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RDY2000BN BACnet Thermostat Conventional Application 14900 Application Note

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Overview

In Application 14900, the controller controls multiple compressors for cooling, and a multiple-stage heater for heating. This unit may be equipped with electric heat or a fossil fuel furnace. Typically, this US Room Temperature Unit (RTU) application fits most five-wire thermostats on the market.

Secondary features include: Demand Ventilation Control, Occupancy indication, Economizer Enabling, and Humidification/Dehumidification Enabling a call for external equipment to energize.

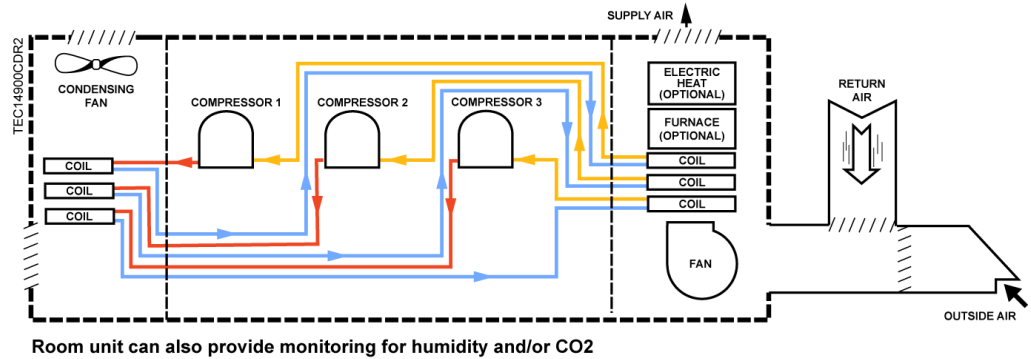


Figure 1: Hardware Diagram.

BACnet

The thermostat communicates on industry-standard BACnet MS/TP networks.



NOTE:

Bold, mixed case names = Exposed BACnet objects

All caps names = Internal variables that cannot be accessed through BACnet

Table 1: BIBB

Product	Supported BIBBs	BIBB Name
RDY2000BN	DS-RP-B	Data Sharing - Read Property-B
	DS-RPM-B	Data Sharing - Read Property Multiple-B
	DS-WP-B	Data Sharing - Write Property-B
	DS-WPM-B	Data Sharing - Write Property Multiple - B
	DS-COV-B	Data Sharing - Change of Value - B
	SCHED-WS-I-B	Scheduling - Weekly Schedule Internal - B
	DM-DDB-B	Device Management - Dynamic Device Binding-B
	DM-DOB-B	Device Management - Dynamic Object Binding-B
	DM-DCC-B	Device Management - Device Communication Control-B
	DM-PT-B	Device Management - Private Transfer - B

Product	Supported BIBBs	BIBB Name
	DM-TS-B	Device Management – Time Synchronization - B
	DM-RD-B	Device Management - Reinitialize Device-B
	DM-R-B	Device Management – Restart - B

Hardware Inputs

- Configurable input IN1
- Configurable input IN2
- Configurable input IN3
- Configurable input IN4
- Onboard space temperature
- Onboard space humidity

Configurable inputs can be configured to the following types:

- 1 = Indoor Temperature (Remote)
- 2 = Indoor Temperature (Average)
- 3 = Supply Temperature
- 4 = Return Temperature
- 5 = Outdoor Temperature
- 6 = Humidity (0-10V)
- 7 = CO2 (0-10V)
- 8 = Occupancy (DI)
- 9 = Fault
- 10 = Not Used

Hardware Outputs

- G Fan
- Y1 Compressor
- Y2 Compressor
- W1 Aux Heat 1
- W2 Aux Heat 2
- O/B may function as the third stage Cool or Heat. See *I/O Mix (Relay Assignment Matrix)* for more details.
- Configurable relay output OUT1
- OUT1 can function as third stage Cool when both third stage Cool and third stage Heat are available. See *I/O Mix (Relay Assignment Matrix)* for more details.
- Configurable relay output OUT2
- Configurable relay output OUT3

Configurable outputs can be configured to the following types:

- 1 = Humidification
- 2 = Dehumidification
- 3 = Occupied
- 4 = Air Quality
- 5 = Economizer Enable
- 6 = Not Used

I/O Mix (Relay Assignment Matrix)

In a conventional RTU application, the maximum number of compressors is three, with up to three stages of heat. The number of stages can be configured using the BACnet points **HtgStg** and **CoolStg**.

Heating Stages	Cooling Stages	Y1	Y2	W1	W2	O/B	OUT1 (AuxOut1)
0	1	Stage 1 Cooling	N/A	N/A	N/A	N/A	N/A
0	2	Stage 1 Cooling	Stage 2 Cooling	N/A	N/A	N/A	N/A
0	3	Stage 1 Cooling	Stage 2 Cooling	N/A	N/A	Stage 3 Cooling	N/A
1	0	N/A	N/A	Stage 1 Heating	N/A	N/A	N/A
1	1	Stage 1 Cooling	N/A	Stage 1 Heating	N/A	N/A	N/A
1	2	Stage 1 Cooling	Stage 2 Cooling	Stage 1 Heating	N/A	N/A	N/A
1	3	Stage 1 Cooling	Stage 2 Cooling	Stage 1 Heating	N/A	Stage 3 Cooling	N/A
2	0	N/A	N/A	Stage 1 Heating	Stage 2 Heating	N/A	N/A
2	1	Stage 1 Cooling	N/A	Stage 1 Heating	Stage 2 Heating	N/A	N/A
2	2	Stage 1 Cooling	Stage 2 Cooling	Stage 1 Heating	Stage 2 Heating	N/A	N/A
2	3	Stage 1 Cooling	Stage 2 Cooling	Stage 1 Heating	Stage 2 Heating	Stage 3 Cooling	N/A
3	0	N/A	N/A	Stage 1 Heating	Stage 2 Heating	Stage 3 Heating	N/A
3	1	Stage 1 Cooling	N/A	Stage 1 Heating	Stage 2 Heating	Stage 3 Heating	N/A
3	2	Stage 1 Cooling	Stage 2 Cooling	Stage 1 Heating	Stage 2 Heating	Stage 3 Heating	N/A

Heating Stages	Cooling Stages	Y1	Y2	W1	W2	O/B	OUT1 (AuxOut1)
3	3	Stage 1 Cooling	Stage 2 Cooling	Stage 1 Heating	Stage 2 Heating	Stage 3 Heating	Stage 3 Cooling

Connection Diagram

Table 2: Standard Conventional Connection Diagram

C	HVAC Control Circuit Common
RC	24 Vac from Transformer on Cooling System
RH	24 Vac from Transformer on Heating System
G	Fan
Y1	First Stage Cooling
Y2	Second Stage Cooling
O/B	Third Stage Heating (only when Third Stage Heating is enabled), or Third Stage Cooling. (only when Third Stage Cooling is enabled and Third Stage Heating is not enabled)
W1	First Stage Heating
W2	Second Stage Heating
OUT1	Third Stage Cooling (only when both Third Stage Cooling and Heating are enabled)
OUT2	Configurable Output
OUT3	Configurable Output
INC	Configurable Input Common
IN1	Configurable Input 1
IN2	Configurable Input 2
IN3	Configurable Input 3
IN4	Configurable Input 4

Ordering Notes

Part Number: RDY2000BN Siemens RDY2000 BACnet Thermostat

Sequence of Operation

The following paragraphs show the sequence of operation for Application 14900.

Control Temperature Setpoints

This application has a number of different room temperature setpoints (**ComfortHtgSP**, **EconHtgSP**, **ComfortClgSP**, and **EconClgSP**). The setpoint can be temporarily overridden for a period of time (default is 30 minutes). The application controls using the effective setpoint (EFF STPT). EFF STPT is set to different values depending on its HVAC Mode (Cooling, Heating, or Neutral), override status, and the time of day.

CoolingSp : Cooling Setpoint

CoolingDB: Cooling Deadband

CoolingDB is divided equally above and below **CoolingSp**; therefore, (**CoolingSp** + 1/2 **CoolingDB**) is the switching on point of the first cooling stage, and (**CoolingSp** - 1/2 **CoolingDB**) is the switching off point of the first cooling stage.

HeatingSp: Heating Setpoint

HeatingDB: Heating Deadband

HeatingDB is divided equally above and below **HeatingSp**; therefore, (**HeatingSp** - 1/2 **HeatingDB**) is the switching on point of the first heating stage, and (**HeatingSp** + 1/2 **HeatingDB**) is the switching off point of the first heating stage.

StgDifCl: Cooling Inter-stage Differential

(**CoolingSp** + 1/2 **CoolingDB** + **StgDifCl**) is the switching on point of the second cooling stage, and (**CoolingSp** - 1/2 **CoolingDB** + **StgDifCl**) is the switching off point of the second cooling stage.

StgDifHt: Heating Inter-stage Differential

(**HeatingSp** - 1/2 **HeatingDB** - **StgDifHt**) is the switching on point of the second heating stage, and (**HeatingSp** + 1/2 **HeatingDB** - **StgDifHt**) is the switching off point of the second heating stage.

CLG SPAN: Cooling SPAN combined ΔT of all stages of cooling,

CLG SPAN is derived from other parameters. For single-stage cooling: CLG SPAN = **CoolingDB**; For multi-stage cooling: CLG SPAN = **CoolingDB** + **StgDifCl*** n (where n represents the number of stages of additional cooling.)

HTG SPAN: Heating SPAN combined ΔT of all stages of heating, HTG SPAN is

derived from other parameters. For single-stage heating: HTG SPAN = **HeatingDB**; For multi-stage heating: HTG SPAN = **HeatingDB** + **StgDifHt*** n (where n represents the number of stages of additional heating.)

CLG SPAN or HTG SPAN indicates how the bias between room temperature and room setpoint could possibly be due to the characteristic of hysteresis control.



NOTE:

Effective Setpoint does not exist as a BACnet object. The controller determines what the Effective setpoint is by evaluating the value of **ModeEff**.

If **ModeEff** is Heating, EffectiveSetpoint is the value of **HeatingSp**.

If **ModeEff** is Cooling, EffectiveSetpoint is the value of **CoolingSp**.

The actual value used by **HeatingSp** or **CoolingSp** at any given time is determined by a number of factors. When operating without any external inputs, the thermostat's schedule will determine the effective operating mode, **RM OP MODE**.

If **RM OP MODE** is set to **Comfort**, then **HeatingSp** controls **ComfortHtgSP** and the **CoolingSp** controls **ComfortClgSP**. If **RM OP MODE** is set to **Economy**, then **HeatingSp** controls **EconHtgSP** and the **CoolingSp** controls **EconClgSP**. If **RM OP MODE** is set to **Protection**, then **HeatingSp** controls **ProtHtgSP** and the **CoolingSp** controls **ProtClgSP**.



NOTE:

You can override the effective setpoint through the local touchscreen interface or remotely through the BACnet network by commanding Multistate Value 24, **SchedMode**. The local override is only effective for the period determined by **HrsOvrRide** (default value is 2 hours).

Effective Room Temperature

IndoorTmpEff:

When an external temperature sensor is not installed, **IndoorTmpEff** is the onboard temperature measuring value.

When an external temperature sensor is installed, **IndoorTmpEff** can be configured to either use an external measuring value or the average of external and onboard measuring values.

The external temperature sensor can also be a network sensor. In this case, the external temperature sensor does not have to be physically installed.

The RDY2000BN supports controlling to sensor input over the network. For example, you can take one of the universal inputs, characterize it as a voltage input, remove it from service, and expose it to the network as writeable. Then, you can assign the value of another sensor over the network to this input.

If **IndoorTmpEff** does not read correctly, you can raise or lower it by changing the value of **TmpOffset** to the appropriate positive or negative value to make **IndoorTmpEff** read the correct value.

If the external temperature sensor fails, the unit can be manually switched to only use an onboard sensor.

If the onboard sensor fails, the unit stops running.

Heating/Cooling Switchover

Auto Switchover enables the controller to automatically switch HVAC modes.

If **IndoorTempEff** > **CoolingSp** and Heating has turned off and has been off for the length of time set in **ChgOvrDly**, the controller switches to Cooling mode.

If **IndoorTempEff** < **HeatingSp** and Cooling has turned off and has been off for the length of time set in **ChgOvrDly**, the controller switches to Heating mode.

ChgOvrDB: Change Over Deadband restricts how close **CoolingSp** and **HeatingSp** can be set. A minimum deadband (default is 5°F) must to be maintained. To separate the **CoolingSp** and **HeatingSp**, one setpoint change may change the other setpoint to maintain a gap between them.

Staging Control

The RTU is controlled by a hysteresis loop (Step Control). Hysteresis prevents the compressor/heater from frequently switching on and off. When the room temperature reaches the corresponding switching on setpoint of a certain cooling/heating stage, that stage will be turned on. When the room temperature reaches the corresponding switching off setpoint of a certain cooling/heating stage, that stage is turned off.

For example, in Heating mode the thermostat switches the heater on when the temperature drops below A, but does not turn it off until the temperature rises above B, where B is greater than A.

If there is a call to turn on/off multiple stages, an Inter-stage delay will apply between the two stages being turned ON/OFF. For more information, see the *Compressor Operation* section.

Compressor Operation

When the HVAC Mode is in Cooling mode, the cooling staging logic controls the compressor.

If a compressor has been ON, it will not shut OFF until its minimum ON timer has expired. Likewise, if a compressor has been OFF, it will not turn ON until its minimum OFF timer has expired.

In addition to the above rules, there is a time-based separation of cooling stages -- Cooling Inter-stage Delay applies to the unit with multiple cooling stages. There is also a time-based separation of heating stages -- Heating Inter-stage Delay which applies to the unit with multiple heating stages.

The following paragraphs explain compressor staging:

If **CoolStg** = 0, the application does not control COMPRESSOR 1 (Y1).

If **CoolStg** ≥ 1, the application controls COMPRESSOR 1 (Y1) as follows:

- If **IndoorTmpEff** is greater than the switching on point of the first cooling stage (**CoolingSp** + 1/2 **CoolingDB**), and the first compressor has been OFF for at least the time set in MIN OFF, COMPRESSOR 1 (Y1) is turned ON.
- If **IndoorTmpEff** is less than the switching off point of the first cooling stage (**CoolingSp** – 1/2 **CoolingDB**), and the first compressor has been ON for at least the time set in MIN ON, COMPRESSOR 1 (Y1) is turned OFF.

If **CoolStg** ≤ 1, the application does not control COMPRESSOR 2 (Y2).

If **CoolStg** = 2, the application controls COMPRESSOR 2 (Y2) as follows:

- If **IndoorTmpEff** is greater than the switching on point of the second cooling stage (**CoolingSp** + 1/2 **CoolingDB** + **StgDifCl**), the second compressor has been OFF for at least the time set in MIN OFF, and the Inter-stage Delay timer has expired, COMPRESSOR 2 (Y2) is turned ON.
- If **IndoorTmpEff** is less than the switching off point of the second cooling stage (**CoolingSp** – 1/2 **CoolingDB** + **StgDifCl**), and the second compressor has been ON for at least the time set in MIN ON, COMPRESSOR 2 (Y2) is turned OFF.

- An Inter-stage Delay timer must be enforced between the second cooling stage OFF and the first cooling stage OFF to ensure that the first compressor will not be turned off until the second compressor has been turned off for the time set in the Inter-stage Delay.

If **CoolStg** = 3, the application controls COMPRESSOR 3 (**O/B** or **AuxOut1**) as follows:

- If **IndoorTmpEff** is greater than the switching on point of the third cooling stage (**CoolingSp** + 1/2 **CoolingDB** + **StgDifCl*2**), the third compressor has been OFF for at least the time set in MIN OFF, and the Inter-stage delay timer has expired, COMPRESSOR 3 (**O/B** or **AuxOut1**) is turned ON.
- If **IndoorTmpEff** is less than the switching off point of the third cooling stage (**CoolingSp** – 1/2 **CoolingDB** + **StgDifCl*2**), and the third compressor has been ON for at least the time set in MIN ON, COMPRESSOR 3 (**O/B** or **AuxOut1**) is turned OFF.
- An Inter-stage Delay timer must be enforced between the third cooling stage OFF and the second cooling stage OFF to ensure that the second compressor will not be turned off until the third compressor has been turned off for the time set in the Inter-stage Delay.

Electric Heat (Optional)

When the HVAC Mode is in heating mode, and the heating staging logic controls the electric heater, Parameter P105 (HTG FAN) in the Installer Setup Menu, Fan Operation, **FanOpr** must be set to **ELE**.

If a heating stage has been ON, it will not shut OFF until its minimum ON timer has expired. Likewise, if a heating stage has been OFF, it will not turn ON until its minimum OFF timer has expired.

In addition to above rules, a time-based separation of heating stages -- Heating Inter-stage Delay applies to the unit with multiple heating stages.

The following paragraphs explain the electric heater staging.

If **HeatStg** = 0, the application does not control HTG STG 1 (**W1**).

If **HeatStg** ≥ 1, the application controls HTG STG 1 (**W1**) as follows:

- If **IndoorTmpEff** is less than the switching on point of the first heating stage (**HeatingSp** – 1/2 **HeatingDB**), and the first heating stage has been OFF for at least the time set in MIN OFF, HTG STG 1 is turned ON.
- If **IndoorTmpEff** is greater than the switching off point of the first heating stage (**HeatingSp** + 1/2 **HeatingDB**), and the first heating stage has been ON for at least the time set in MIN ON, HTG STG 1 (**W1**) is turned OFF.

If **HeatStg** ≤ 1, the application does not control HTG STG 2 (**W2**).

If **HeatStg** ≥ 2, the application controls HTG STG 2 (**W2**) as follows:

- If **IndoorTmpEff** is less than the switching on point of the second heating stage (**HeatingSp** – 1/2 **HeatingDB** – **StgDifHt**), the second heating stage has been OFF for at least the time set in MIN OFF, and Inter-stage Delay timer has expired, HTG STG 2 (**W2**) is turned ON.
- If **IndoorTmpEff** is greater than the switching off point of the second heating stage (**HeatingSp** + 1/2 **HeatingDB** – **StgDifHt**), and the second heating stage has been ON for at least the time set in MIN ON, HTG STG 2 (**W2**) is turned OFF.

- An Inter-stage Delay (**StgDlyHt**) timer must be enforced between the third heating stage OFF and the second heating stage OFF to ensure that the second heating stage won't be turned off until the third heating stage has been turned off for the time set in Inter-stage Delay timer.

If **HeatStg** = 3, the application controls HTG STG 3 (**O/B**) as follows:

- If **IndoorTmpEff** is less than the switching on point of the third heating stage (**HeatingSp** – 1/2 **HeatingDB** - **StgDifHt*2**), the third heating stage has been OFF for at least the time set in MIN OFF, and Inter-stage Delay timer has expired, HTG STG 3 (**O/B**) is turned ON.
- If **IndoorTmpEff** is greater than the switching off point of the third heating stage (**HeatingSp** + 1/2 **HeatingDB** – **StgDifHt*2**), and the third heating stage has been ON for at least the time set in MIN ON, HTG STG 3 is turned OFF.

Gas Furnace (Optional)

When the HVAC Mode is in heating mode, and the heating staging logic controls a furnace, Parameter P105 (HTG FAN) **FanOpr** in the Installer Setup Menu must be set to **gAS**.

If a heating stage has been ON, it will not shut OFF until its minimum ON timer has expired. Likewise, if a heating stage has been OFF, it will not turn ON until its minimum OFF timer has expired.

In addition to above rules, a time-based separation of heating stages--Heating Inter-stage Delay--applies to the unit with multiple heating stages.

The following paragraphs explain the electric heater staging.

If **HeatStg** = 0, the application does not control HTG STG 1.

If **HeatStg** ≥ 1, the application controls HTG STG 1 as follows:

- If **IndoorTempEff** is less than the switching on point of the first heating stage (**HeatingSp** – 1/2 HTG DB), and the first heating stage has been OFF for at least the time set in MIN OFF, HTG STG 1 (**W1**) is turned ON.
- If **IndoorTempEff** is greater than the switching off point of the first heating stage (**HeatingSp** + 1/2 **HeatingDB**), and the first heating stage has been ON for at least the time set in MIN ON, HTG STG 1 (**W1**) is turned OFF.

If **HeatStg** ≤ 1, the application does not control HTG STG 2 (**W2**).

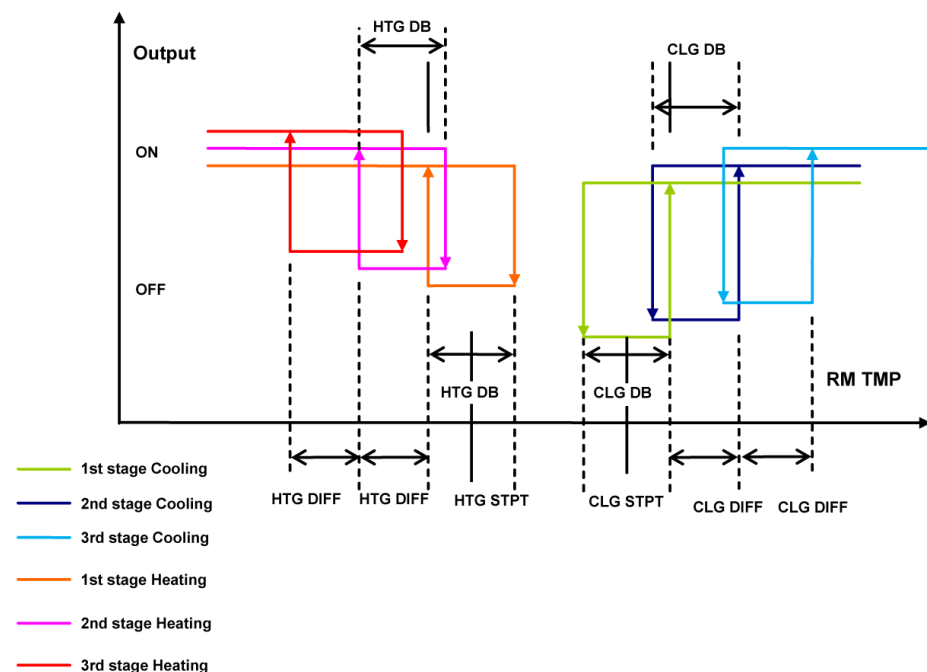
If **HeatStg** ≥ 2, the application controls HTG STG 2 (**W2**) as follows:

- If **IndoorTempEff** is less than the switching on point of the second heating stage (**HeatingSp** – 1/2 **HeatingDB** - **StgDifHt**), the second heating stage has been OFF for at least the time set in MIN OFF, and the Inter-stage Delay timer has expired, HTG STG 2 (**W2**) is turned ON.
- If **IndoorTempEff** is greater than the switching off point of the second heating stage (**HeatingSp** + 1/2 **HeatingDB** – **StgDifHt**), and the second heating stage has been ON for at least the time set in MIN ON, HTG STG 2 (**W2**) is turned OFF.
- An Inter-stage Delay (**StgDlyHt**) timer must be enforced between the third heating stage OFF and the second heating stage OFF to ensure that the second heating stage won't be turned off until the third heating stage has been turned off for the time set in the Inter-stage Delay (**StgDlyHt**).

If HTG STG NUMBER = 3, the application controls HTG STG 3 (O/B) as follows:

- If **IndoorTempEff** is less than the switching on point of the third heating stage ($\text{HeatingSp} - 1/2 \text{ HeatingDB} - \text{StgDifHt} * 2$), the third heating stage has been OFF for at least the time set in MIN OFF, and the Inter-stage Delay (**StgDlyHt**) timer has expired, HTG STG 3 (O/B) is turned ON.
- If **IndoorTempEff** is greater than the switching off point of the third heating stage ($\text{HeatingSp} + 1/2 \text{ HeatingDB} - \text{StgDifHt} * 2$), and the third heating stage has been ON for at least the time set in MIN ON, HTG STG 3 (O/B) is turned OFF.

Operation Diagram – RTU with Three Cooling Stages and Three Heating Stages.



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Figure 2: RTU with Three Cooling Stages and Three Heating Stages.

Fan Operation

AUTO Mode – The fan relay is energized upon a call for heating or cooling per the operating sequence. When there is no demand for heating or cooling (none of heating/cooling stages are activated) the fan relay is de-energized.

The fan will turn ON when one of the following conditions has been met:

- In Heating mode, when the compressor or stage of electric heat is ON.
- In Cooling mode, 15 seconds before the first stage of cooling is energized.

The fan will turn OFF only after the following condition has been met:

- The compressor and stages of electric heat have been OFF for at least 30 seconds.

ON Mode – The fan relay is energized regardless of whether or not there is a call for heating or cooling, unless the unit is set to Unit Off.

Fan Opr - The fan relay can be set to be energized or not energized upon call for heat using Parameter P105 (HTG FAN). If P105 is set to **ELE**, the fan relay responds to the call for heat to energize. If P105 is set to **gAS**, the fan relay will not be energized upon a call for heat; instead the blower motor is energized by the furnace control board. The furnace control board provides fan delay on/off, protection, and provides other control functions as it directly interacts with the ignition/blower sequence.

Wiring Diagram



⚠ CAUTION

The thermostat's digital outputs only control 24 Vac loads. The maximum rating is 1A (24 VA) for each DO. Total maximum rating for the thermostat, including all energized DOs is 4A (96 VA). Auxiliary Output 3 (OUT3) may be configured as a Dry Contact by removing jumper RC-C3 and connecting the controlled device to both terminals OUT3 and C3.

An external interposing relay is required for any of the following:

- VA requirements higher than the maximum
- 110 or 220 Vac requirements
- DC power requirements



Configurable Inputs are Off (default). See *RDY2000BN BACnet Enabled Commercial Room Thermostat Installation Instructions* (125-1009), 300 Series Parameters to enable inputs. Temperature sensors that may be configured as Thermistor inputs are: 10K Type 2 (default) or 0 to 10V inputs. Humidity and CO2 sensors may be configured as 0 to 10V inputs. Occupancy and Fault sensors may be configured as digital inputs.

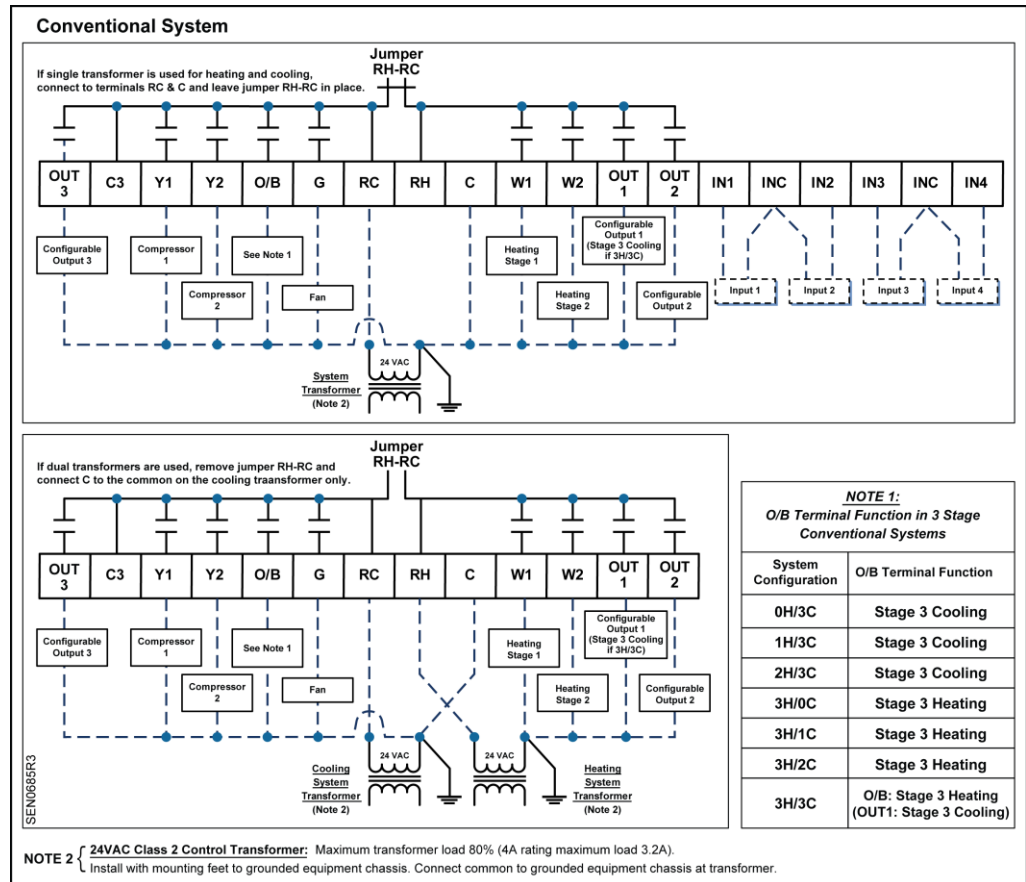


Figure 3: Wiring Schematic, Conventional.

Auxiliary Sequences

The RDY2000BN primary sequences are designed to control single and multi-stage heating/cooling systems to maintain a user-defined temperature setpoint.

The following auxiliary sequences are available to optimize occupant comfort and system efficiency:

Humidification

If one of the configurable digital outputs is configured for a humidification function, the corresponding relay will close and enable a 24 Vac output signal to be transmitted to the humidification device. Humidification and dehumidification relays, if configured as such, cannot be energized simultaneously.

- The humidification relay (monitored through **HmdyOn**) will be energized when measured humidity drops approximately 4% below setpoint (**HmdySp**) and will be de-energized when measured humidity reaches setpoint. Deadbands and proof timers are in force to prevent short cycling. The thermostat controls humidification only in Heating mode.
- You must enter a humidity setpoint (**HmdySp**). The valid range is 10 to 90%; the default value is 25%. If the humidity drops to 4% below setpoint, a 30-second proof timer engages. If the humidity is still 4% below the setpoint after the proof timer times out, the humidification relay energizes.

- If humidity rises above (setpoint – 4%) before the proof timer times out, the humidification relay does not engage and the proof timer is reset. If the humidity rises to setpoint, a 30-second proof timer engages. If the humidity is still above the setpoint after the proof timer times out, the humidification relay de-energizes.
- If Parameter P320 (IND HMDTY) is set to **NO** (default) then the humidification relay will not be enabled unless the heating relay is energized. If Parameter P320 is set to **YES**, then the humidification relay can be energized at any time, regardless of the heating status. The fan relay is not energized by the humidification sequence.

Dehumidification

If one of the configurable digital outputs is configured for a humidification function, the corresponding relay closes and enables a 24 Vac output signal to be transmitted to the dehumidification device. Humidification and dehumidification relays cannot be energized simultaneously.

- The dehumidification relay will energize when measured humidity rises approximately 4% above setpoint, and will de-energize when measured humidity reaches setpoint. Deadbands and proof timers are enforced to prevent short cycling. The thermostat defaults to control dehumidification in Cooling mode only.
- You must enter a humidity setpoint (**HmdySp**). The valid range is 10 to 90%; the default value is 50%. If the humidity rises to 4% above setpoint, a 30-second proof timer engages. If the humidity is still 4% above setpoint after the proof timer times out, the dehumidification relay energizes.
- If the humidity drops below (setpoint + 4%) before the proof timer times out, the dehumidification relay does not engage, and the proof timer is reset. If the humidity drops to setpoint, a 30-second proof timer engages. If the humidity is still below setpoint after the proof timer times out, the dehumidification relay de-energizes.
- If Parameter P320 (IND HMDTY) is set to **NO** (default), the dehumidification relay will not be enabled unless the cooling relay is energized. If Parameter P320 is set to **YES**, then the dehumidification relay can be energized at any time, regardless of the cooling status. The fan relay is not energized by the dehumidification sequence.

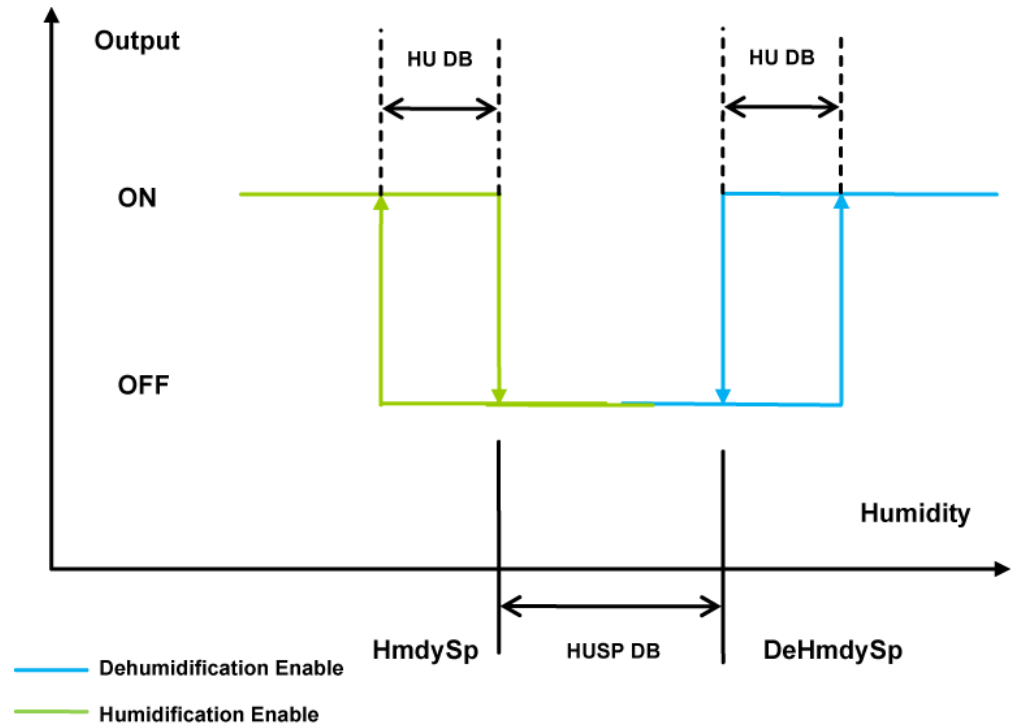


Figure 4: Humidification and Dehumidification Operation.

HmdySp: Humidification Setpoint, user-adjustable to desired level in Humidification mode.

DeHmdySp: Dehumidification Setpoint, user-adjustable to desired level in Dehumidification mode.

HUSP DB: A deadband maintained between the **HmdySp** and the **DeHmdySp**. If one changes, the other dynamically shifts to maintain at least a 15% gap.

HU DB: Humidification/Dehumidification Deadband.

Occupancy Notification

Many internal control sequences rely on occupancy status, for example: room setpoint choice, fan operation, and economizer enable. Occupancy Notification also goes out from a configurable relay to enable external equipment. The space is assumed to be occupied when the schedule mode is set to **Comfort**. An optional occupancy sensor can also be used for definitive proof of occupancy (manual override to the room temperature setpoint is the evidence that the space is being occupied).

The thermostat uses three methods to determine if the space is occupied: scheduler, manual override, or occupancy sensor.

- To use the Occupancy functions, the thermostat must have an active schedule. The local scheduler does not have the direct information about occupancy; instead, the space is assumed to be occupied when the schedule mode is set to **Comfort**.
- During periods in which the schedule indicates the space is unoccupied, any human interaction with the thermostat (for example, setpoint adjustment) will put the thermostat into Occupied mode.


- An optional occupancy sensor can be used in conjunction with the schedule. The thermostat will follow the assumptions above, but an input from the occupancy sensor during a scheduled unoccupied period will put the thermostat into Occupied mode for the duration of the timer set in Parameter P404 (OCC MRT) Occupancy Min run Timer (**OccMinRun**). If the optional occupancy sensor is used, Parameter P404 can be used to set a minimum run timer for any actions that are activated by occupancy, such as Economizer Enable, Control to occupied temperature setpoints, and so on. Note that many occupancy sensors also have onboard proof timers.
- If the unit does not have an active schedule, or if it has an active schedule set locally with the effective setpoint being overridden by BMS, the thermostat assumes that the space is always occupied.

Economizer Enable

The Economizer Enable relay energizes whenever a cooling relay is energized or the space is occupied. The space is assumed to be occupied when the schedule mode is set to **Comfort**. An optional occupancy sensor can also be used for definitive proof of occupancy.

An output configured for Occupancy Notification can also be used for Economizer Enabling, for example, while working with Siemens POL 220 Series Economizer Controller.

Economizer Enable relay (if configured) functions as follows:

- Occupied = Relay energized
- Unoccupied and no call for cooling = Relay not energized
- Unoccupied and call for cooling = Relay energized
- Fresh Air icon  is activated

Pre-Purge

To enable the economizer and energize the fan relay prior to scheduled occupancy, set Parameter P403 (PRE OC PRG) **PreOcpPrg** to the number of hours before scheduled occupancy for pre-purge to begin. This function requires a schedule to be configured.

Three conditions enable this functionality:

- Unit must have an active onboard scheduler.
- One of the outputs must be set to ECONOMIZER ENABLE.
- PRE-OCCUPANCY PURGE parameter must be greater than 0.

The Economizer Enable and fan relays energize at X number of hours before the first scheduled occupancy period. (where X is the value entered for PRE-OCCUPANCY

PURGE parameter). The Fresh Air icon  and Fan icon  icons are activated. Other icons are activated or deactivated per standard operation.


The pre-purge period stops when the first scheduled occupancy period starts. At that time, everything reverts to normal operation.

Semi-Continuous Fan

If Parameter P405 (CONT FAN) is selected in the set-up menu, the fan relay energizes any time the space is occupied as determined by the Scheduler, or input from the occupancy sensor.

Air Quality Management

If measured **CO2** exceeds the setpoint (1000 ppm) by 200 ppm, after a proof timer of 60 seconds, or a CO2 concentration still exceeds the setpoint (1000 ppm) by 200 ppm,

the Air Quality output relay energizes and the Fresh Air  icon activates. The fan relay (G) energizes and the icon displays.

When measured **CO2** falls below the setpoint (**CO2Setpoint**) after a proof timer of 60 seconds has expired, and the appropriate minimum run time has been met, the Air Quality output relay de-energizes and the fan relay reverts to Normal operation.

The **DCV** Minimum run time is five minutes; **DCV** Minimum off time is five minutes.

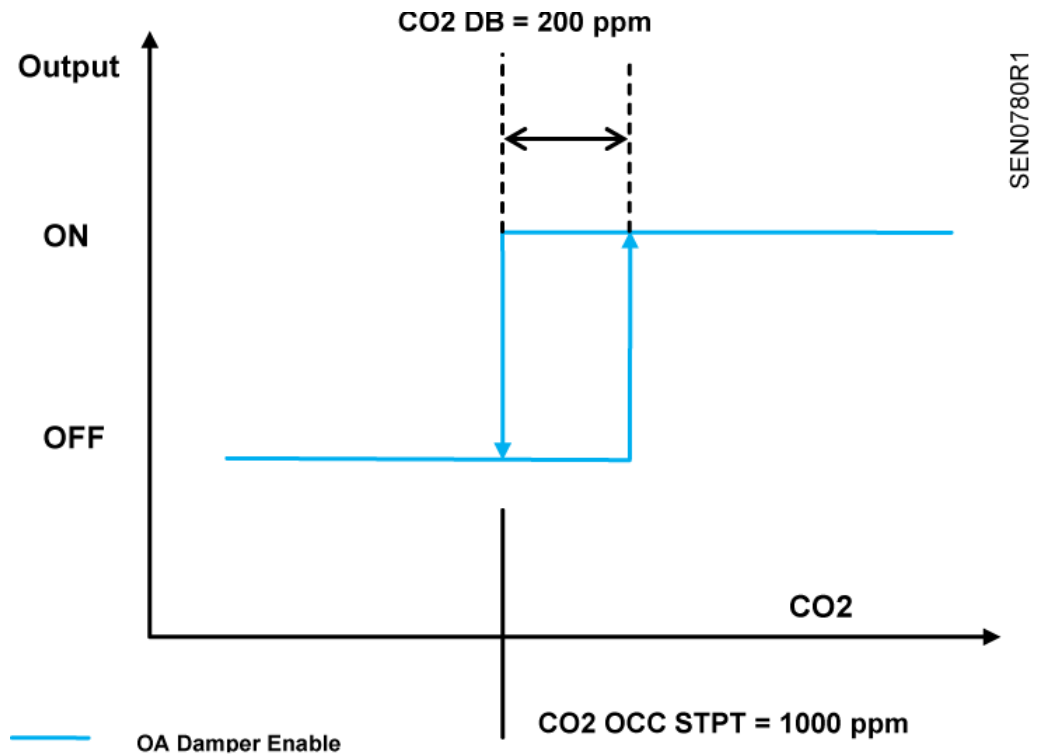


Figure 5: Air Quality Management Operation.

Service and Fault Messages

All of the three counters for the Service UV Lamp, Service Humidifier and Service Air Filter are tied to the fan running and are based on calendar days.

- **Service UV Lamp (SrvcUvLamp):**
The UV Lamp counter keeps track of the run time of the fan calendar days since the UV Lamp service reminder was last acknowledged/cleared. The UV Lamp Service reminder is triggered when the counter reaches the value set in the Service UV Lamp parameter. The counter is reset while acknowledging/clearing the UV Lamp service reminder.
- **Service Humidifier (SrvcHmdy):**
The Humidifier counter keeps track of the run time of the fan calendar days since the Humidifier service reminder was last acknowledged/cleared. The Humidifier service reminder is triggered when the counter reaches the value set in Service Humidifier parameter. The counter is reset while acknowledging/clearing the Humidifier service reminder.
- **Service Air Filter (SrvcFilter):**
The Air Filter counter keeps track of the run time of the fan calendar days since the Air Filter service reminder was last acknowledged/cleared. The Air Filter service reminder is triggered when the counter reaches the value set in the Service Air Filter parameter. The counter is reset while acknowledging/clearing the Air Filter service reminder.

Sensor Failure Handling

- **Failure of external temperature sensor:**
Stop control - manual change to internal sensor required
Control to onboard sensor, and activate SERVICE REQUIRED segment. Help text displays `SNSR X FAIL`.
- **Failure of external humidity sensor:**
Control to onboard sensor, and activate SERVICE REQUIRED segment. Help text displays `SNSR X FAIL`.
- **Failure of onboard temp sensor:**
Stop control and displays `FAILURE`
- **Failure of onboard humidity sensor:**
Stop humidity control, and activate SERVICE REQUIRED segment. Help text displays `HUM FAIL`.
- **Failure of external CO2 sensor:**
Stop Air Quality control, and activate SERVICE REQUIRED segment. Help text displays `SNSR X FAIL`.

I/O Test Mode

Certain expert menus, such as the P500 Series and P900 Series, can disrupt the normal operation and force the unit into Test mode, releasing all of the outputs.

Under the P900 Series menu, the outputs can be overridden by I/O test function and no minimum on/off timers are enforced.

After exiting the P500 Series and P900 Series menus, the unit goes back to normal operation from the Test mode, enforcing all minimum off timers first and then restarting all primary and secondary logic.

Overcurrent Protection

If the sum of the current flowing through all of the relays exceeds 3A, all of the relays will revert to their **OFF** state and the **OverCurrent** binary value object will turn **ON**. The RDY2000BN will remain in that state for four minutes. After that time, all of the relays that were placed in the **OFF** state will change to their **ON** state.

Then, the controller re-evaluates the overcurrent condition:

- If the sum of the current through the relays does not exceed 3A, the RDY2000BN controls normally, and the **OverCurrent** binary value turns **OFF**
- If the sum of the current through the relays exceeds 3A again, the process repeats itself, and the **OverCurrent** binary value turns **ON**.

BACnet Scheduler

The thermostat's Scheduler functionality can be manually configured using the P107 SCHEDULER in the Wizard/Installer menu. This parameter simplifies the task of entering the local schedule using the touchscreen interface for cases where a day's schedule may be identical to another day's schedule. The local schedule can be disabled by setting P107 = **OFF**.

- By setting P107 = **1**, all days will contain the same schedule.
- By setting P107 = **2**, Monday through Friday will share a schedule and Saturday through Sunday will share another schedule.
- By setting P107 = **3**, Monday through Friday will share a schedule, Saturday and Sunday will each have a unique schedule.
- By setting P107 = **7**, all seven days of the week will have individual schedules.

When editing a schedule through the local touchscreen interface, up to six events can be defined per schedule using the Scheduler menu. When editing a schedule over the BACnet network, the client simply needs to write to the Weekly_Schedule property of Schedule instance 0, **WeeklySchedule_1**.



NOTES:

1. When the schedule is edited using the BACnet network, P107 will be set to **7**.
 2. The local schedule will write to MultistateValue Instance 24, **SchedMode**.
-

This object may be overridden using the network to affect a "temporary exception mode". Valid states include: Comfort (1), Economy (2) and Protection (3). The corresponding setpoints for each mode are set using AnalogValue instance 32, **ComfortClgSP**, AnalogValue instance 33, **ComfortHtgSP**, AnalogValue instance 34, **EconClgSP**, AnalogValue instance 35, **EconHtgSP**, AnalogValue instance 39, **ProtClgSP** and AnalogValue instance 40, and **ProtHtgSP**. Local overrides will occur for a user-defined duration using the thermostat's touchscreen interface. The local override will impact the effective runtime setpoints AnalogValue 30, **HeatingSp** and AnalogValue 31, **CoolingSp**.



NOTES:

1. If an Occupancy sensor is configured, the Present_Value of the BinaryInput is evaluated after **SchedMode**'s Priority_Array arbitration, so the effective runtime operating mode MultistateValue 26, **RM OP MODE**, will ultimately indicate Comfort if the BinaryInput is active; otherwise, the Present_Value of **SchedMode** will take effect.
 2. The RDY2000BN does not support BACnet schedule features such as exception schedules. Tridium Niagara users must set those unsupported parameters to **Skip Write** before importing the schedule objects from the unit for editing. After editing, the parameters can be downloaded to the RDY2000BN. If **Skip Write** is not marked for those unsupported parameters, an error message displays that the writing failed.
-

Application 14900 Point Database

Table 3: Point Database.

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
Device	4194303	RDY	4194303			
AnalogInput	0	UI1.NTC10K	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	1	UI1.10V	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	2	UI2.NTC10K	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	3	UI2.10V	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	4	UI3.NTC10K	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	5	UI3.10V	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	6	UI4.NTC10K	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	7	UI4.10V	0.0	DegF/DegC		For troubleshooting purposes only.
AnalogInput	8	OnbrdTmp	0.0	DegF/DegC		
AnalogInput	9	OnbrdRH	0.0	%RH		
BinaryInput	0	DI1	0		DI1 inactive/DI1 active	
BinaryInput	1	DI2	0		DI2 Inactive/DI2 active	
BinaryInput	2	DI3	0		DI3 Inactive/DI3 active	
BinaryInput	3	DI4	0		DI4 Inactive/DI4 active	
BinaryOutput ³	0	O/B	0		RelayOff/Relay On	
BinaryOutput ³	1	FanCmd	0		RelayOff/Relay On	
BinaryOutput ³	2	Y1	0		RelayOff/Relay On	
BinaryOutput ³	3	Y2	0		RelayOff/Relay On	
BinaryOutput ³	4	W1	0		RelayOff/Relay On	
BinaryOutput ³	5	W2	0		RelayOff/Relay On	
BinaryOutput ³	6	AuxOutput1	0		RelayOff/Relay On	OUT1

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
BinaryOutput ³	7	AuxOutput2	0		RelayOff/Relay On	OUT2
BinaryOutput ³	8	AuxOutput3	0		RelayOff/Relay On	OUT3
AnalogValue	0	HmdySp	25.0	%RH		If AuxOut1-3 = 1, this is a runtime humidity setpoint.
AnalogValue	1	DeHmdySp	50.0	%RH		If AuxOut1-3 = 2, this is a runtime dehumidification setpoint.
AnalogValue	2	CO2Setpoint	1000.0	Ppm		If AuxOut1-3 = 4 and Input1-4 = 7, this is a runtime CO2 setpoint.
AnalogValue	3	ChgOvrDB	5.0	DegF/DegC		
AnalogValue	4	TmpOffset	0.0	DegF/DegC		
AnalogValue	5	ChgOvrDly	10.0	Minutes		
AnalogValue	6	MinOnTimeHt	3.0	Minutes		
AnalogValue	7	MinOffTimeHt	5.0	Minutes		
AnalogValue	8	MinOffTimeCl	5.0	Minutes		
AnalogValue	9	MinOnTimeCl	3.0	Minutes		
AnalogValue	10	OccMinRun	30.0	Minutes		
AnalogValue	11	StgDlyHt	5.0	Minutes		
AnalogValue	12	StgDlyCl	5.0	Minutes		
AnalogValue	13	HeatStg	2.0			
AnalogValue	14	AuxHeatStg	0.0			
AnalogValue	15	HrsOvrRide	2.0	Hours		Present, but no impact on the control sequence.
AnalogValue	16	UvLampSrv	0.0	Days		
AnalogValue	17	HmdfrSrv	0.0	Days		
AnalogValue	18	FilterSrv	0.0	Days		
AnalogValue	19	BackLight	15.0	Seconds		
AnalogValue	20	Tmpln1Low	0.0	DegF/DegC		
AnalogValue	21	Tmpln1High	120.0	DegF/DegC		
AnalogValue	22	Tmpln2Low	0.0	DegF/DegC		
AnalogValue	23	Tmpln2High	120.0	DegF/DegC		

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
AnalogValue	24	Tmpln3Low	0.0	DegF/DegC		
AnalogValue	25	Tmpln3High	120.0	DegF/DegC		
AnalogValue	26	Tmpln4Low	0.0	DegF/DegC		
AnalogValue	27	Tmpln4High	120.0	DegF/DegC		
AnalogValue	28	InstallPW	0000.0			
AnalogValue	29	ExpertPW	9999.0			
AnalogValue	30	HeatingSp	70.0	DegF/DegC		Effective runtime heating setpoint.
AnalogValue	31	CoolingSp	75.0	DegF/DegC		Effective runtime cooling setpoint.
AnalogValue	32	ComfortClgSP	75.0	DegF/DegC		
AnalogValue	33	ComfortHtgSP	70.0	DegF/DegC		
AnalogValue	34	EconClgSP	82.0	DegF/DegC		
AnalogValue	35	EconHtgSP	62.0	DegF/DegC		
AnalogValue	36	CoolStg	2			
AnalogValue	37	PreOcpyPrg	0.0	Hours		
AnalogValue	38	MS/TP MAC	255			
AnalogValue	39	ProtClgSP	104.0	DegF/DegC		
AnalogValue	40	ProtHtgSP	40.0	DegF/DegC		
AnalogValue	41	UnitNumber	0.0			
AnalogValue	42	HEAT LIMIT	95.0	DegF/DegC		
AnalogValue	43	COOL LIMIT	50.0	DegF/DegC		
AnalogValue	44	APPLICATION	14900.0			Conventional = 14900 (Read Only, write to SystemType).
AnalogValue	45	IndoorTmpRmt	0.0	DegF/DegC		If Input1-4 = 1, this is an intermediate value.
AnalogValue	46	CO2	0.0	Ppm		If Input1-4 = 7, this is a runtime value.
AnalogValue	47	SupplyTmp	0.0	DegF/DegC		If Input1-4 = 3, this is a runtime value.
AnalogValue	48	ReturnTmp	0.0	DegF/DegC		If Input1-4 = 4, this is a runtime value

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
AnalogValue	49	OutDoorTmp	0.0	DegF/DegC		If Input1-4 = 5, this is runtime value.
AnalogValue	50	IndoorTmpAvg	0.0	DegF/DegC		If Input1-4 = 2, this is an intermediate value.
AnalogValue	51	Humidity	0.0	%RH		If Input1-4 = 6, this is a runtime value.
AnalogValue	52	IndoorTmpEff	0.0	DegF / DegC		If Input1-4 = 1 or 2, this is a runtime value.
AnalogValue	53	FanRunTime	0.0	Minutes		
BinaryValue	0	FanMode	0		Auto/Manual	
BinaryValue	1	RevValveMode	0		Cooling/Heating	
BinaryValue	2	SemiContFan	0		No/Yes	
BinaryValue	3	FanOpr	1		Gas/Electric	
BinaryValue	4	Eco_MstEn	0		Disabled/Enable	
BinaryValue	5	Eco_MstCtrl	0		Disabled/Enabled	
BinaryValue	6	HumidityIndp	0		No/Yes	
BinaryValue	7	Changeover	1		Manual/Automatic	
BinaryValue	8	ClockFormat	0		12-hour/24-hour	
BinaryValue	9	AckService	0		NoAction/Clear	
BinaryValue	10	Units	0		DegF/DegC	
BinaryValue	11	DST	0		Disabled/Enabled	
BinaryValue	12	SpDispMode	0		Absolute/Relative	
BinaryValue	13	OcupyInput	0		Unocc/Occ	
BinaryValue	14	HmdyOn	14		Off/On	
BinaryValue	15	DeHmdyOn	0		Off/On	
BinaryValue	16	OcupyStatus	1		No/Yes	
BinaryValue	17	DCV	0		Off/On	
BinaryValue	18	ExtFault	0		Normal/Fault	
BinaryValue	19	EcomzrOn	1		Off/On	
BinaryValue	20	SrvcUvLamp	0		No Serv/Service	
BinaryValue	21	SrvcHmdy	0		No Serv/Service	

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
BinaryValue	22	SrvcFilter	0		No Serv/Service	
BinaryValue	23	HpCompLockOn	0		No Lock/Lock	Present, but no impact on the control sequence.
BinaryValue	24	HpAuxLockOn	0		No Lock/Locke	Present, but no impact on the control sequence.
BinaryValue	25	OverCurrent	0		Off/On	
BinaryValue	26	SchOccupy	1		No/Yes	
BinaryValue	27	HmiOccupy	0		No/Yes	
BinaryValue	28	VntlationEff	0		Off/On	
BinaryValue	29	PrePurgeEn	0		Off/On	
MultistateValue	0	Periods	1		6 Prds	
MultistateValue	1	TmpOvrRide	11		1F/0.5C, 2F/1C, 3F/1.5C, 4F/2C, 5F/2.5C, 6F/3C, 7F/3.5C, 8F/4C, 9F/4.5C, 10F/5C, No Limit	
MultistateValue	2	KeyLock	1		NONE, PARTIAL, FULL	
MultistateValue	3	SystemType	1		CONVEN,HEAT P	
MultistateValue	4	AuxOut1	6		Humid, Dehumid, Occupied, AirQual, EconEn, Not Used	
MultistateValue	5	AuxOut2	6		Humid, Dehumid, Occupied, AirQual, EconEn, Not Used	
MultistateValue	6	AuxOut3	6		Humid, Dehumid, Occupied, AirQual, EconEn, Not Used	
MultistateValue	7	Input1	10		InTemRem, InTemAvg, Sup Temp, Ret Temp, Out Temp, Hum 0-10, CO2 0-10, Occ DI, Fault, Not Used	
MultistateValue	8	Input2	10		InTemRem, InTemAvg, Sup Temp, Ret Temp, Out Temp, Hum 0-10, CO2 0-10, Occ DI, Fault, Not Used	
MultistateValue	9	Input3	10		InTemRem, InTemAvg, Sup Temp, Ret Temp, Out Temp, Hum 0-10, CO2 0-10, Occ DI, Fault, Not Used	

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
MultistateValue	10	Input4	10		InTemRem, InTemAvg, Sup Temp, Ret Temp, Out Temp, Hum 0-10, CO2 0-10, Occ DI, Fault, Not Used	
MultistateValue	11	Tmpln1Type	1		Type2Th, 0-10V	
MultistateValue	12	Tmpln2Type	1		Type2Th, 0-10V	
MultistateValue	13	Tmpln3Type	1		Type2Th, 0-10V	
MultistateValue	14	Tmpln4Type	1		Type2Th, 0-10V	
MultistateValue	15	StgDifCl	1		1F/0.5C, 2F/1C, 3F/1.5C, 4F/2C, 5F/2.5C, 6F/3C, 7F/3.5C, 8F/4C, 9F/4.5C, 10F/5C	
MultistateValue	16	CoolingDB	1		1F/0.5C, 2F/1C, 3F/1.5C, 4F/2C, 5F/2.5C	
MultistateValue	17	StgDifHt	1		1F/0.5C, 2F/1C, 3F/1.5C, 4F/2C, 5F/2.5C	
MultistateValue	18	HeatingDB	1		1F/0.5C, 2F/1C, 3F/1.5C, 4F/2C, 5F/2.5C	
MultistateValue	19	BaudRate	7		9600, 19200, 38400, 57600, 76800, 115200, Auto	
MultistateValue	20	SchEditMode	2		7 days, 5+2, 5+1+1, Individ, disable	
MultistateValue	21	HpCompLock	1		Off, 15F/9C, 20F/7C, 25F/4C, 30F/1C, 35F/2C, 40F/4C, 45F/7C	Present, but no impact on the control sequence.
MultistateValue	22	HpAuxLock	1		Off, 40F/4C, 45F/7C, 50F/10C, 55F/13C, 60F/16C	Present, but no impact on the control sequence.
MultistateValue	23	HeatCoolMode	4		COOLING, HEATING, AUTO, Off	The factory Relinquish_Default value is OFF. If AUTO or another default value is preferred, set it appropriately.
MultistateValue	24	SchedMode	1		Comfort, Economy, Protect	
MultistateValue	25	ModeEff	1		COOLING, HEATING, Off	

Object Type ¹	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ²	Eng Units (SI Units)	State Text	Enumerations/Notes
MultistateValue	26	RM OP MODE	1		Comfort, Economy, Protect	Effective runtime room operating mode
Schedule	0	WeeklySchedule_1				

1) Object Types are: Analog Input (AI), Analog Value (AV), Binary Input (BI), Binary Value (BV), Multistate Value (MV), and Binary Output (BO).

2) A single value in a column means that the value is the same in English units and in SI units.

3) This object has an internal algorithm commanding at Priority 16. To issue a command to the object, use a higher priority.



NOTES:

1. The RDY2000BN commands its points at Priority 16.

2. To change between Heat Pump and Conventional Applications, write to the Point System Type rather than the Application Point.

Table 4: Points that Can be Read and Written.

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Read (R)/ Write (W) Present Value	Write Values	Read (R)/ Write (W) Out of Service
AnalogInput ¹	0	UI1.NTC10K	R	N/A	W
AnalogInput ¹	1	UI1.10V	R	N/A	W
AnalogInput ¹	2	UI2.NTC10K	R	N/A	W
AnalogInput ¹	3	UI2.10V	R	N/A	W
AnalogInput ¹	4	UI3.NTC10K	R	N/A	W
AnalogInput ¹	5	UI3.10V	R	N/A	W
AnalogInput ¹	6	UI4.NTC10K	R	N/A	W
AnalogInput ¹	7	UI4.10V	R	N/A	W
AnalogInput ¹	8	OnbrdTmp	R	N/A	W
AnalogInput ¹	9	OnbrdRH	R	N/A	W
BinaryInput ²	0	DI1	R	N/A	W
BinaryInput ²	1	DI2	R	N/A	W
BinaryInput ²	2	DI3	R	N/A	W
BinaryInput ²	3	DI4	R	N/A	W
BinaryOutput ^{2,3}	0	O/B	W	(0) RelayOff; (1) Relay On	W

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Read (R)/ Write (W) Present Value	Write Values	Read (R)/ Write (W) Out of Service
BinaryOutput ^{2,3}	1	FanCmd	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	2	Y1	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	3	Y2	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	4	W1	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	5	W2	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	6	AuxOutput1	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	7	AuxOutput2	W	(0) RelayOff; (1) Relay On	W
BinaryOutput ^{2,3}	8	AuxOutput3	W	(0) RelayOff; (1) Relay On	W
AnalogValue	0	HmdySp	W	10 – 90%	R
AnalogValue	1	DeHmdySp	W	10 – 90%	R
AnalogValue	2	CO2Setpoint	W	500 – 2000 ppm	R
AnalogValue	3	ChgOvrDB	W	3 – 9°F; 2 – 5°C	R
AnalogValue	4	TmpOffset	W	-5 – 5°F; -3 – 3°C	R
AnalogValue	5	ChgOvrDly	W	1 – 60 min	R
AnalogValue	6	MinOnTimeHt	W	1 – 10 minutes	R
AnalogValue	7	MinOffTimeHt	W	1 – 10 minutes	R
AnalogValue	8	MinOffTimeCl	W	1 – 10 minutes	R
AnalogValue	9	MinOnTimeCl	W	1 – 10 minutes	R
AnalogValue	10	OccMinRun	W	3 – 60 minutes	R
AnalogValue	11	StgDlyHt	W	1 – 10 minutes	R
AnalogValue	12	StgDlyCl	W	1 – 10 minutes	R
AnalogValue	13	HeatStg	W	0 – 3 stages	R
AnalogValue	14	AuxHeatStg	W	0 – 2 stages	R
AnalogValue	15	HrsOvrRide	W	0 – 96 hours	R
AnalogValue	16	UvLampSrvc	W	0 – 365 days	R
AnalogValue	17	HmdfrSrvc	W	0 – 365 days	R
AnalogValue	18	FilterSrvc	W	0 – 365 days	R
AnalogValue	19	BackLight	W	0 – 99 seconds	R
AnalogValue	20	Tmpln1Low	W	-58 – 250°F; -50 – 120°C	R

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Read (R)/ Write (W) Present Value	Write Values	Read (R)/ Write (W) Out of Service
AnalogValue	21	TmpIn1High	W	-58 – 250°F; -50 – 120°C	R
AnalogValue	22	TmpIn2Low	W	-58 – 250°F; -50 – 120°C	R
AnalogValue	23	TmpIn2High	W	-58 – 250°F; -50 – 120°C	R
AnalogValue	24	TmpIn3Low	W	-58 – 25°F; -50 – 120°C	R
AnalogValue	25	TmpIn3High	W	-58 – 25 °F; -50 – 120°C	R
AnalogValue	26	TmpIn4Low	W	-58 – 250°F ; -50 – 120°C	R
AnalogValue	27	TmpIn4High	W	-58 – 250°F; -50 – 120°C	R
AnalogValue	28	InstallPW	W	0000 – 4999	R
AnalogValue	29	ExpertPW	W	5000 – 9999	R
AnalogValue	30	HeatingSp	R	N/A	R
AnalogValue	31	CoolingSp	R	N/A	R
AnalogValue	32	ComfortClgSP	W	50 – 95°F; 5 – 3 °C	R
AnalogValue	33	ComfortHtgSP	W	45 – 95°F; 7 - 40°C	R
AnalogValue	34	EconClgSP	W	45 - 104°F; 8 – 40°C	R
AnalogValue	35	EconHtgSP	W	40 – 104°F; 5 – 40°C	R
AnalogValue	36	CoolStg	W	0 – 3 stages	R
AnalogValue	37	PreOcpyPrg	W	0 – 3 hours	R
AnalogValue	38	MS/TP MAC	W	0 – 255	R
AnalogValue	39	ProtClgSP	W	45 - 104°F; 8 – 40°C	R
AnalogValue	40	ProtHtgSP	W	40 – 104°F; 5 – 40°C	R
AnalogValue	41	UnitNumber	W	0 – 999	R
AnalogValue	42	HEAT LIMIT	W	45 – 95°F; 7 – 35°C	R
AnalogValue	43	COOL LIMIT	W	50 – 95°F; 10 – 35°C	R
AnalogValue	44	APPLICATION	R	N/A	R
AnalogValue	45	IndoorTmpRmt	R	N/A	W
AnalogValue	46	CO2	R	N/A	W
AnalogValue	47	SupplyTmp	R	N/A	W
AnalogValue	48	ReturnTmp	R	N/A	W
AnalogValue	49	OutDoorTmp	R	N/A	W

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Read (R)/ Write (W) Present Value	Write Values	Read (R)/ Write (W) Out of Service
AnalogValue	50	IndoorTmpAvg	R	N/A	W
AnalogValue	51	Humidity	R	N/A	W
AnalogValue	52	IndoorTmpEff	R	N/A	W
AnalogValue	53	FanRunTime	R	N/A	W
BinaryValue ³	0	FanMode	W	(0) Auto; (1) Manual	W
BinaryValue	1	RevValveMode	W	(0) Cooling; (1) Heating	R
BinaryValue	2	SemiContFan	W	(0) No; (1) Yes	R
BinaryValue	3	FanOpr	W	(0) Gas; (1) Electric	R
BinaryValue	4	Eco_MstEn	W	(0) Disabled; (1) Enabled	R
BinaryValue	5	Eco_MstCtrl	W	(0) Disabled; (1) Enabled	R
BinaryValue	6	HumidityIndp	W	(0) No; (1) Yes	R
BinaryValue	7	Changeover	W	(0) Manual; (1) Auto	R
BinaryValue	8	ClockFormat	W	(0) 12-hour; (1) 24-hour	R
BinaryValue	9	AckService	W	(0) NoAction; (1) Clear	R
BinaryValue	10	Units	W	(0) Deg F; (1) Deg C	R
BinaryValue	11	DST	W	(0) Disabled; (1) Enabled	R
BinaryValue	12	SpDispMode	W	(0) Absolute; (1) Relative	R
BinaryValue	13	OcupyInput	R	N/A	W
BinaryValue	14	HmdyOn	R	N/A	W
BinaryValue	15	DeHmdyOn	R	N/A	W
BinaryValue	16	OcupyStatus	R	N/A	W
BinaryValue	17	DCV	R	N/A	W
BinaryValue	18	ExtFault	R	N/A	W
BinaryValue	19	EcomzrOn	R	N/A	W
BinaryValue	20	SrvcUvLamp	R	N/A	W
BinaryValue	21	SrvcHmdy	R	N/A	W
BinaryValue	22	SrvcFilter	R	N/A	W
BinaryValue	23	HpCompLockOn	R	N/A	W
BinaryValue	24	HpAuxLockOn	R	N/A	W

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Read (R)/ Write (W) Present Value	Write Values	Read (R)/ Write (W) Out of Service
BinaryValue	25	OverCurrent	R	N/A	W
BinaryValue	26	SchOcupy	R	N/A	W
BinaryValue	27	HmiOcupy	R	N/A	W
BinaryValue	28	VntlationEff	R	N/A	W
BinaryValue	29	PrePurgeEn	R	N/A	W
MultistateValue	0	Periods	R	N/A	R
MultistateValue	1	TmpOvrRide	W	(1) 1F/0.5C; (2) 2F/1C; (3) 3F/1.5C; (4) 4F/2C; (5) 5F/2.5C; (6) 6F/3C; (7) 7F/3.5C; (8) 8F/4C; (9) 9F/4.5C; (10) 10F/5C; (11) No Limit	R
MultistateValue	2	KeyLock	W	(1) NONE; (2) PARTIAL; (3) FULL	R
MultistateValue	3	SystemType	W	(1) CONVEN; (2) HEAT P	R
MultistateValue	4	AuxOut1	W	(1) Humid; (2) Dehumid; (3) Occupied; (4) AirQual; (5) EconEn; (6) Not Used	R
MultistateValue	5	AuxOut2	W	(1) Humid; (2) Dehumid; (3) Occupied; (4) AirQual; (5) EconEn; (6) Not Used	R
MultistateValue	6	AuxOut3	W	(1) Humid; (2) Dehumid; (3) Occupied; (4) AirQual; (5) EconEn; (6) Not Used	R
MultistateValue	7	Input1	W	(1) InTemRem; (2) InTemAvg; (3) Sup Temp; (4) Ret Temp; (5) Out Temp; (6) Hum 0-10; (7) CO2 0-10; (8) Occ DI; (9) Fault; (10) Not Used	R
MultistateValue	8	Input2	W	(1) InTemRem; (2) InTemAvg; (3) Sup Temp; (4) Ret Temp; (5) Out Temp; (6) Hum 0-10; (7) CO2 0-10; (8) Occ DI; (9) Fault; (10) Not Used	R
MultistateValue	9	Input3	W	(1) InTemRem; (2) InTemAvg; (3) Sup Temp; (4) Ret Temp; (5) Out Temp; (6) Hum 0-10; (7) CO2 0-10; (8) Occ DI; (9) Fault; (10) Not Used	R
MultistateValue	10	Input4	W	(1) InTemRem; (2) InTemAvg; (3) Sup Temp; (4) Ret Temp; (5) Out Temp; (6) Hum 0-10; (7) CO2 0-10; (8) Occ DI; (9) Fault; (10) Not Used	R

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Read (R)/ Write (W) Present Value	Write Values	Read (R)/ Write (W) Out of Service
MultistateValue	11	Tmpln1Type	W	(1) Type2Th; (2) 0-10V	R
MultistateValue	12	Tmpln2Type	W	(1) Type2Th; (2) 0-10V	R
MultistateValue	13	Tmpln3Type	W	(1) Type2Th; (2) 0-10V	R
MultistateValue	14	Tmpln4Type	W	(1) Type2Th; (2) 0-10V	R
MultistateValue	15	StgDifCl	W	(1) 1F/0.5C; (2) 2F/1C; (3) 3F/1.5C; (4) 4F/2C; (5) 5F/2.5C; (6) 6F/3C; (7) 7F/3.5C; (8) 8F/4C; (9) 9F/4.5C; (10) 10F/5C	R
MultistateValue	16	CoolingDB	W	(1) 1F/0.5C; (2) 2F/1C; (3) 3F/1.5C; (4) 4F/2C; (5) 5F/2.5C	R
MultistateValue	17	StgDifHt	W	(1) 1F/0.5C; (2) 2F/1C; (3) 3F/1.5C; (4) 4F/2C; (5) 5F/2.5C	R
MultistateValue	18	HeatingDB	W	(1) 1F/0.5C; (2) 2F/1C; (3) 3F/1.5C; (4) 4F/2C; (5) 5F/2.5C	R
MultistateValue	19	BaudRate	W	(1) 9600; (2) 19200; (3) 38400; (4) 57600; (5) 76800; (6) 115200; (7) Auto	R
MultistateValue	20	SchEditMode	R	N/A	R
MultistateValue	21	HpCompLock	W	(1) Off; (2) 15F/-9C; (3) 20F/-7C; (4) 25F/-4C; (5) 30F/1C; (6) 35F/2C; (7) 40F/4C; (8) 45F/7C	R
MultistateValue	22	HpAuxLock	W	(1) Off; (2) 40F/4C; (3) 45F/7C; (4) 50F/10C; (5) 55F/13C; (6) 60F/16C	R
MultistateValue ³	23	HeatCoolMode	W	(1) COOLING; (2) HEATING; (3) AUTO; (4) Off	W
MultistateValue ³	24	SchedMode	W	(1) Comfort; (2) Economy; (3) Protect	W
MultistateValue	25	ModeEff	R	N/A	W
MultistateValue	26	RM OP MODE	R	N/A	W
Schedule ⁴	0	WeeklySchedule_1	R	N/A	W

- 1) This point has a resolution of 0.10.
- 2) This point has a writable polarity property.
- 3) This point has a relinquish default that can be written.
- 4) See the *Scheduling* section for more information on configuring a schedule.

Table 5: Object Parameter Mapping.

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Installer Menu Parameter Number	Installer Menu Parameter Name
Device	4194303	RDY		
AnalogInput	0	UI1.NTC10K		
AnalogInput	1	UI1.10V		
AnalogInput	2	UI2.NTC10K		
AnalogInput	3	UI2.10V		
AnalogInput	4	UI3.NTC10K		
AnalogInput	5	UI3.10V		
AnalogInput	6	UI4.NTC10K		
AnalogInput	7	UI4.10V		
AnalogInput	8	OnbrdTmp		
AnalogInput	9	OnbrdRH		
BinaryInput	0	DI1		
BinaryInput	1	DI2		
BinaryInput	2	DI3		
BinaryInput	3	DI4		
BinaryOutput	0	O/B		
BinaryOutput	1	FanCmd		
BinaryOutput	2	Y1		
BinaryOutput	3	Y2		
BinaryOutput	4	W1		
BinaryOutput	5	W2		
BinaryOutput	6	AuxOutput1		
BinaryOutput	7	AuxOutput2		
BinaryOutput	8	AuxOutput3		
AnalogValue	0	HmdySp		
AnalogValue	1	DeHmdySp		
AnalogValue	2	CO2Setpoint	P402	CO2 SET PT
AnalogValue	3	ChgOvrDB	P111	DEADBAND

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Installer Menu Parameter Number	Installer Menu Parameter Name
AnalogValue	4	TmpOffset	P203	TMP OFFSET
AnalogValue	5	ChgOvrDly	P505	C-O DLY
AnalogValue	6	MinOnTimeHt	P510	M R T HT
AnalogValue	7	MinOffTimeHt	P509	M O T HT
AnalogValue	8	MinOffTimeCl	P503	M O T CL
AnalogValue	9	MinOnTimeCl	P504	M R T CL
AnalogValue	10	OccMinRun	P404	OCC MRT
AnalogValue	11	StgDlyHt	P507	STG DLY HT
AnalogValue	12	StgDlyCl	P501	STG DLY CL
AnalogValue	13	HeatStg	P103	HEAT STGS
AnalogValue	14	AuxHeatStg	P104	AUX HTG STG
AnalogValue	15	HrsOvrRide	P204	HRS OVR RD
AnalogValue	16	UvLampSrvc	P208	UV LAMP
AnalogValue	17	HmdfrSrvc	P209	HMDFR SRVC
AnalogValue	18	FilterSrvc	P210	FLTR SRVC
AnalogValue	19	BackLight	P213	LIGHT
AnalogValue	20	Tmpln1Low	P303	TMP 1 LO
AnalogValue	21	Tmpln1High	P304	TMP 1 HI
AnalogValue	22	Tmpln2Low	P307	TMP 2 LO
AnalogValue	23	Tmpln2High	P308	TMP 2 HI
AnalogValue	24	Tmpln3Low	P311	TMP 3 LO
AnalogValue	25	Tmpln3High	P312	TMP 3 HI
AnalogValue	26	Tmpln4Low	P315	TMP 4 LO
AnalogValue	27	Tmpln4High	P316	TMP 4 HI
AnalogValue	28	InstallPW	P407	INSTALL PW
AnalogValue	29	ExpertPW	P911	XPRT PW
AnalogValue	30	HeatingSp		
AnalogValue	31	CoolingSp		
AnalogValue	32	ComfortClgSP	P221	COMF CL SP
AnalogValue	33	ComfortHtgSP	P220	COMF HT SP

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Installer Menu Parameter Number	Installer Menu Parameter Name
AnalogValue	34	EconClgSP	P223	ECO CL SP
AnalogValue	35	EconHtgSP	P222	ECO HT SP
AnalogValue	36	CoolStg	P102	COOL STGS
AnalogValue	37	PreOcpyPrg	P403	PRE OC PRG
AnalogValue	38	MS/TP MAC	P601	MS/TP MAC
AnalogValue	39	ProtClgSP	P225	PROT HT SP
AnalogValue	40	ProtHtgSP	P224	PROT CL SP
AnalogValue	41	UnitNumber	P401	UNIT NMBR
AnalogValue	42	HEAT LIMIT	P201	HEAT LIMIT
AnalogValue	43	COOL LIMIT	P202	COOL LIMIT
AnalogValue	44	APPLICATION		
AnalogValue	45	IndoorTmpRmt		
AnalogValue	46	CO2		
AnalogValue	47	SupplyTmp		
AnalogValue	48	ReturnTmp		
AnalogValue	49	OutDoorTmp		
AnalogValue	50	IndoorTmpAvg		
AnalogValue	51	Humidity		
AnalogValue	52	IndoorTmpEff		
AnalogValue	53	FanRunTime		
BinaryValue	0	FanMode		
BinaryValue	1	RevValveMode	P106	REV VALVE
BinaryValue	2	SemiContFan	P405	CONT FAN
BinaryValue	3	FanOpr	P105	HTG FAN
BinaryValue	4	Eco_MstEn		
BinaryValue	5	Eco_MstCtrl		
BinaryValue	6	HumidityIndp	P320	IND HMDTY
BinaryValue	7	Changeover	P110	AUTO CHNGE
BinaryValue	8	ClockFormat	P212	CLOCK
BinaryValue	9	AckService		

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Installer Menu Parameter Number	Installer Menu Parameter Name
BinaryValue	10	Units	P109	UNITS
BinaryValue	11	DST	P112	DAYLT SAVE
BinaryValue	12	SpDispMode	P113	TMP SP DIS
BinaryValue	13	OccupInput		
BinaryValue	14	HmdyOn		
BinaryValue	15	DeHmdyOn		
BinaryValue	16	OccupStatus		
BinaryValue	17	DCV		
BinaryValue	18	ExtFault		
BinaryValue	19	EcomzrOn		
BinaryValue	20	SrvUvLamp		
BinaryValue	21	SrvHmdy		
BinaryValue	22	SrvFilter		
BinaryValue	23	HpCompLockOn		
BinaryValue	24	HpAuxLockOn		
BinaryValue	25	OverCurrent		
BinaryValue	26	SchOccup		
BinaryValue	27	HmiOccup		
BinaryValue	28	VntlationEff		
BinaryValue	29	PrePurgeEn		
MultistateValue	0	Periods		
MultistateValue	1	TmpOvrRide	P205	TMP OVR RD
MultistateValue	2	KeyLock	P211	KEY LOCK
MultistateValue	3	SystemType	P101	SYS TYPE
MultistateValue	4	AuxOut1	P317	AUX OUT 1
MultistateValue	5	AuxOut2	P318	AUX OUT 2
MultistateValue	6	AuxOut3	P319	AUX OUT 3
MultistateValue	7	Input1	P301	INPUT 1
MultistateValue	8	Input2	P305	INPUT 2
MultistateValue	9	Input3	P309	INPUT 3

Object Type	Object Instance (Point Number)	Object Name (Descriptor)	Installer Menu Parameter Number	Installer Menu Parameter Name
MultistateValue	10	Input4	P313	INPUT 4
MultistateValue	11	Tmpln1Type	P302	TMP IN 1
MultistateValue	12	Tmpln2Type	P306	TMP IN 2
MultistateValue	13	Tmpln3Type	P310	TMP IN 3
MultistateValue	14	Tmpln4Type	P314	TMP IN 4
MultistateValue	15	StgDifCl	P502	STG DIF CL
MultistateValue	16	CoolingDB	P506	CL DEADBND
MultistateValue	17	StgDifHt	P508	STG DIF HT
MultistateValue	18	HeatingDB	P511	HT DEADBND
MultistateValue	19	BaudRate	P602	BAUD RATE
MultistateValue	20	SchEditMode	P107	SCHEDULER
MultistateValue	21	HpCompLock	P206	HP COMP LO
MultistateValue	22	HpAuxLock	P207	HP AUX LO
MultistateValue	23	HeatCoolMode		
MultistateValue	24	SchedMode		
MultistateValue	25	ModeEff		
MultistateValue	26	RM OP MODE		
Schedule	0	WeeklySchedule_1		



Certain parameters may not appear in the Installer Menu depending upon how other parameters are configured.

Scheduling Examples

*Table 6: Daily Schedule Example
6 Periods per Day, Parameter 107 = 1.*

Day	Monday – Sunday (Each day is the same)					
Event	1	2	3	4	5	6
Mode	COM	ECO	COM	ECO	COM	ECO
Time	6:00 AM	11:00 AM	1:00 PM	2:00 PM	3:00 PM	10:00 PM

*Table 7: Work Week Schedule with Weekend Example
6 Periods per Day, Parameter 107 = 2.*

Day	Work Week (Monday-Friday)					
Event	1	2	3	4	5	6
Mode	COM	ECO	COM	ECO	COM	ECO
Time	6:00 AM	11:00 AM	1:00 PM	2:00 PM	3:00 PM	10:00 PM

Day	Weekend (Saturday-Sunday)					
Event	1	2	3	4	5	6
Mode	COM	ECO	COM	ECO	COM	ECO
Time	8:00 AM	11:00 AM	1:00 PM	2:00 PM	3:00 PM	10:00 PM

*Table 8: Work Week Schedule with Separate Weekend Days Example
6 Periods per Day, Parameter 107 = 3.*

Day	Work Week (Monday-Friday)					
Event	1	2	3	4	5	6
Mode	COM	ECO	COM	ECO	COM	ECO
Time	6:00 AM	11:00 AM	1:00 PM	2:00 PM	3:00 PM	10:00 PM

Day	Saturday					
Event	1	2	3	4	5	6
Mode	COM	ECO	COM	ECO	COM	ECO
Time	8:00 AM	11:00 AM	1:00 PM	2:00 PM	3:00 PM	10:00 PM

Day	Sunday					
Event	1	2	3	4	5	6
Mode	COM	ECO	COM	ECO	---	---
Time	10:00 AM	12:00 PM	2:00 PM	3:00 PM	--:--	--:--

*Table 9: Individual Days (Monday – Sunday) Example
6 Periods per Day, Parameter 107 = 7.*

Day	Monday – Sunday (Each day can be unique)					
Event	1	2	3	4	5	6
Mode	Comfort	Economy	Comfort	Economy	Comfort	Economy
Time	6:00 AM	11:00 AM	1:00 PM	2:00 PM	3:00 PM	10:00 PM



NOTE:

The Scheduler default setting consists of two events:

Event 1 = ON (Comfort) at 7:00 AM,

Event 2 = ECO (Economy) at 7:00 PM.

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Siemens Industry, Inc.
Building Technologies Division
1000 Deerfield Pkwy
Buffalo Grove IL 60089
Tel. +1 847-215-1000

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