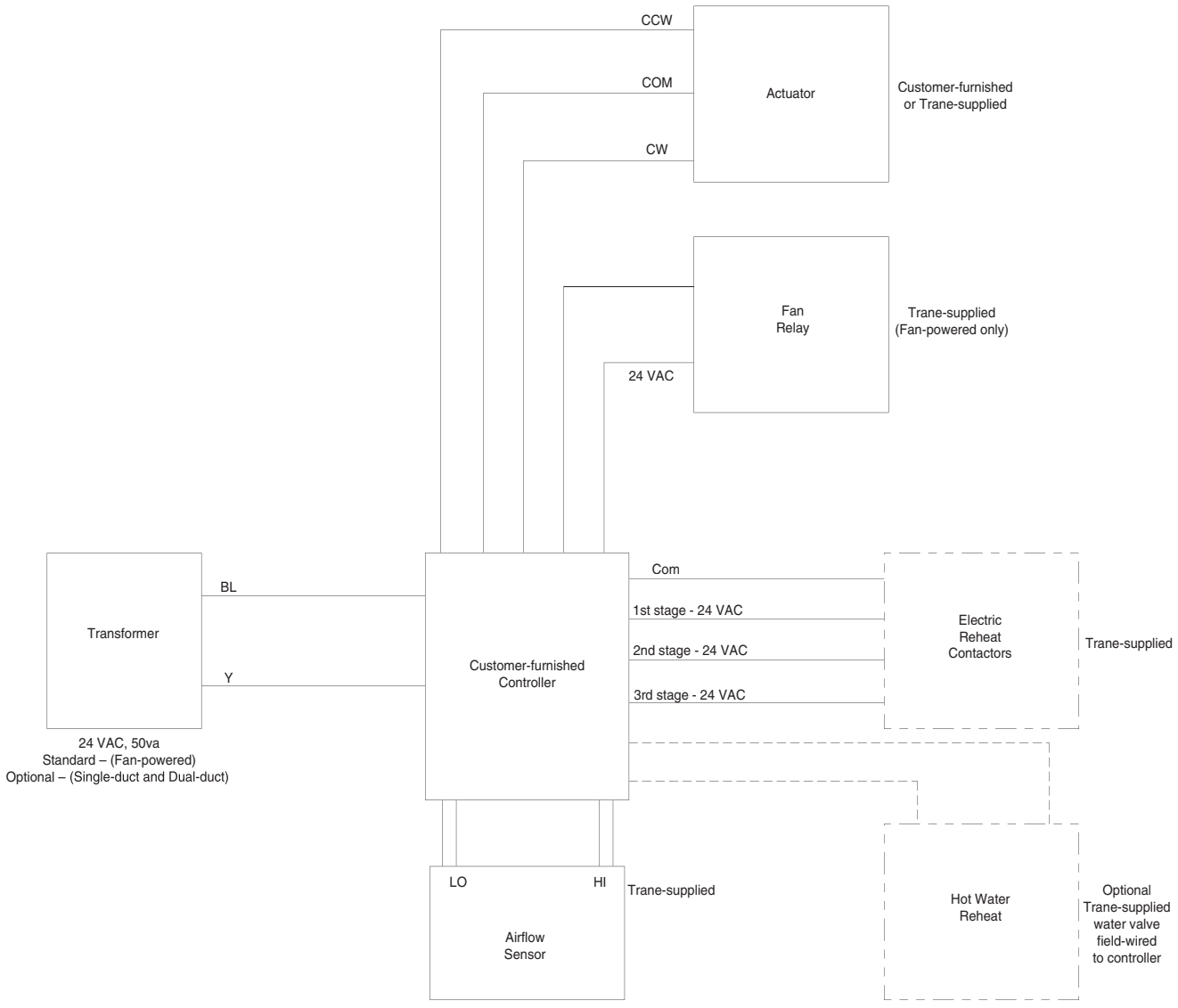
5. Only available with dual-duct units.

Available on all VariTrane Units

FM00 – Customer-supplied actuator and DDC controller factory-installed.

FM01 – Trane actuator and customer-supplied DDC controller factory-installed

All customer furnished controllers and actuators are installed and wired per control manufacturer's specifications. Metal control enclosure is standard.



NOTES:

1. Factory-installed
   Field Wiring
   Optional or installed by others
2. NEMA-1 Enclosure provided.

VCCF—Single-Duct Terminal Units

(Normal Operation: Cooling Only with Reheat Capabilities)

DD01 – Cooling Only

DD02 – Cooling with Remote Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)

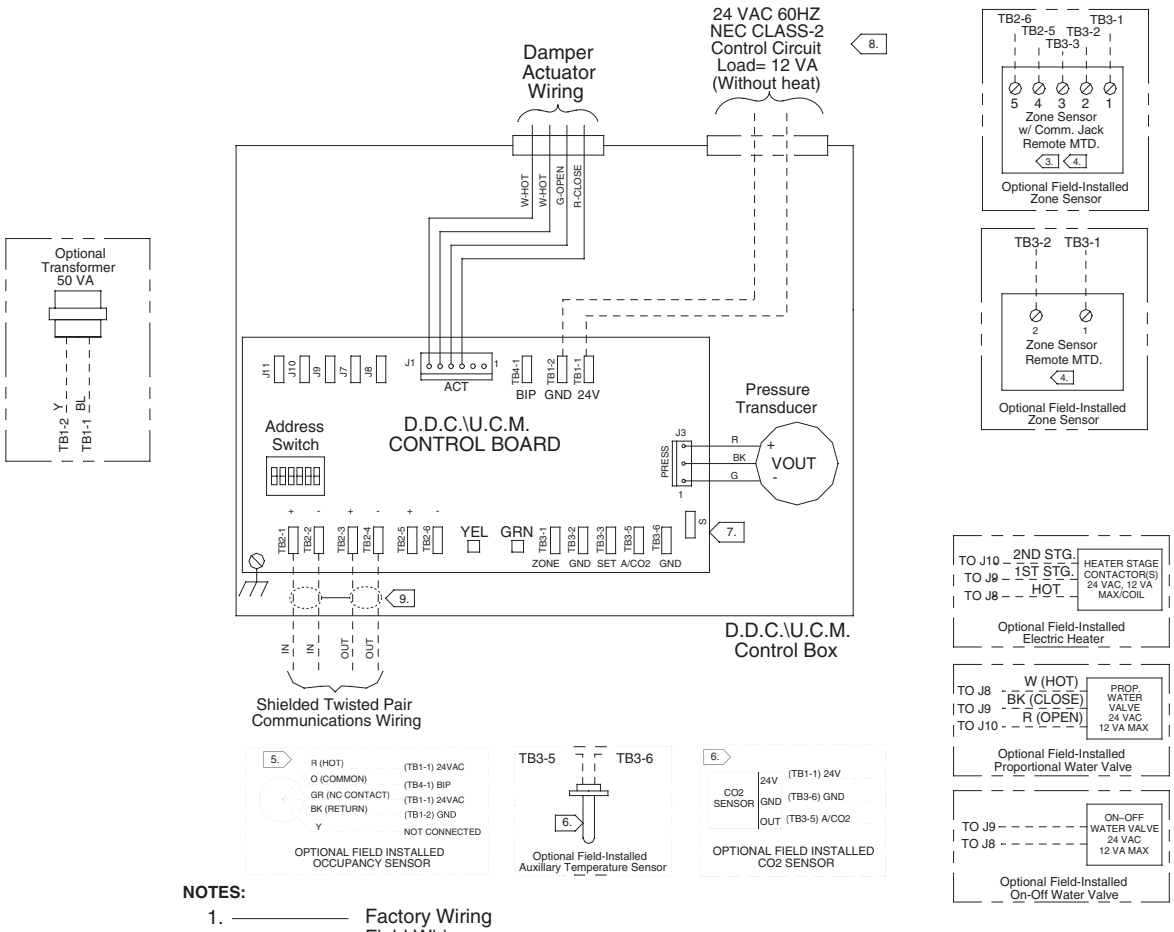
DD03 – Cooling with Remote Proportional Hot Water Valve with Optional Spare On/Off Output

DD04 – Cooling with Remote Staged On/Off Electric Heat

DD05 – Cooling with Remote Pulse-Width Modulation Electric Heat

DD07 – Cooling with Remote Normally-Open On/Off Hot Water Valve (Normally-Closed Outputs)

See "General Logic" and "DDC Reheat Control" sections for Sequence of Operation.



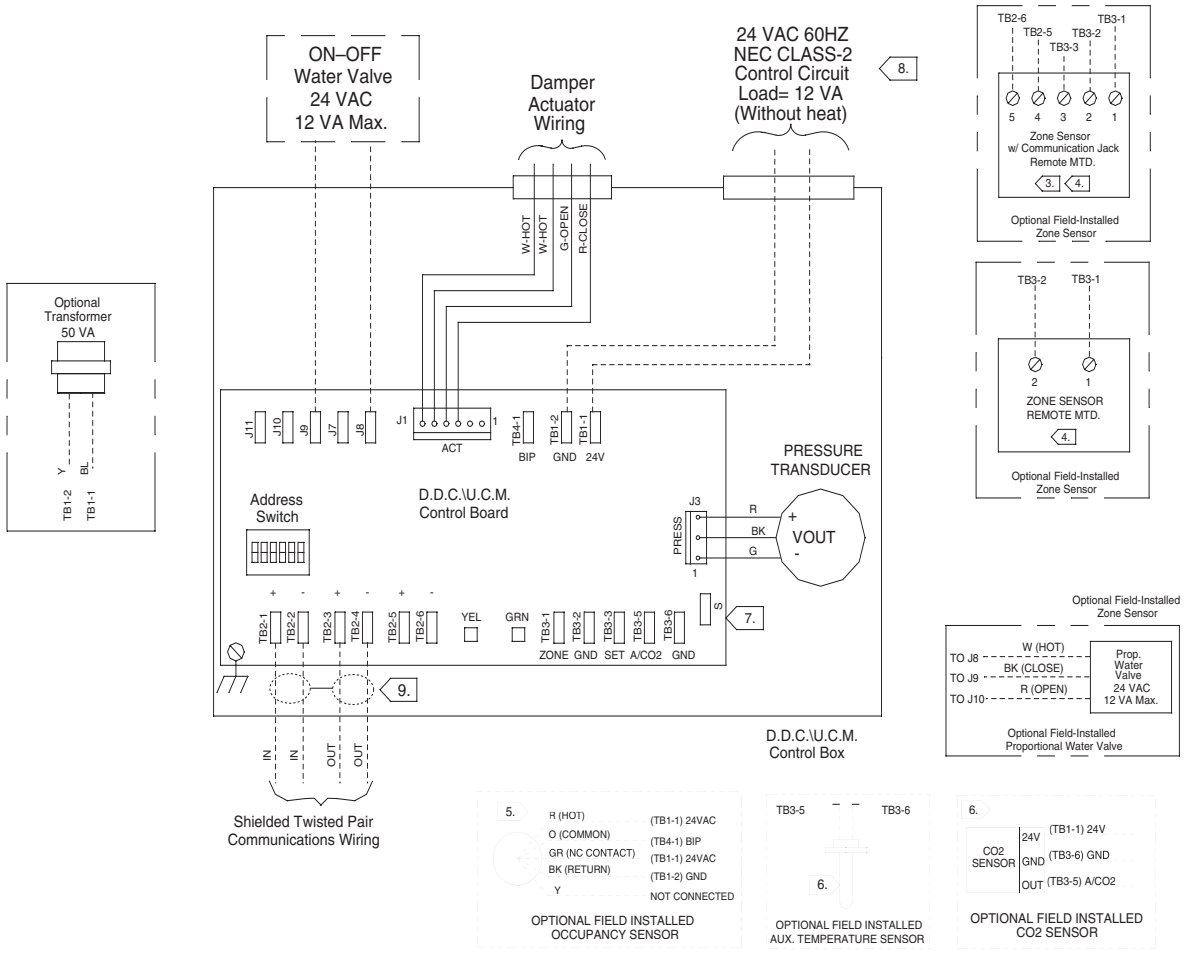
NOTES:

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 zone sensor equipped with communications jack. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.
4. No additional wiring required for night setback override (On/Cancel).
5. The optional binary input connects between TB4-1 (BIP) and 24 VAC (Hot) from the 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 Auxiliary Temperature Input. The AUX input can be reconfigured as a CO2 Sensor Input via the communications interface.
7. S-terminal is not to be used with VariTrane.
8. If unit-installed transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24 VAC supply is grounded, then ground leg must be connected to TB1-2.
9. Connect shielding from each communication cable together and insulate.

VCWF—Single-Duct Terminal Units

(Normal Operation: Cooling with Hot Water Reheat)
DD02 – Cooling with Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)
DD03 – Cooling with Proportional Hot Water Valve with Optional Spare On/Off Output
DD07 – Cooling with Normally-Open On/Off Hot Water Valve (Normally-Closed Outputs)

See "General Logic" and "DDC Reheat Control" sections for Sequence of Operation.



NOTES:

1. ———————— Factory Wiring
   - - - - - - - - - - - - - - - - Field Wiring
   ———— — ———— Optional or Alternate Wiring
2. 1/4" quick connect required for all field connections.

3. Zone sensor terminals 4 & 5 require shielded twisted pair wiring for communications jack equipped zone sensor options. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.

4. No additional wiring required for night setback override (ON/CANCEL).

5. The optional binary input connects between TB4-1 (BIP) and 24-VAC (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 Auxillary Temperature Input. The Aux. Input can be reonconfigured as a CO2 sensor input via the communications interface.

7. S Terminal not to be used with VariTrane.

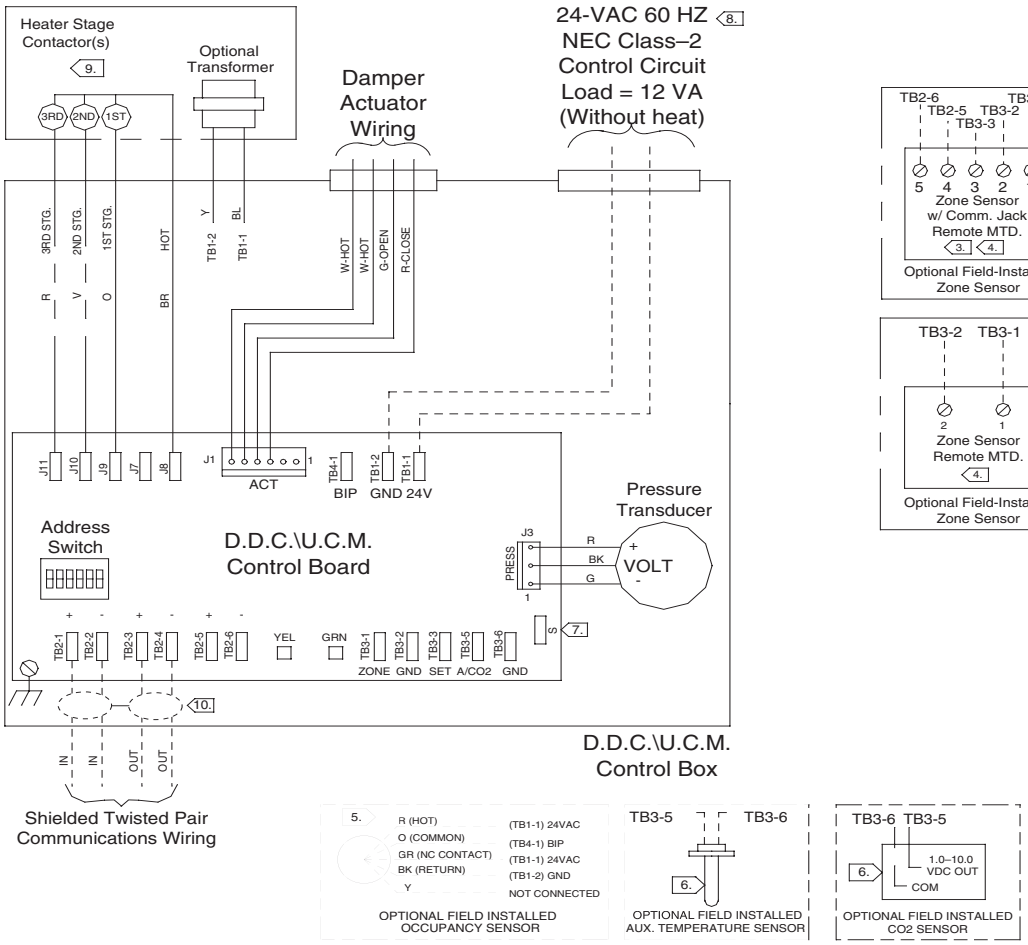
8. If unit-installed transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24-VAC supply is grounded, the ground leg must be connected to TB1-2.

9. Connect shielding from each communication cable together and insulate.

VCEF—Single-Duct Terminal Units

(Normal Operation: Cooling with Electric Reheat)
DD04 – Cooling with Staged On/Off Electric Heat
DD05 – Cooling with Pulse-Width Modulation Electric Heat

See "General Logic" and "DDC Reheat Control" sections for Sequence of Operation.



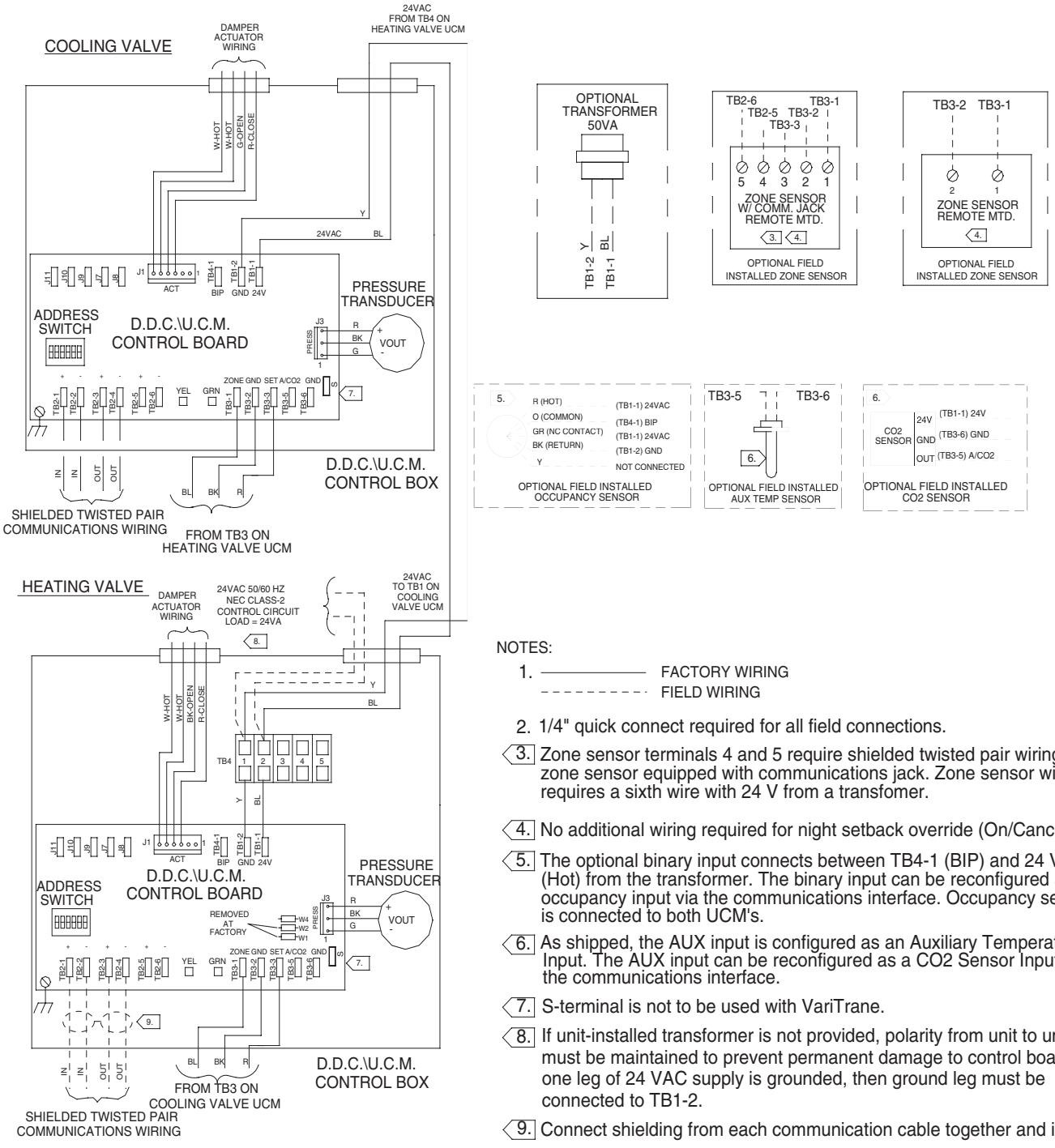
NOTES:

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 zone sensor equipped with communications jack. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.
4. No additional wiring required for night setback override (On/Cancel).
5. The optional binary input connects between TB4-1 (BIP) and 24 VAC (Hot) from the 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 Auxiliary Temperature Input. The AUX input can be reconfigured as a CO2 Sensor Input via the communications interface.
7. S-terminal is not to be used with VariTrane.
8. If unit-installed transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24 VAC supply is grounded, the the ground leg must be connected to TB1-2.
9. Contactors are 24 VAC: 12 VA max./coil (mercury contactors) and 10 VA max./coil (magnetic coils).
10. Connect shielding from each communication cable together and insulate.

VDDF – Dual-Duct Terminal Units

(Normal Operation: Cooling and Heating)
DD01 – Cooling (No Remote Heat) and Heating Control

See "General Logic" and DDC Reheat Control" sections for Sequence of Operation.



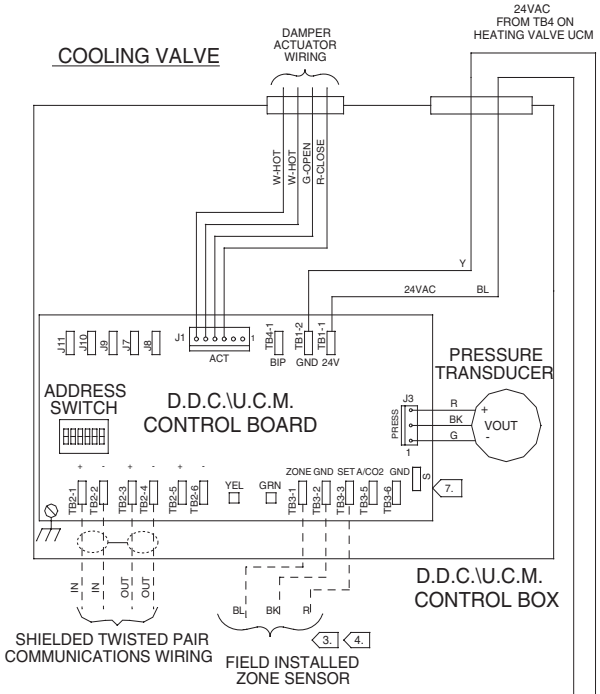
NOTES:

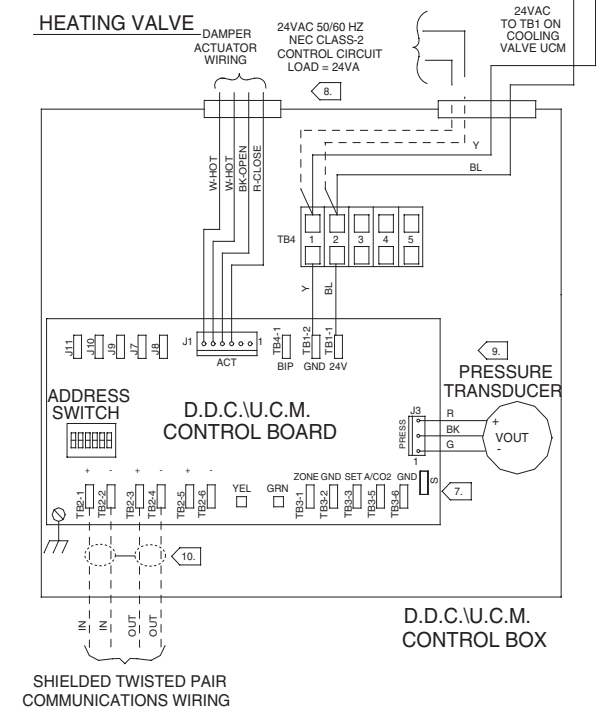
1. ——— FACTORY WIRING
   - - - - - - - - - FIELD WIRING
2. 1/4" quick connect required for all field connections.
3. Zone sensor terminals 4 and 5 require shielded twisted pair wiring for zone sensor equipped with communications jack. Zone sensor with LCD requires a sixth wire with 24 V from a transfomer.
4. No additional wiring required for night setback override (On/Cancel).
5. The optional binary input connects between TB4-1 (BIP) and 24 VAC (Hot) from the transformer. The binary input can be reconfigured as an occupancy input via the communications interface. Occupancy sensor is connected to both UCM's.
6. As shipped, the AUX input is configured as an Auxiliary Temperature Input. The AUX input can be reconfigured as a CO2 Sensor Input via the communications interface.
7. S-terminal is not to be used with VariTrane.
8. If unit-installed transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24 VAC supply is grounded, then ground leg must be connected to TB1-2.
9. Connect shielding from each communication cable together and insulate.

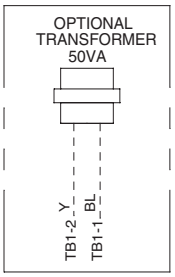
VDDF – Dual-Duct Terminal Units

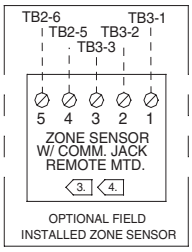
(Normal Operation: Cooling and Heating)
DD08 – Cooling (no Remote Heat) and Heating - Constant Volume Control

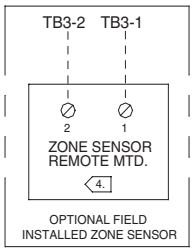
See "General Logic" and "DDC Reheat Control" sections for Sequence of Operation.

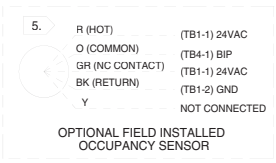


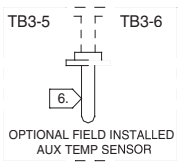


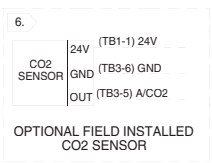












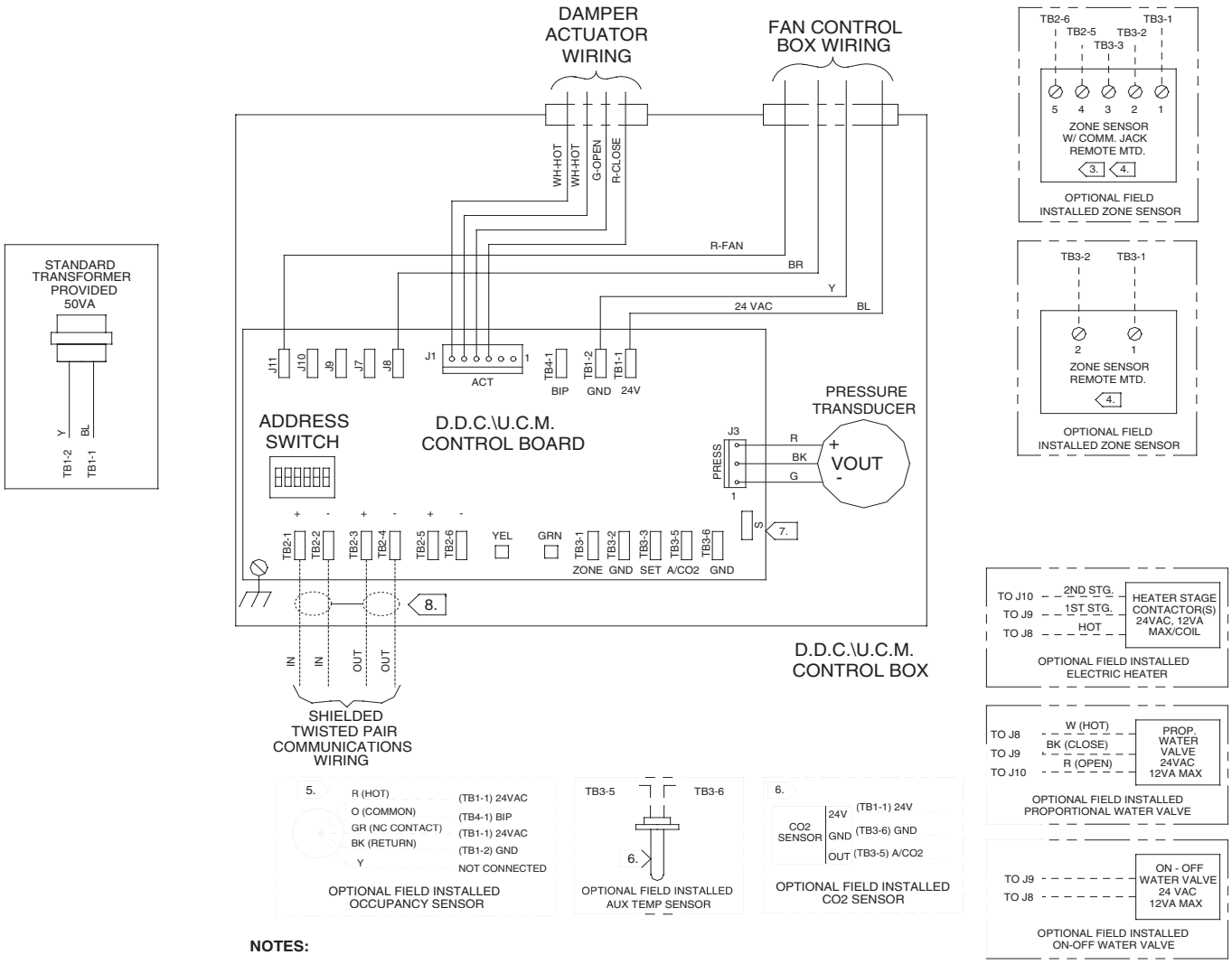
NOTES:

1. ———— FACTORY WIRING
   - - - - - - - - - - FIELD WIRING
2. 1/4" quick connect required for all field connections.
3. Zone sensor terminals 4 and 5 require shielded twisted pair wiring for zone sensor equipped with communications jack. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.
4. No additional wiring required for night setback override (On/Cancel).
5. The optional binary input connects between TB4-1 (BIP) and 24 VAC (Hot) from the transformer. The binary input can be reconfigured as an occupancy input via the communications interface. Occupancy sensor is connected to both UCMs.
6. As shipped, the AUX input is configured as an Auxiliary Temperature Input. The AUX input can be reconfigured as a CO2 Sensor Input via the communications interface.
7. S-terminal is not to be used with VariTrane.
8. If unit-installed transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24 VAC supply is grounded, then ground leg must be connected to TB1-2.
9. The flow ring, normally used for sensing heating airflow, is placed at the discharge of the unit and is used to control constant volume.
10. Connect shielding from each communication cable together and insulate.

For Use With VariTrane Fan-Powered Terminals

(Normal Operation: Cooling with Electric Reheat Capability)
DD01 – Cooling Only
DD04 – Cooling With Staged On/Off Electric Heat
DD05 – Cooling With Pulse-Width Modulation Electric Heat

See "General Logic" and "DDC Reheat Control" sections for Sequence of Operation.



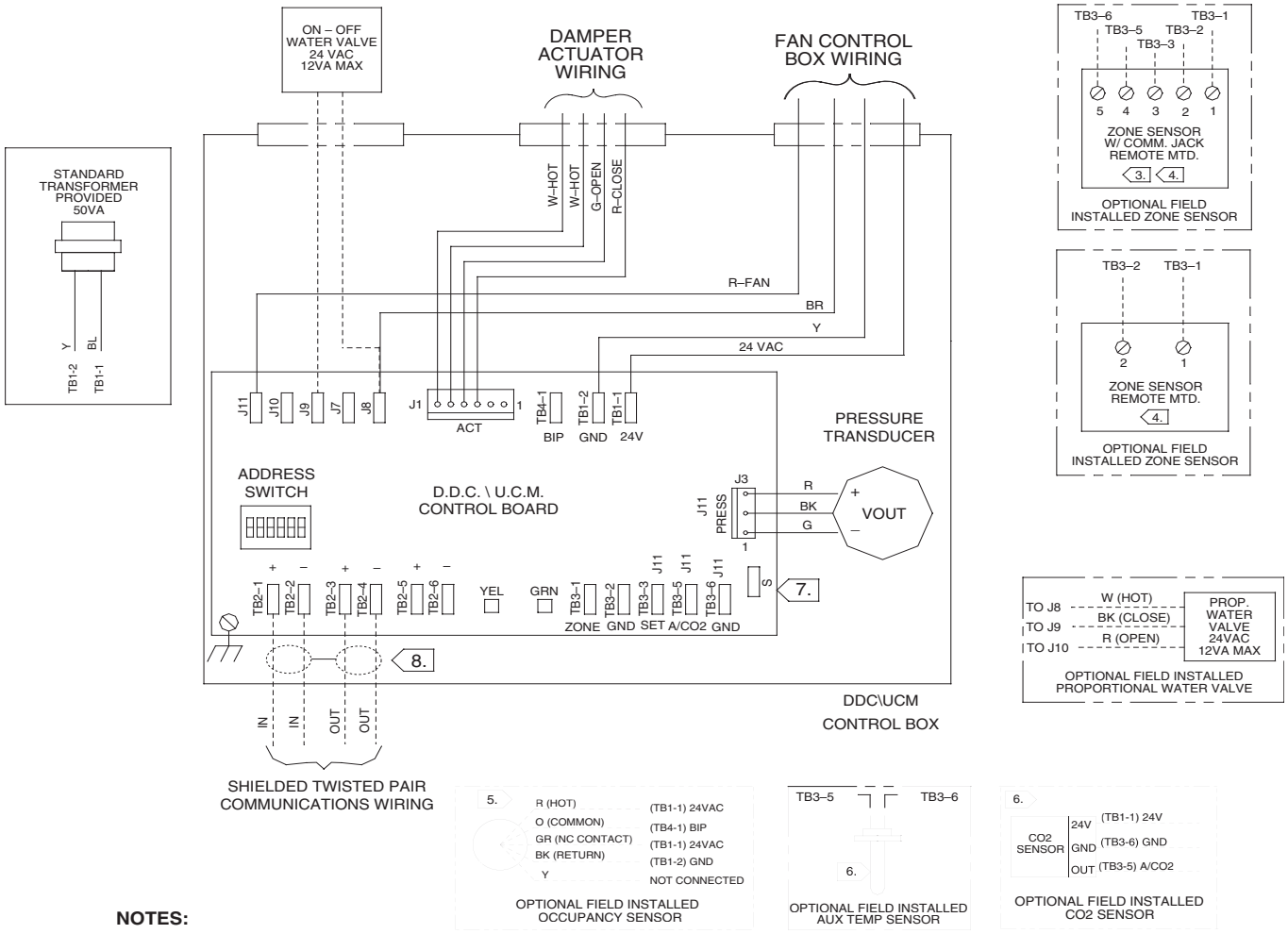
NOTES:

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. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.
4. No additional wiring required for night setback override (on/cancel).
5. The optional binary input connects between TB4-1 (BIP and 24 VAC (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 with VariTrane.
8. Connect shielding from each communication cable together and insulate.

For Use With VariTrane Fan-Powered Terminals

(Normal Operation: Cooling with Hot Water Reheat)
DD02 – Cooling with Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)
DD03 – Cooling with Proportional Hot Water Valve
DD07 – Cooling with Normally-Open On/Off Hot Water Valve (Normally-Closed Outputs)

See "General Logic" and "DDC Reheat Control" sections for Sequence of Operation.



NOTES:

1. ———— Factory Wiring
   - - - - - - - - - - Field Wiring
   ——— – – ——— Optional or Alternate Wiring
2. 1.4" quick connect required for all field connections.
3. Zone sensor terminals 4 & 5 require shielded twisted pair wiring for communications jack equipped zone sensor options. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.
4. No additional wiring required for night setback override (ON/CANCEL).
5. The optional binary input connects between TB–1 (BIP) AND 24 VAC (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 Auxillary Temporary Input. The Aux. Input can be reconfigured as a CO2 sensor input via the communications interface.
7. S Terminal not to be used with VariTrane.
8. Connect shielding from each communication cable together and insulate.

For Use With ECM VariTrane Fan-Powered Terminals

(Normal Operation: Cooling with Reheat Capability)

DD01 – Cooling Only

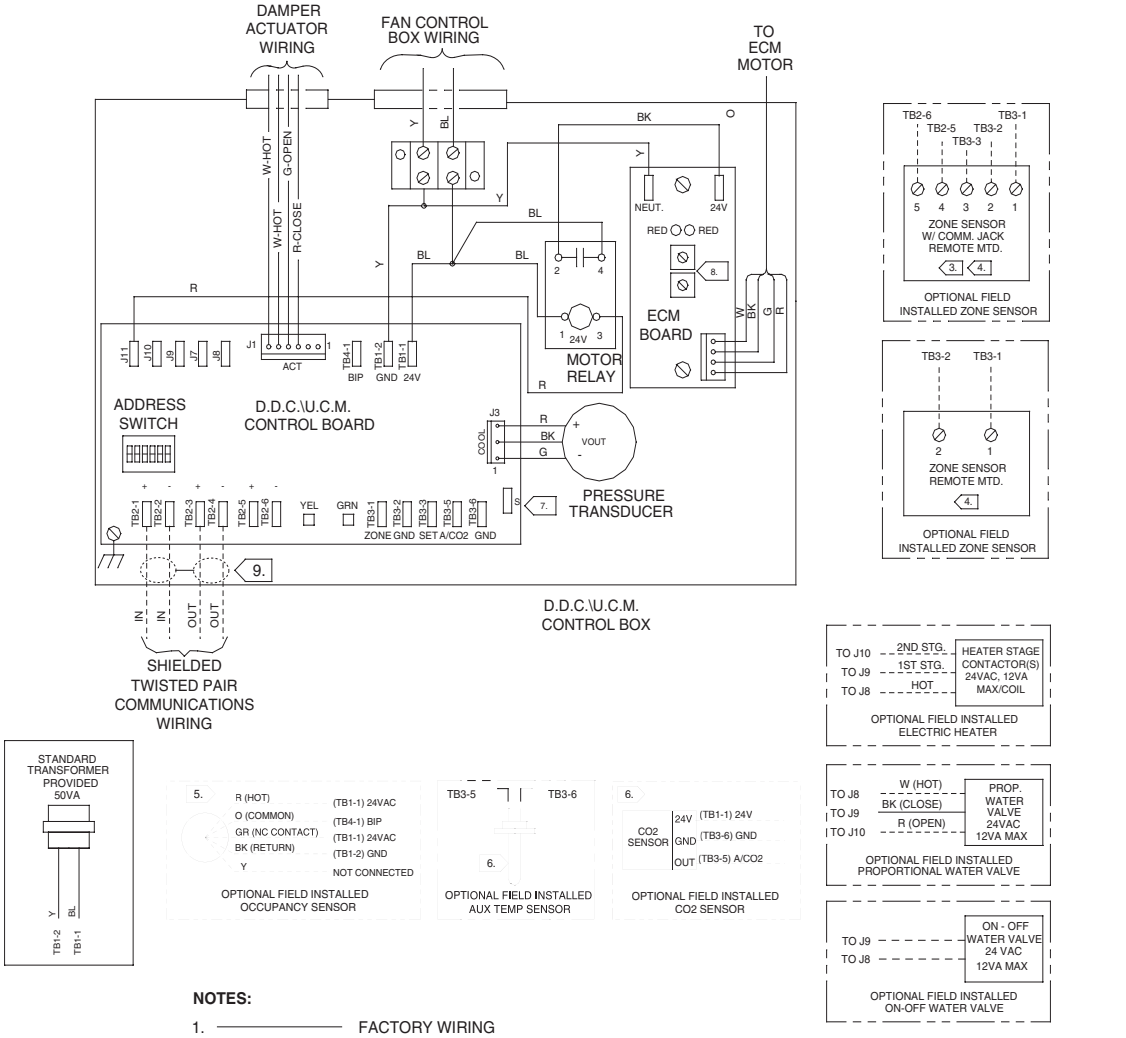
DD02 – Cooling with Normally-Closed On/Off Hot Water Vavle (Normally-Open Outputs)

DD03 – Cooling with Proportional Hot Water Valve

DD04 – Cooling with Staged On/Off Electric Heat

DD05 – Cooling with Pulse-Width Modulation Electric Heat

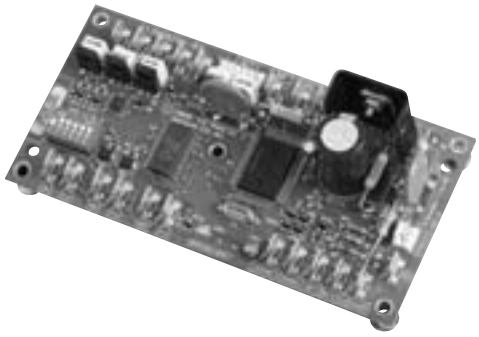
DD07 – Cooling with Normally-Closed On/Off Hot Water Valve (Normally-Closed Outputs)



NOTES:

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. Zone sensor with LCD requires a sixth wire with 24 V from a transformer.
4. No additional wiring required for night setback override (on/cancel).
5. The optional binary input connects between TB4-1 (BIP and 24 VAC (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 with VariTrane.
8. Fan cfm can be adjusted from its min. cfm to its max. cfm via the ECM control board dial switches. The switches set the percentage flow.
9. Connect shielding from each communication cable together and insulate.

Direct Digital Controller—Unit Control Module



The Trane direct digital controller Unit Control Module (DDC-UCM) is a microprocessor-based terminal unit with non-volatile memory which provides accurate airflow and room temperature control of Trane VAV air terminal units. The UCM can operate in a pressure-independent or a pressure-dependent mode and uses a proportional plus integral control algorithm. The controller monitors zone temperature setpoints, zone temperature and its rate of change and valve airflow (via flow ring differential pressure). The controller also accepts an auxiliary duct temperature sensor input or a suupply air temperature value from Tracer Summit. Staged electric heat, pulse width modulated electric heat, proportional hot water heat or on/off hot water heat control are provided when required. The control board operates using 24-VAC power. The Trane DDC-UCM is a member of the Trane Integrated Comfort™ systems (ICS) family of products. When used with a Trane Tracer Summit™ building management controller or other Trane controllers, zone grouping and unit diagnostic information can be obtained. Also part of ICS is the factory-commissioning of parameters specified by the engineer (see "Factory-Installed vs. Factory-Commissioned" in the Features and Benefits section for more details).

SPECIFICATIONS

Supply voltage:
24 VAC, 50/60 Hz

Maximum VA load:
No heat or fan:
12 VA (Board, Transducer, Zone Sensor, and Actuator)

Note: If using field-installed heat, 24 VAC transformer should be sized for additional load.

Output ratings:

Actuator Output:	24 VAC at 12 VA
1st Stage Reheat:	24 VAC at 12 VA
2nd Stage Reheat:	24 VAC at 12 VA
3rd Stage Reheat:	24 VAC at 12 VA

Binary input:
24 VAC

Auxiliary input:
Can be configured for an optional 2–10 VDC CO_2 sensor, or auxiliary temperature sensor.

Operating environment:
32 to 140°F, (0 to 60°C)
5% to 95% RH, Non-condensing

Storage environment:
-40 to 180°F (-40 to 82.2°C),
5% to 95%RH, Non-Condensing

Physical dimensions:

Width:	5.5" (139.7 mm)
Length:	2.8" (69.85 mm)
Height:	1.8" (44.45 mm)

Connections:
1/4" (6.35 mm) Stab Connections

Communications:
RS-485; Stranded wire, twisted pair, shielded, copper conductor only, 18–20 awg

Fan control:

Series fan:	On unless unoccupied and min. flow has been released.
Parallel fan:	On when zone temperature is less than heating setpoint plus fan offset. Off when zone temperature is more than heating setpoint plus fan offset plus 0.5°F (0.28°C).

Heat staging:
Staged electric or hot water proportional or pulse-width modulation

Wireless Receiver/Wireless Zone Sensor

The wireless zone sensor system eliminates the wiring problems associated with VAV temperature sensors. It provides the flexibility to move zone sensors after the occupants have revised the space floor plan layout. The zone sensor houses the space temperature sensor, local setpoint adjustment thumbwheel, OCCUPIED/UNOCCUPIED button, battery life, signal strength indicators, and spread spectrum transmitter. The spread spectrum receiver/translator can be field or factory installed and functions as a communication translator between spread spectrum radio communications and the VAV communications link. For further information, refer to the wireless zone sensor product catalog at http://www.trane.com/commercial/equipment/PDF/42/BASPRC023_032306.pdf.

SPECIFICATIONS

Power requirements:
Receiver:
24 V nominal AC/DC ± 10% < 1VA

Zone Sensor:
(2) AA lithium batteries

Sensor Operating environments:
32 to 122°F, (0 to 50°C)
5 to 95%RH, Non-condensing

Receiver Operating environments:
-40 to 158°F, (-40 to 70°C)
5 to 95%RH, Non-condensing

Storage environment—sensor/receiver:
-40 to 185°F, (-40 to 85°C)
5 to 95%RH, Non-condensing

Mounting:
Receiver:
Suitable for mounting above or below ceiling grid. Requires 24 V power. Factory installed receiver comes mounted to the VAV unit with power provided by associated unit controller transformer. Field installed option provided with associated wireharness for similar power and communication connection.

Sensor:
Mounts to a 2x4 handi-box or directly to the wall by attaching the backplate and then snapping the sensor body into place.

Dimensions:
Receiver/Translator

Enclosure:	Plastic
Height:	4.75" (120.6 mm)
Width:	2.90" (73.5 mm)
Depth:	1.08" (27.5 mm)

Sensor/Transmitter

Enclosure:	Plastic
Height:	4.78" (121.4 mm)
Width:	2.90" (73.5 mm)
Depth:	1.08" (27.5 mm)

DDC Zone Sensor

The DDC zone sensor is used in conjunction with the Trane direct digital controller to sense the space temperature and to allow for user adjustment of the zone setpoint. Models with external zone setpoint adjustments, plug-in communications jack and occupied mode override pushbuttons are available.

SPECIFICATIONS

Thermistor resistance rating:
10,000 Ohms at 77°F (25°C)

Setpoint resistance rating:
Setpoint potentiometer is calibrated to produce 500 Ohms at a setting of 70°F (21.11°C)

Electrical connections:
Terminal Block – Pressure Connections
Communications Jack – WE-616

Physical dimensions:

Width:	2.75" (69.85 mm)
Length:	4.5" (114.3 mm)
Height:	1.0" (25.4 mm)

CO_2 Wall Sensor

Duct CO_2 Sensor

DDC Zone Sensor with LCD

The wall- and duct-mounted carbon dioxide (CO_2) sensors are designed for use with Trane DDC/UCM control systems. Installation is made simple by attachment directly to the DDC/ UCM controller. This allows the existing communication link to be used to send CO_2 data to the higher-level Trane control system.

Wall-mounted sensors can monitor individual zones, and the duct-mounted sensor is ideal for monitoring return air of a given unit. Long-term stability and reliability are assured with advanced silicon based Non-Dispersive Infrared (NDIR) technology.

When connected to a building automation system with the appropriate ventilation equipment, the Trane CO_2 sensors measure and record carbon dioxide in parts-per-million (ppm) in occupied building spaces. These carbon dioxide measurements are typically used to identify under-ventilated building zones and to override outdoor airflow beyond design ventilation rates if the CO_2 exceeds acceptable levels.

SPECIFICATIONS

Measuring Range
0–2000 parts per million (ppm)

Accuracy at 77°F (25°C)
< ± (40 ppm CO_2 + 3% of reading)
(Wall only)

< ± (30 ppm CO_2 + 3% of reading)

Recommended calibration interval
5 years

Response time
1 minute (0–63%)

Operating Temperature
59 to 95°F (15 to 35°C) **(Wall only)**

23 to 113°F (-5 to 45°C)

Storage Temperature
-4 to 158°F (-20 to 70°C)

Humidity Range
0–85% relative humidity (RH)

Output Signal (jumper selectable)
4-20 mA, 0–20 mA,
0–10 VDC

Resolution of analog outputs
10 ppm CO_2

Power Supply
Nominal 24 VAC

Power Consumption
<5 VA

Housing Material
ABS plastic

Dimensions
4 1/4" x 3 1/8" x 1 7/16" **(Wall only)**
(108 mm x 80 mm x 36 mm) **(Wall only)**

3 1/8" x 3 1/8" x 7 ¾"
(80 mm x 80 mm x 200 mm)

The DDC zone sensor with LCD has the look and functionality of the standard Trane DDC zone sensor but has a LCD display. The sensor includes setpoint adjustment, the display of the ambient temperature, a communication jack, and occupied mode override pushbuttons. Also, it can be configured in the field for either a Fahrenheit or Celsius display, a continuous display of the setpoint and the offset of displayed temperatures.

SPECIFICATIONS

Thermistor resistance rating:
10,000 Ohms at 77°F (25°C)

Setpoint resistance rating:
Setpoint potentiometer is calibrated to produce 500 Ohms at a setting of 70°F (21.11°C)

Temperature range:
Displays 40 to 99°F (5 to 35°C)
With Setpoints 50 to 90°F (10 to 32°C)

Electrical connections:
Terminal Block – Pressure Connections
Communication Jack – WE – 616
4 VA maximum power input.

Physical dimensions:

Width:	2.8" (71.12 mm)
Length:	4.5" (114.3 mm)
Height:	1.1" (27.94 mm)

Zone Occupancy Sensor

The zone occupancy sensor is ideal for spaces with intermittent occupancy. It is connected to the Trane DDC UCM and allows the zone to shift to unoccupied setpoints for energy savings when movement is not detected in the space.

The zone occupancy sensor has a multi-cell, multi-tier lens with a maximum field of view of 360°. The maximum coverage area of the sensor is 1200 square feet with a maximum radius of 22 feet from the sensor when mounted at 8 feet above the floor.

Sensor ships with 30-minute time delay pre-set from the factory. Time delay and sensitivity can be field-adjusted.

SPECIFICATIONS

Power Supply
24 VAC or 24 VDC, ± 10%

Maximum VA Load
0.88 VA @ 24 VAC,
0.72 VA @ 24 VDC

Isolated Relay Rating
1 A @ 24 VAC or 24 VDC

Operating Temperature
32 to 131°F (0 to 55°C)

Storage Temperature
-22 to 176°F (-30 to 80°C)

Humidity Range
0 to 95% non-condensing

Effective Coverage Area
1200 sq ft

Effective Coverage Radius
22 feet

Housing Material
ABS Plastic

Dimensions
3.3" dia. x 2.2" deep (85 mm x 56 mm). Protrudes 0.36" (9 mm) from ceiling when installed.

Auxiliary Temperature Sensor

The auxiliary temperature sensor is used in conjunction with the Trane DDC controller to sense duct temperature. When the DDC controller is used with a Building Automation System, the sensor temperature is reported as status only. When the DDC controller is used in a stand-alone configuration, the sensor determines the control action of the UCM in a heat/cool changeover system.

SPECIFICATIONS

Sensing Element:
Thermistor 10,000 Ohms @ 77°F (25°C)

Operating environment:
-4 to 221°F (-20 to 105°C), 5%-95%RH Non-Condensing

Wiring Connection:
8 ft 18 awg

Sleeving for wire leads is acyrlic #5 awg grade C rated @ 155 C

Probe Dimensions:
3.4" long x 5/16" diameter
(86 mm x 7.9 mm diameter)

Mounting:
In any position on duct.

Mount the sensor to the duct using #10 x ¾" (19.05 mm) sheet metal screws.

Control Relay

The control relay is an output device used to provide on/off control of electrical loads. The SPST relay also will isolate the electrical load from the direct digital controller.

SPECIFICATIONS

Coil rating:
24 VAC, 50/60 Hz, pull in at 85%, 4 VA inrush, 3 VA sealed, Class B insulation

Contact rating:
120 VAC, 12 FLA , 60 LRA, 18A Resistive Pilot Duty – 125 VA/3A

277 VAC, 7 FLA, 42 LRA, 18A Resistive Pilot Duty – 277 VA/3A

347 VAC, 25 FLA, 50 LRA, 30A Resistive

Two-Position Water Valve

Two-position hot water valves are used with Trane DDC/UCM controls and analog electronic controls. Valve actuation is by a hysteresis synchronous motor.

All valves are field-installed and convertible from three-way to two-way by means of an included cap.

SPECIFICATIONS

Valve design

Body:	Brass
Cover:	Aluminum
Case:	Stainless Steel
Stem:	Brass, Hard Chrome Plate
"O" Ring Seals:	Viton
Operating Paddle:	Buna N

Valve body ratings:
UL 873 Listed File E27743

Plenum Rated CSA C22.2 No. 139 Certified, File LR85083, Class 3221 01

Temperature limits:
200°F (93.33°C) Fluid
104°F (40°C) Ambient

Maximum Operating Pressure:
300 psi (2069 kPa)

Electrical rating:
Motor Voltage – 24 VAC, 50/60 Hz

Power Consumption – 7.0 VA of 24 VAC

Valve offerings:
All valves are spring returned.
1.17 Cv – ½" (12.7 mm) O.D. NPT
3.0 Cv – ¾" (19.1 mm) O.D. NPT
6.4 Cv – 1" (25.4 mm) O.D. NPT

Cv offered (Close-off Pressure):

1.17	30 psi (207 kPa)
3.0	14.5 psi (100 kPa)
6.4	9 psi (62 kPa)

Proportional Water Valve

The proportional water valve is used to provide accurate control of a hot water heating coil to help maintain a zone temperature setpoint. The valve plug is an equal percentage design and comes available in four different flow capacities for proper controllability. The valves are field-adjustable for use as a two- or three-way configuration. The valves ship in a two-way configuration with a cap over the bottom port. Conversion to three-way operation is accomplished by removing the plug from the "B" port. The valve actuator contains a three-wire synchronous motor. The direct digital controller uses a time-based signal to drive the motor to its proper position. When power is removed from the valve, it remains in its last controlled position.

SPECIFICATIONS

Valve design:
Equal percentage plug designed for water or water with up to 50% glycol or ethylene

Valve body ratings:
ANSI B16.15, Class 250 pressure/temperature

ANSI B16.104, Class IV control valve shut off leakage standard

ISA S75.11 flow characteristic standard

Temperature limits:
34–203°F (1–95°C) Fluid
32–150°F (0–66°C) Ambient

Maximum operating pressure:
345 psi at 281°F (2379 kPa at 138°C)

Maximum actuator close-off pressure:
55 psi (379 kPa)

Electrical rating:
Motor Voltage – 24 VAC, 50/60 Hz

Power Consumption – 6.0 VA at 24 VAC

Valve offerings:
All valves are proportional Tri-state Control with ½" (12.7 mm) O.D. NPT connections with the exception of 7.3 Cv, which is ¾" (19.1 mm).

Cv offered:
- 0.7
- 2.2
- 3.8
- 6.6

Differential Pressure Transducer

The differential pressure transducer is used in conjunction with the Trane direct digital controller and analog electronic controller. The pressure transducer measures the difference between the high-pressure and low-pressure ports of the Trane flow ring. The transducer is self-adjusting to changes in environmental temperature and humidity.

SPECIFICATIONS

Input pressure range:
0.0 to 5.0 in. wg
(Maximum input pressure 5 psig)

Operating environment:
32 to 140° F, (0 to 60°C)
5% to 95% RH, Non-Condensing

Storage environment:
-40 to 180° F, (-40 to 82.2°C)
5% to 95%RH, Non-condensing

Electrical connections:
V_{in} = 5.0 VDC nominal
(4.75 to 5.25 VDC acceptable)
Current Draw = 5 mA maximum
Null Voltage = 0.250 VDC ± 0.06 VDC
Span = 3.75 VDC ± 0.08 VDC
Note:
Null and Span are ratiometric with V_{in}

Physical dimensions:

Width:	2.5" (63.5 mm)
Length:	3.0" (76.2 mm)
Height:	1.5" (38.1 mm)

Pressure connections:
$^1/_8$" (3.175 mm) barbed tubing connections

Transformers

The transformer converts primary power supply voltages to the voltage required by the direct digital controller and analog. The transformer also serves to isolate the controller from other controllers which may be connected to the same power source.

SPECIFICATIONS

Primary voltage:
120 VAC
208 VAC
240 VAC
277 VAC
347 VAC
480 VAC
575 VAC

Secondary voltage:
24 VAC

Power rating:
50 VA

Physical dimensions:
For all voltages:
The transformers will be no larger than the following dimensions:

Width:	2.63" (66.7 mm)
Length:	2.50" (63.5 mm)
Height:	2.30" (58.4 mm)

Trane Actuator – 90 Second Drive Time

This actuator is used with DDC controls and retrofit kits. It is available with a 3-wire floating-point control device. It is a direct-coupled over the shaft (minimum shaft length of 2.1"), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper when the actuator is not powered. The actuator is Underwriters Laboratories Standard 873 and Canadian Standards Association Class 3221 02 certified as meeting correct safety requirements and recognized industry standards.

SPECIFICATIONS

Actuator design:
3-wire, 24-AC floating-point control. Non-spring return.

Actuator housing:
Housing type-NEMA 1

Rotation range:
90° clockwise or counterclockwise

Electrical rating:
Power Supply –24 VAC (20 to 30 VAC) at 50/60 Hz

Power Consumption – 1.8 VA maximum, Class 2

Electrical connection:
No. 6-32 screw terminals (For DD00 and FM01 control options and retrofit kits).

6-pin female connector harness for Trane UCM (for Trane DDC controls except retrofit kits)

Manual override:
External clutch release lever

Shaft requirement:
½" round

2.1" length

Humidity:
5% to 95% RH, Non-Condensing

Temperature rating:
Ambient operating: 32 to 125°F (0 to 52°C)

Shipping and storage: -20 to 130°F (-29 to 66°C)

Torque:
Running: 35 in.-lb (4 N-m)

Breakaway: 35 in.-lb (4 N-m) minimum

Stall: 60 in.-lb (4.5 N-m) minimum

Trane Spring Return Actuator

This actuator is used with DDC controls and is a floating-point control device. It is direct-coupled over the shaft (minimum shaft length of 2.1"), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator is Underwriters Laboratories Standard 60730 and Canadian Standards Association C22.2 No. 24-93 certified as meeting correct safety requirements and recognized industry standards.

SPECIFICATIONS

Actuator design:
24-VAC, floating-point control. Spring return

Actuator housing:
Housing Type-NEMA IP54

Rotation range:
Adjustable from 0° to 90° at 5° intervals, clockwise or counterclockwise

Electrical rating:
Power Supply – 24 VAC (19.2 to 28.8 VAC) at 50/60 Hz

Power Consumption – 4VA holding, 5VA running maximum, Class 2

Electrical connection:
6-pin female connector for Trane UCM (for Trane DDC controls)

Manual override:
Manual override key provided

Shaft requirement:
¼" to ¾" round

2.1" length

Humidity:
95% RH, Non-Condensing

Temperature rating:
Ambient operating: 32 to 130°F (0 to 54°C)

Shipping and storage: -40 to 158°F (-40 to 70°C)

Torque:
62 in.-lbs (7N-m)

VariTrane DDC Retrofit Kit

The retrofit kit provides the system advantages of VariTrane DDC controls to building owners for existing systems. The kit can be applied when converting from pneumatic or analog controlled systems to a DDC controlled system. The kit may be used on existing single-duct units with hot water and electric reheat (three stages), dual-duct units, and all fan-powered units (both series and parallel) with hot water and electric reheat (two stages).

A VariTrane DDC-UCM, an electronic differential pressure transducer, and a six-pin connector with wiring for an actuator, make up the assembly of the retrofit kit. All are housed inside a metal enclosure. For maximum flexibility, the kit is available with one of two actuators or without an actuator. If a kit is ordered without an actuator, ensure the actuator used has 24VAC three-wire floating control. Other accessories are available with the retrofit kit which include zone sensors, flow bars (used with units without a flow sensor), power transformers, control relays, and E/P solenoid valves.

Retrofit Kit Actuator

This actuator is available with the DDC Retrofit Kit and is a 3-terminal, floating-point control device. It is direct-coupled over the damper shaft so there is no need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper when the actuator is not powered. A three-foot plenum-rated cable with bare ends will be sent separately. The actuator is listed under Underwriters Laboratories Standard 873, CSA 22.2 No. 24 certified, and CE manufactured per Quality Standard SO9001.

SPECIFICATIONS

Actuator design:
on-off/floating-point

Actuator housing:
Housing Type-NEMA type 1

Housing Material Rating- UL 94-5V

Direction of rotation:
Reverse wires terminals 2 and 3

Angle of rotation:
Max 95°, adjustable with mechanical stops

Electrical rating:
Power Supply – 24 VAC ± 20% 50/60 Hz
24 VDC ± 10%

Power Consumption – 2 W

Transformer Sizing – 3 VA (Class 2 power source)

Manual override:
External push button

Humidity:
5% to 95% RH, Non-Condensing

Ambient temperature:
-22 to 122°F (-30C to 50°C)

Storage environment:
-40 to 176°F (-40 to 80°C)

Torque:
Min 35 in.-lb (4Nm), Independent of load

Running time:
95 sec. for 0 to 35 in-lb

Noise rating:
Less than 35 dB (A)

Weight:
1.2 lbs (0.55 kg)