



# VT8000 Room Controllers

## VT8650 Engineering Guide Specification

### Roof Top Unit (RTU), Heat Pump and Indoor Air Quality (IAQ) Controller

**General** – The VT8650 series is designed for single-stage and multi-stage control of heating/cooling equipment such as self-contained indoor air quality and rooftop and units. By default, controllers communicate using BACnet™ IP, and ZigBee™ Pro radio option (can be upgraded with a ZigBee™ Pro wireless module) as needed. Controllers are programmed with standard applications that can be selected in the user interface, via BACnet or ZigBee communication. Controllers also offer a programming engine allowing modification of standard applications to meet specific project requirements.

**Quality Assurance** - The controller shall be manufactured within a systems certified **ISO 9001** and **ISO 14001** facility and must have the following specifications and industry approvals:

<b>Room Controller power requirements:</b>	20 - 28 Vac, 50/60Hz 6VA + Output Load (100 VA total Max.)
<b>Operating conditions:</b>	0 °C to 50 °C (32 °F to 122 °F) 0% to 95% R.H. non-condensing
<b>Storage conditions:</b>	-30 °C to 50 °C (-22 °F to 122 °F) 0% to 95% R.H. non-condensing
<b>Temperature sensor:</b>	Local 10 K NTC thermistor
<b>Temperature sensor resolution:</b>	± 0.1 °C (± 0.2 °F)
<b>Temperature control accuracy:</b>	±0.5 °C (± 0.9 °F) @ 21 °C (70 °F) typical calibrated
<b>Contact output rating:</b>	Electronic Relay output: 1 Amp. Maximum, 3 Amp. Inrush (<100ms)
<b>Occ, Stand-By and Unocc cooling set point range:</b>	12.0 to 37.5 °C (54 to 100 °F)
<b>Occ, Stand-By and Unocc heating set point range:</b>	4.5 °C to 32 °C (40 °F to 90 °F)
<b>Room and outdoor air temperature display range:</b>	-40 °C to 50 °C (-40 °F to 122 °F)
<b>Proportional band for room temperature control:</b>	Cooling & Heating: Default: 1.8°C (3. 2°F)
<b>Binary inputs:</b>	Dry contact across terminal UI16 or UI17 to Common
<b>Economizer analog output rating</b>	0 to 10 VDC into 2KΩ resistance min
<b>Economizer analog output accuracy:</b>	± 3% typical
<b>Humidity Sensor Precision:</b>	Reading range from 10-90 % R.H. non-condensing 10 to 20% precision: 10% 20% to 70% precision: 5% 70% to 90% precision: 10%
<b>Humidity Sensor Stability:</b>	Less than 0.25 % yearly (typical drift)
<b>Dehumidification Setpoint Range:</b>	30% to 95% R.H.
<b>Wire gauge:</b>	16 gauge maximum, 22 gauge
<b>Approximate shipping weight:</b>	0.75 lb ( 0.34 kg )
<b>EMC / Safety Standards:</b>	EMC Directive 2014/30/EU LVD Directive 2014/35/EU FCC 15 Subpart B Class B ICES-003 Issue 6 2016 Class B  EN 60730-1:2016 EMC EN 60730-2-9:2010 EN 60730-2-13 IEC 60730-1:2010 (4th Ed.) IEC 60730-2-9:2008 (3rd Ed.)+Am. 1:2011 CAN/CSA-E60730-1:2015 CAN/CSA-E60730-2-9:2015 IEC 60730-2-13:2014 UL 60730-1:2016



	UL 60730-2-9:2017
<b>Radio Standards:</b>	RE Directive 2014/53/EU ETSI EN 300 328 V2.1.1 ETSI EN 301 489-1 V1.9.2 ETSI EN 301 489-17 V2.2.1 FCC Part 15 Subpart C 15.247:2016 RSS 247 Issue 2:2017

**VT8650 Series**

**Hardware / Firmware:**

- **Controller shall be able to communicate with BMS using BACnet™ IP**
- **Controller shall be able to communicate using ZigBee™ Pro wireless protocol either with the onboard ZigBee radio option or when the VCM8000V5045P ZigBee Pro extended profile wireless communication adapter is installed**
  - Controller can be retrofitted with the adapter in the field.
  - Controller with the wireless option can communicate with specified ZigBee Pro enabled end devices by default.
  - Controller with the wireless option can communicate with a BMS using ZigBee Pro through a proprietary ZigBee Pro / BACnet gateway.
- Controller shall be equipped with a TFT transmissive LED-backlit LCD touch screen with a 70.08 mm x 52.56 mm (2.759 inch x 2.069 inch) active area. Display colours of LCD screen shall be a customizable choice among 5 colour options.
- Controller shall have a removable fascia that can be customized with replacement fascia available in multiple styles and colours.
- Controller shall have an embedded local configuration utility using the touch screen allowing for simplified configuration, sequence selection, re-initialization, setting of setpoints and control of display settings. Controllers requiring external configuration tools or network interface for start-up and configuration are not acceptable.
- Controller shall be configurable by default for display in several languages.
- Controllers shall be customizable with one of at least 12 different user interfaces selected based on intended use (Hospitality or Commercial) and level of local control.
- Controller shall achieve accurate temperature control using a PI proportional-integral algorithm. Traditional differential-based controllers are not acceptable.
- Controller shall utilize EEPROM memory to back up local configuration parameters in the event of power failure. Controllers requiring batteries, or having no provisions for data retention during loss of power shall not be acceptable.
- Controller shall have inputs for remote mixing/return temperature sensors, outdoor temperature sensor and discharge air temperature sensor.
- Controller shall have removable connectors for easier wiring.
- Controller shall have password protection to prevent unauthorized access to the configuration menu parameters.
- Controller shall have six (6) adjustable lockout levels limiting access as follows:

Level	Occupied temperature set points	System mode setting	Fan mode setting	Unoccupied Override
0	Yes access	Yes access	Yes access	Yes access
1	Yes access	Yes access	Yes access	No access
2	Yes access	No access	No access	Yes access



3	Yes access	No access	No access	No access
4	No access	No access	No access	Yes access
5	No access	No access	No access	No access

- Controllers shall be provided with intelligent HMI, which will display services only as are available as switched through local digital input or network layer such as:
  - Outdoor air temperature display only enabled when outdoor air temperature sensor is connected.
  - COM Address and various other parameters when a communication module is integrated inside the unit.

**Application:**

- The low-voltage rooftop unit controller shall have built-in programs capable of performing the following applications:
  - Indoor air quality
    - CO2 sensor
    - Fresh air sensor
  - Single stage heating and cooling;
  - Multi-stage heating and cooling (2 heat / 2 cool);
  - Economizer
- For applications not covered by built-in program, the controller must accept custom programs to match project requirements.
- Controller shall have built-in frost protection for all system modes pre-configured at 42 °F (5.6 °C). Frost protection can be enabled or disabled.
- Controller shall support continuous, “smart” and auto-fan sequences.
- Controller shall have integrated changeover function, which will allow seamless switching between cooling and heating mode based upon temperature or network value input.
- Controller shall be capable of local or remote override during unoccupied mode. The controller shall resume occupied set points and will revert back to unoccupied set points after a certain amount of time (adjustable from 0 – 24 hours in one hour increments).
- Controller shall have configurable temporary or permanent local override set points. When the “temporary set points” mode is enabled, once the temporary occupancy timer expires, the set points will revert back to their default values.
- Controller shall have configurable maximum heating set points (40 to 90 °F, 4.5 to 32.0 °C) and minimum cooling set points (54 to 100 °F, 12.0 to 37.5 °C).
- User shall have the ability to link the heating and cooling set points, and define a minimum deadband between them (from 2F to 4 F, 1 °C to 2.0 °C).
- Proportional band of the PI algorithm shall be adjustable (from 3 °F to 8 °F, 1.7 °C to 4.4 °C).
- Controller shall have an adjustable anti-cycling on/off operation time of cooling and heating stages from 0 minutes to 5 minutes.
- Controller shall have adjustable number of allowed heating and cooling cycles per hour.
- Controller shall have an auxiliary contact that can be used to energize peripheral devices such as: lighting equipment, exhaust fans, economizers, etc. This contact shall operate in parallel with the internal occupied/unoccupied schedule of the controller or the remote night setback contact if UI16 or UI17 is used. When the system is in OFF mode, the contact shall remain in its unoccupied status independently of the occupied / unoccupied schedule unless configured otherwise by a custom application (for example, if lighting should not be turned off).
- Controller shall have an adjustable changeover set point from 14°F to 70°F (-10.0°C to 21.0°C) based on outside air temperature for economizer function. The controller will switch between mechanical (compressor) cooling or free cooling (economizer) based on this set point.
- Controller shall have an adjustable minimum outside air damper position from 0% to 100% for economizer function. This function shall be enabled on when the controller is in “occupied” mode.



- Controller shall have an adjustable free cooling mixed air set point 50°F to 90°F (10.0°C to 32.0°C) for economizer function if mixed air temperature sensor is installed. The controller shall have the ability to display the mixed air temperature directly on the LCD screen.
- Controller shall provide the following local monitoring functionality, useable with standard or custom applications:
  - UI-16
    1. **(None)**: No function will be associated with the input
    2. **(Rem NSB)**: remote NSB timer clock input. The scheduling will now be set as per the binary input. It provides low cost setback operation via a dry contact.  
Contact opened = Occupied  
Contact closed = Unoccupied
    3. **(Motion NO) and (Motion NC)**: Advanced PIR occupancy functions using a normally open (NO) or normally closed (NC) remote PIR motion sensor. Occupancy mode is now set as per applied PIR function and configuration. Application information and examples are available on document: APP-PIR-SE8xxx. This document will provide the installers and system designers with detailed examples on applications, parameter configuration information, sequence of operation, troubleshooting and diagnostic help required for the proper usage of the onboard PIR sensor.
    4. **(Window) EMS**: Forces the system to disable any current heating or cooling action by the Terminal Equipment Controller. The mode stays the same and the current setpoints are the same occupied setpoints. Only the outputs are disabled. There is a Door/Window alarm displayed on the Terminal Equipment Controller to indicate to the local tenant that the door/window needs to be closed for cooling or heating to resume. Use NC contact.  
Contact opened = System disabled with local Window alarm  
Contact closed = System enabled
    5. **(Fan lock)**: a Fan lock alarm short text message will be displayed on the Terminal Equipment Controller screen when the input is not energized. Used in conjunction with a local airflow sensor connected to the input. Locks out the Terminal Equipment Controller heating and cooling action if no airflow is detected 10 seconds after the fan (G terminal) is energized.  
Open contact = no airflow  
Closed contacts = airflow present
  - UI-17
    1. **(None)**: No function will be associated with the input. Input can be used for remote network monitoring.
    2. **(Door Dry) Door contact & Motion detector**: This configuration is only functional if binary input #1 is set to Motion NO or Motion NC or an onboard PIR sensor is used. With this sequence enabled, the occupancy is now dictated through those 2 inputs. Any motion detected will set the zone to occupied status. The zone will remain permanently in occupied mode until the door contact switch opens momentarily. The Terminal Equipment Controller will then go in stand-by mode. If more movements are detected, the occupied mode will resume. While the door is opened, any movements detected by the remote PIR sensor or the onboard PIR sensor will be ignored. Use a Normally Closed contact switching device.  
Contact opened = Door opened  
Contact closed = Door closed



3. **(Override):** Temporary override remote contact. Disables all override menu function of the Terminal Equipment Controller. The override function is now controlled by a manual remote momentarily closed contact. When configured in this mode, the input operates in a toggle mode. With this function enabled it is now possible to toggle between unoccupied & occupied setpoints for the amount of time set by parameter (TOccTime) temporary occupancy time. When Override is enabled, an Override status message will be displayed
  4. **(Filter):** a Filter alarm short text message will be displayed on the Terminal Equipment Controller screen when the input is energized
  5. **(Service):** a Service alarm short text message will be displayed on the Terminal Equipment Controller screen when the input is energized
- UI-19
1. **None:** no function associated with input though input can be used for remote network monitoring.
  2. **CO2:** the 0-10VDC input value is used as a 0-2000ppm CO2 level:  
0 VDC = 0ppm  
10VDC = 2000ppm

#### **Optional: Onboard Passive Infrared (PIR) Sensor**

- Controller can be supplied with an installed PIR sensor. Passive infrared sensor shall be integrated into the controller. Controls with remote motion detectors are not acceptable.
- PIR sensor shall add a third level of occupancy, “Stand-by” in between “Occupied” and “Unoccupied”.
- Controller shall have an adjustable timer integrated to change the occupancy mode from “Occupied” to “Stand-by” if no motion is detected for the specified amount of time during “Occupied” mode.
- Controller shall have an adjustable timer integrated to change the occupancy mode from “Stand-by” mode to “Unoccupied” if no motion is detected for the specified amount of time during “Stand-by” mode.
- “Stand-by” mode shall have adjustable heating and cooling set points. Stand-by set points are intended to be set a few degrees less or more respectively than “Occupied” set points to ensure a quick recovery to “Occupied” set points when motion is detected.
- Controls with motion detectors that only switch from “Unoccupied” mode to “Occupied” mode without a stand-by mode are not acceptable.

#### **Optional: ZigBee Pro wireless communication on-board or adapter**

- Controller shall be able to pair with up to 10 ZigBee end devices using interface screen to enter pairing mode.

**Controllers are Schneider Electric model VT8650U5000B**

**Controllers with integrated PIR sensor are Schneider Electric model VT8650U5500B**

**Controllers with integrated PIR sensor and onboard ZigBee radio are Schneider Electric model VT8650U5500BP**