Viconics Zoning System Application Guide
VZ7200F5x00B and VZ76565000B Thermostats

BACnet_Zoning_System_Guide-E03
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Please refer to the installation manuals of the zoning system thermostats for all required information related to wiring, installation, commissioning and integration:

- For detailed information on the Viconics VZ72xx zone thermostat, please refer and read the VZ72xx product guide. Installation and commissioning information is available on document: *LIT-VZ7200B-Exx*
- For detailed information on the Viconics VZ76xx RTU thermostat, please refer and read the VZ76xx product guide. Installation and commissioning information is available on document: *LIT-VZ7600B-Exx*
- Information on 3rd party BACnet integration, is available on document *ITG-VZ7xxx-BAC-Exx*

1) System Overview and Architecture

The Viconics Zoning System product is comprised of two thermostat types.

- The VZ7200F5x00B Zoning thermostat
- The VZ7656B1000B RTU thermostat

When combined, they deliver a simple and efficient demand based system implementation which controls pressure dependent VAV zones with roof top units (RTU). The system is designed to work with small to medium sized RTU staged heating and cooling equipment (2 to 20 tons).

A local BACnet RS485 MS-TP communication bus between all devices insures proper communication and data exchange of all required information between the zones and the RTUs. They can be seamlessly integrated into any 3rd party BACnet supervision system.

The Viconics **VZ7200F5x00B BACnet thermostat** family is specifically designed for local pressure dependent VAV zone control within Viconics zoning system product family.

The primary damper output uses a common 0 to 10 Vdc VAV actuator for control.

The product features a backlit LCD display with dedicated function menu buttons for simple user operation. Accurate temperature control is achieved due to the product's PI proportional control algorithm, which virtually eliminates temperature offset associated with traditional, differential-based thermostats.

The Zone thermostats are also compatible with the new Viconics PIR cover accessories. Thermostat is equipped with a PIR cover which provides advanced active occupancy logic. The system will automatically switch occupancy levels from occupied to stand-by and unoccupied as required when activity is detected or not detected by the unit. This advanced occupancy functionality provides valuable energy savings during occupied hours without sacrificing occupant comfort. All zone thermostats can be ordered with or without a factory installed PIR cover.

The following hardware is required for operation of the zone thermostats but not included:

- 24 Vac power supply. Dedicated to a single zone or many zones
- An analog 0 to 10 Vdc pressure dependent actuator
- Terminal reheat if required by the design
- Proper wiring of all components as per the installation manual
- Proper network wires pulled through all devices communication connections

The Viconics **VZ7656B1000B BACnet Roof Top Unit (RTU) thermostat** has been specifically designed for equipment control based on the zone demands.

The RTU thermostat has been designed for single stage or multi-stage control of heating and cooling equipment such as rooftop and self-contained units used in zoning systems.

The product also features a backlit LCD display with dedicated function menu buttons for simple operation. Accurate temperature control is achieved through to the product's PI proportional control algorithm, which virtually eliminates temperature offset associated with traditional, differential-based thermostats.

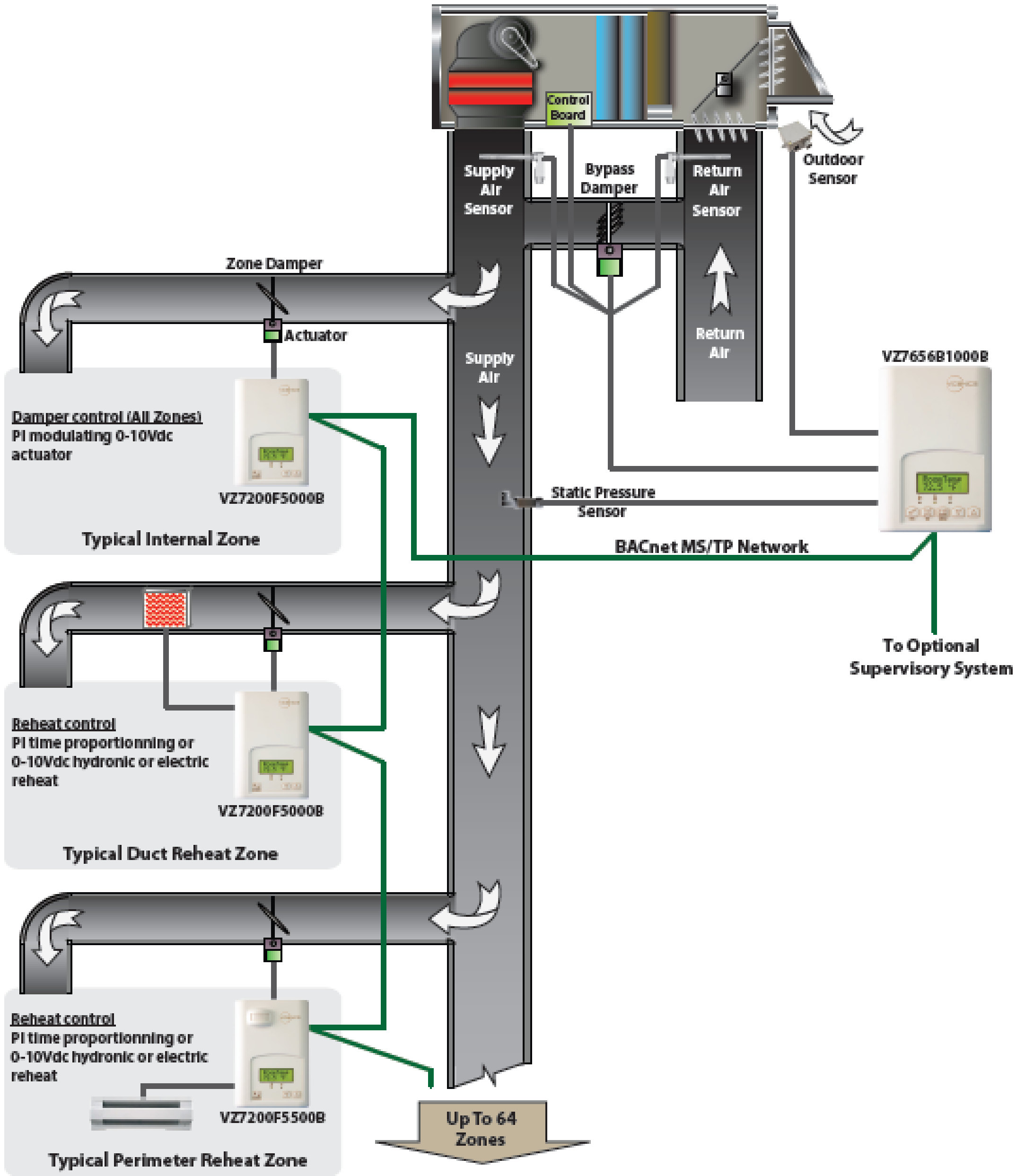
The thermostat also contains extra digital inputs, which can be set by the user to monitor filter status or can be used as a general purpose service indicator. All models contain a SPST auxiliary switch, which can be used to control lighting or disable the RTU economizer function during unoccupied periods. It also features a discharge air sensor input. Proportional static pressure logic (input and output) has been integrated onto the thermostat to provide a complete single packaged unit for most small to medium size jobs.

The following hardware is required for operation of the RTU thermostats, but not included:

- 24 Vac power supply. Typically taken directly from the RTU power supply (C & RC)
- An outdoor air sensor (Viconics S2020E1000)
- A supply air duct sensor (Viconics S2000D1000)
- A return air duct sensor (Viconics S2000D1000)
- A 0 to 5 Vdc static pressure sensor and transducer
- An analog 0 to 10 Vdc by-pass damper actuator (spring-return or not)
- Proper wiring of all components as per the installation manual
- Proper network wires pulled through all devices communication connections

BACnet System Overview

Viconics VZ72005x00B Zone thermostats are used in conjunction with the VZ7656B1000B roof top controller thermostats. When combined, they are designed for operate typical single or multistage RTUs and their associated local zones.



Typical BACnet zoning system installation

Please refer to the following Viconics documents for detailed information and design guidelines on the BACnet zoning system version:

The following documents are available at: www.viconics.com

- For detailed information on the Viconics VZ72xx Zone thermostat, please refer and read the VZ72xx Product Guide. Installation and commissioning information is available on document: *LIT-VZ7200_B-Exx*
- For detailed information on the Viconics VZ76xx RTU thermostat, please refer and read the VZ76 Product Guide. Installation and commissioning information is available on document: *LIT-VZ7656_B-Exx*
- PIR cover installation information is available on document: *PIR Cover Installation-Exx*
- Information on 3rd party BACnet integration, is available on document *ITG-VZ7xxx-BAC-Exx*

As an example, a typical job layout system may feature 3 RTU thermostats with 31 zones total. This would bring to total number of nodes (individual Com addresses) to 34. RTU 1 would have 10 zones under its command, RTU 2 would have 10 zones under its command and RTU 3 would have 11 zones under its command.

1A) Initial Design Considerations

The scope of this document is not intended to be a resource or white paper on VAV zoning system design. There are many good resources available on the subject of VAV zoning systems and their associated advantages and disadvantages. Please consult these resources for further information on this subject.

It is the responsibility of the designer and installer to ensure the following considerations are met:

- Size the installed equipment for properly calculated heating and or cooling peak loads. There are no advantages to over sizing the system's capacity to more than what is required as this simply leads to short cycling of the equipment during small load periods.
- Properly size and layout all ductworks including the by-pass damper according to local codes and standards in effect.
- Properly size the capacity of the zones according to the actual requirements of the room. Using square footage calculations only can create situations where the installed total deliverable load may be insufficient for the actual intended use of an area. Conference rooms, computer rooms, cafeterias or other rooms where large gatherings occur would be a prime example of this scenario.

It is not the mandate of the zoning control system to correct for wrong initial mechanical layout and or load calculations of the mechanical equipment. The control system will attempt to deliver the loads required by master demanding zones by distributing the total available capacity of the installed equipment to the required demanding areas. If the equipment is undersized for the required peak loads, the control system will distribute the available capacity according to the priorities requested hence making most of the areas comfortable.

Proper planning and design will ensure that a job site will be up and running faster with less service calls during the initial occupancy period.

1B) Scalability and Limitations

The system is fully scalable in terms of number of zone thermostats and RTU thermostats used on the same network layer (BACnet MS-TP or Wireless models).

BACnet thermostat system overview:

A BACnet MS-TP network segment is a single 22 gauge shielded network wire loop run between all devices communication connections that is no longer than 1200 meters (4000 feet). It is possible to install up a maximum of 64 nodes on a single network segment.

To install more than 64 nodes or if the network wire loop is longer than 1200 meters (4000 feet), repeaters will be needed for proper communication. Please refer to the BACnet integration guide if repeaters are required. With the proper use of repeaters, the maximum number of nodes on a single BACnet MS-TP trunk can be extended to 128 nodes.

	Smallest System Supported		**Largest System Supported**	
	Number of Zones	**Number of RTUs**	**Number of Zones**	**Number of RTUs**
Single Segment of 64 nodes maximum	1 zone reporting to	1 RTU Minimum	63 zone reporting to	1 RTU Minimum
			32 zone reporting to	32 RTU Maximum
Single Network trunk of 128 nodes maximum	1 zone reporting to	1 RTU Minimum	126 zone reporting to	1 RTU Minimum
			63 zone reporting to	63 RTU Maximum

With BACnet supervision devices and multiple systems installed on a job site, there is no practical limit to the number of zone and RTU thermostats which can be installed on a single job site.

1C) Local Zone with Terminal Reheat or without Terminal Reheat

Including or excluding use of terminal reheat is dictated by design criteria's of the installer. The use of terminal reheat in a VAV system will always result in a more comfortable set-up for the occupants of the space. However this may not be practical from a cost standpoint or regional requirements. System designs will vary from Northern to Southern and Eastern to Western geographical locations because of the specific regions peak load requirements.

In colder climates, VAV system heating operation without the use of terminal reheat typically always results in colder outside walls. Although the zone dry-bulb temperature may be well maintained, it may be possible for occupants not to be comfortable simply because of the low outside wall temperate.

Also, in the perimeter zones, the delivery process of the heating capacity from the ceiling is not as efficient as when delivering the heating load directly where the losses occur such as in the case of a perimeter electric baseboard or perimeter hydronic baseboard.

In regions where the heating load is small and required for only a small portion of the year, a properly sized up zone VAV can deliverer the required heating demand and insure comfort without the use or terminal reheat. However it is important to design the zone ductwork and area diffusers to be the most efficient with air delivery close to the outside walls.

In certain problematic cases where air delivery may be an issue, the use of fan powered VAV units may reduce the occupant discomfort by providing constant airflow to the zone and maximizing the air delivery process.

1 D) Special Considerations

A typical office installation may require that a single unit service areas being used for different applications. These areas will commonly be a combination of external and internal zones.

It is always good to verify the intended use of all areas knowing their true peak loads before committing to its final design and sizing.

It may be necessary to oversize or undersize the design to meet their daily demands. The following are examples of when over sizing of a zone damper may be needed:

- Areas with oversized windows that are exposed to the sun longer
- Conference rooms
- Cafeterias
- Areas with vending machines
- Areas with extra lighting
- Areas with computers, photocopier, etc…..

Areas such as computer rooms, kitchens and certain types of conference rooms may warrant a totally separate system of their own and should not be part of the zones attached to an RTU. Certain critical areas may call for cooling all year long and based on system settings could only guarantee occupant comfort a portion of the year.

Knowing the critical areas of a building in advance and designing for them specifically will always result in a more comfortable occupant. And it can be as simple as adding terminal reheat, radiant floor heating, a fan powered VAV or even a separate small water source heat pump to critical area.

1E) By-Pass Damper Design Rules

A bypass damper is an airflow regulating device connected between the supply and return ducts. The bypass damper will automatically open and bypass supply air normally delivered to the zone directly from the supply to the return on a pressure rise when the VAV zone dampers are closing.

The by-pass damper should be sized to allow at least 70 to 80% of the nominal airflow of the RTU. A simple way to determine if it is sized properly, assume all VAV zones are closed to their minimum position. The by-pass should be large enough to re-circulate all the air from the RTU minus the amount set by the minimum positions at the zones. A properly sized damper will result in an efficient and quiet operation.

2) Zone Thermostats VZ7200F5x00B Operation

The following information needs to be carefully read and properly understood if proper system commissioning is to be achieved.

Contrary to low end commercial and residential zoning thermostats which use a two positions open-close actuator, Viconics VZ7200F5x00B uses proportional analog 0 to 10 Vdc modulating damper actuator. This enables performances and control sequences to be much closer to what is normally found in DDC application specific control devices.

The operation of the ZONE thermostats is intrinsically linked with the operation of their RTU thermostat. Although it will operate in a stand-alone mode if the communication network is down, normal operation of the system as a whole requires that communication with the RTU thermostat is functional.

Data exchanged from the ZONE thermostats to the RTU thermostat:

- Current PI heating demand (output value is based on PI heating weight configuration)
- Current PI cooling demand (output value is based on PI cooling weight configuration)

Data exchanged from the RTU thermostat to the ZONE thermostats:

- Current central system occupancy
- Current system mode active (hot air or cold air being delivered)
- Outdoor air temperature

2A) Demand Based Heating and Cooling Systems

System operation as a whole consists of selecting which zone thermostats will have heating and cooling weighted votes used by the RTU thermostat to which they are attached. The weighted heating and cooling demand values from the selected master zones are then used by the RTU thermostat to determine if heating or cooling action is required for the system as a whole.

Both internal and external zones are typically serviced by the same unit. This means that the system may be exposed to conflicting heating and cooling demands in mid-seasons. The conflicting demand conditions are addressed with the heating and cooling lockouts based on the outside air temperature value at the RTU.

The heating or cooling action at the zone is dependent on how the RTU thermostat treats and calculates what will be delivered point in time to the zones. Many factors can influence the delivery or availability of hot air or cold air to satisfy the current zone demand point in time.

The following is an example of a RTU system mode calculation based on highest, average of the three highest demands or the average of the five highest demands.

Example 1 with 3 voting master zones only

Voting Zone 1	Voting Zone 2	Voting Zone 3	RTU Control Type	
Current heat demand	Current heat demand	Current heat demand	Highest	Average of 3 highest
50%	0%	0%		
Heat weight set	Heat weight set	Heat weight set		
50%	100%	100%		
Resulting heat weight to RTU	Resulting heat weight to RTU	Resulting heat weight to RTU		
25%	0%	0%	25%	8.3%
Current cool demand	Current cool demand	Current cool demand		
0%	100%	100%		
Cool weight set	Cool weight set	Cool weight set		
100%	100%	50%		
Resulting cool weight to RTU	Resulting cool weight to RTU	Resulting cool weight to RTU		
0%	100%	50%	100%	50%

It can be seen here that the resulting demand used by the RTU thermostat for the three master voting zones are different and will result in different heating and cooling actions simply based on the RTU configuration.

Example 2 with 3 voting master zones only

Voting Zone 1	Voting Zone 2	Voting Zone 3	RTU Control Type	
Current heat demand	Current heat demand	Current heat demand	Highest	Average of 3 highest
100%	0%	0%		
Heat weight set	Heat weight set	Heat weight set		
100%	100%	100%		
Resulting heat weight to RTU	Resulting heat weight to RTU	Resulting heat weight to RTU		
100%	0%	0%	100%	33.3%
Current cool demand	Current cool demand	Current cool demand		
0%	100%	100%		
Cool weight set	Cool weight set	Cool weight set		
100%	75%	75%		
Resulting cool weight to RTU	Resulting cool weight to RTU	Resulting cool weight to RTU		
0%	75%	75%	75%	50%

It can be seen here that the resulting demand used by the RTU thermostat for the three master voting zones are different and will result in different heating and cooling action simply based on the RTU configuration.

- If the RTU is set to Control Type = Highest demand, the current action delivered by the RTU will be heating.

- If the RTU is set to Control Type = Average of 3 Highest demand, the current action delivered by the RTU will be cooling.

Example 3 with 5 voting master zones only

Voting Zone 1	**Voting Zone 2**	**Voting Zone 3**	**Voting Zone 4**	**Voting Zone 5**	**RTU Control Type**		
Current heat demand	Current heat demand	Current heat demand	Current heat demand	Current heat demand	Highest	Average of 3 highest	Average of 5 highest
100%	0%	50%%	50%	0%			
Heat weight set	Heat weight set	Heat weight set	Heat weight set	Heat weight set			
100%	100%	100%	50%	100%			
Resulting heat weight to RTU	Resulting heat weight to RTU	Resulting heat weight to RTU	Resulting heat weight to RTU	Resulting heat weight to RTU			
100%	0%	50%	25%	0%	100%	58.3%	35%
Current cool demand	Current cool demand	Current cool demand	Current cool demand	Current cool demand			
0%	100%	0%	0%	100%			
Cool weight set	Cool weight set	Cool weight set	Cool weight set	Cool weight set			
100%	50%	50%	50%	75%			
Resulting cool weight to RTU	Resulting cool weight to RTU	Resulting cool weight to RTU	Resulting cool weight to RTU	Resulting cool weight to RTU			
0%	50%	0%	0%	75%	75%	41.7.3%	25%

It can be seen here that the resulting demand used by the RTU thermostat for the five master voting zones are different and will result in different heating action simply based on the RTU configuration.

Please note that the heating or cooling action delivered to the zones is also dependent on heating and cooling lockout functions based on the outdoor and supply air temperature. Please see the next section for more information.

2B) Overrides and User Zone Interface Lockouts

Each zone thermostat can have a function locked out for the local user. This can prevent unwanted inputs to the system as a whole when the zone thermostats are installed in public areas or when certain local user interface functions of the zone thermostats are to be prevented.

Lock level is access through the lockout configuration parameter. Please set the appropriate level for each individual zone in the system according to their requirements.

VZ72xx Thermostat Lockout Level Configuration Value	**0**	**1**	**2**	**3**
Local occupied set point access using the Up and Down arrow keys	Yes	Yes	Yes	No
Pressing the local override key will command the local override function only, However the local heating and cooling demands are not sent to the RTU thermostat and the central system will not restart. Typically used only when perimeter reheat is used and re-started during an override period. Pressing the override key allows an override for this zone thermostat only.	Yes	Yes	No	No
Pressing the local override key will command the local override function and allow the local heating and cooling demands to be sent to the RTU thermostat. This will have the effect of re-starting the central system and allowing delivery of hot or cold air based on the current local demand. Pressing the override key allows an override for this zone thermostat only. All other zones although being delivered hot or cold air will still be in unoccupied mode and using their unoccupied set points.	Yes	No	No	No

Pressing local keys that have their function locked out will display a “keypad lock” message on the zone thermostat display.

If a global override is required for the whole system and all zones return to occupied mode, then the override needs to be enabled at the RTU thermostat itself. This can be accomplished by using the local user menu at the RTU thermostat or configuring the extra digital input as a remote override button if the location of the override button is required to be installed centrally.

2C) Zone Set point Limits

It cannot be stressed enough that must take caution and properly explain to the user or tenants of the building or system that a demand based heating or cooling system is designed to respond to actual local demand of a number of selected zones. Even if the local demand cannot be meet by the central system.

For the following reason it is recommended to “limit” the set point adjustments of any zone thermostat that have actual demand voting capacity at the RTU thermostat. It is also recommended to limit set points of all zones even if they are not voting on central RTU demand.

This will prevent any local set point adjustments that may create heating or cooling locking conditions at the RTU thermostat by having local set points that are not reachable. It also avoids any master voting thermostat from having unreasonable authority over the zoning system.

Ex.: If a local user sets the current occupied set point to 62°F, the PI weighted demand sent by this zone to the RTU thermostat will always be at its maximum value.

Configuration Parameter	Factory Default Value	**Recommended Settings**
Heat max Maximum local heating set point limit	Default: **90 °F (32 °C)**	**75 °F (24 °C)**
Cool min Minimum local cooling set point limit	Default: **54 °F (12 °C)**	**68 °F (20 °C)**

2D) Heating and Cooling Weight Zone Selection

For any system to operate properly, care must be taken to select which zones will be driving the system as well as their weight attached to the calculations.

The values below are provided as an initial rule of thumb and need to be re-evaluated on a job per job basis depending on the specifics of the system design and layout.

Total number of zones	System layout	Recommended initial number of master voting zones with weight
1 to 5	All internal or external zones	1 to 3
3 to 5	Mix and match of internal and external zones	2 to 3
6 to 20	Mix and match of internal and external zones	3 to 8
21 +	Mix and match of internal and external zones	8 +

Notes regarding the master voting zones selection:

- Not all zones in the system need to be masters. A good rule of thumb is to provide a ratio of 1/3 to 1/2 of the total number of zones which can be master to the system.
- On larger installations where internal zones are present in the system. I.E. zones not exposed to an outside wall. The ratio of internal to external master zones should be in the approximate range of 1 internal zone to 4 external zones.

- Zones selected to be masters for demand calculations should represent either:
    - Typical zones or areas that will be exposed to some of the highest peak heating and cooling loads.
    - Zones or areas that represent a significant portion of the equipment peak load capacity. Example, if a system has five zones where a single zone represents ½ of the total MAX CFM of the equipment, then for sure this zone needs to be master to the system.
    - Zones or areas that are subject to temporarily larger occupancy need to be part of demand calculations if the zones are to be expected to respond during those spikes of occupancy. Typical examples are: Conference room, cafeteria and other such common areas.
- Attaching a zone as a master to the system which is either undersized or was commissioned with operational flaws and errors may result in erratic system behaviour by adding total demand that cannot be met by the system.

Notes regarding the weight parameter value of the master zones:

- Internal zones do not need to affect heating demand calculations. They should only affect the cooling demand calculations. Such zones will always call for cooling during occupied periods even during winter. If they where to call for heating at a certain point in time, then the surrounding external zones would typically already be in heating mode.
    - It is possible for an internal zone to be slightly overcooled during peak summer cooling loads because of the dampers minimum position during occupied periods. The RTU is providing its maximum cooling capacity and the amount of cold air provided by the minimum position is already providing more capacity to the internal zone.
    - Alternately, it is also possible for an internal zone to be slightly overheated during peak winter heating loads because of the dampers minimum position. During occupied periods the RTU is providing its maximum heating capacity and the amount of hot air provided by the dampers minimum position will provide more heat to the internal zone than necessary.
- External zones considered of primary importance should have both their heating and cooling weight set to 100%
- Zones considered of secondary importance can have their weight set to a lesser value than 100% to reflect their importance on the systems total voting when making demand calculations.
- Due to, their location, exposure, design, etc……, certain zones can have problematic behaviour specifically in peak heating or cooling mode. (Ex.: when an office surrounded by panoramic windows).

    These zones can have their peak load demand satisfied. However this will be either at the expense of energy used and or slightly overheating or overcooling the other zones.

    It is the responsibility of the installer to properly identify any problematic areas and to determine if those problematic areas are to be either fully satisfied or to simply leave them unsatisfied during certain peak load periods in order to minimize energy consumption and to allow the rest of the zones in the system to be optimized.

    When dealing with the type of system which control many areas from a single central system, a choice must be taken during set-up to either prioritize comfort or equipment cycling and energy consumption.

    - Adding many master voting zones (including problematic ones) to an RTU thermostat will provide better comfort at the expense of higher energy consumption.
    - Restricting the number of master voting zones (and excluding the problematic ones) to the RTU thermostat will always provide a more energy efficient system at the expense of comfort in certain areas.

2E) Minimum, Maximum and Heat flow Adjustments

Although system balancing can be accomplished by utilizing the thermostat's built in configuration settings. It is recommended to add a balancing side-takeoff damper on all zones. This will ensure that any supplementary air can be reduced and will limit excessive noise due to airflow if the zones or associated ductwork were improperly sized.

Minimum Position Ajustement (Min Pos)

This parameter sets the minimum amount of air being delivered to the zone. The VAV damper (when powered) will never close below this value setting.

Maximum Position Adjustment (Max Pos)

This parameter sets the maximum amount of air being delivered to the zone; both in heating and cooling mode. The VAV damper (when powered) will never open above this value setting.

Please note that the maximum amount of hot air delivered is set by this parameter, and NOT the Max Heat flow parameter. Please refer to the next section for a description and usage of the Max Heat flow parameter functions.

Maximum Heat flow Adjustment (MaxHTPos)

Many installers will assume that this parameter sets the Maximum airflow of the VAV damper when the RTU is delivering hot air. This is not the case. Both the maximum amount of cold AND hot air delivered to the zone is set by the (Max Pos) zone damper parameter. Please see section above for more details.

The value set by this parameter will open the damper to a maximum heating position and will maximize hot air flow when heat is requested with cold primary air using the duct reheat output.

The Max Heat flow function is only used if the local reheat configuration (RehtConf) is set to any value except None. None = No local reheat. An example of this is a local reheat configuration using a duct mounted reheat coil device.

Type of reheat configured (RehtConf)	BO5 reheat output time base (BO5 Time	MaxHTPos value function and adjustment
0 = None	N/A	Leave default of 30% or any adjustment. MaxHTPos is not used in scenario
1 = Analog Duct Rht Only	N/A	Set to any value superior to the current selected minimum position. Ex. If the minimum airflow is set at 25% and Max heat is set at 75%. If primary is cold air; when the PI heating loop (and analog output) goes from 0 to 100%, the damper linearly move from 25% to 75% opening
2 = On/Off Duct Rht Only	0= 15 minutes	Set to any value superior to the current selected minimum position. Ex. If the minimum airflow is set at 25% and Max heat is set at 75%. If primary is cold air; when the BO5 output is energized on a call for heat, the damper will directly move from 25% to a 75% position. As soon as BO5 is de-energized, the damper will move back to 25% opening
	1= 10 seconds for Solid state relays	Set to any value superior to the current selected minimum position. Ex. If the minimum airflow is set at 25% and Max heat is set at 75%. If primary is cold air; when the PI heating loop (and pulsed BO5 output) goes from 0 to 100%, the damper linearly moves from 25% to 75% opening
3 = On/Off Peri Rht Only	0= 15 minutes	Leave default of 30% or any adjustment. MaxHTPos is not used in scenario
	1= 10 seconds for Solid state relays	Leave default of 30% or any adjustment. MaxHTPos is not used in scenario
4 = Analog Duct Rht & On/Off Peri Rht		Set to any value superior to the current selected minimum position. Ex. If the minimum airflow is set at 25% and Max heat is set at 75%. If primary is cold air; when the PI heating loop (and analog output) goes from 0 to 100%, the damper linearly moves from 25% to 75% opening

- The selected zone dampers minimum position has a direct impact on the temperature stability for certain zones. Having a minimum position selected may produce an over cooling or over heating effect. This effect is created when the primary air temperature is in the inverse mode than that which the zone currently requires. An example of this is when an internal zone is requesting cooling during winter while the RTU is supplying hot air for the external zones.

  Adjusting the minimum position of a zone damper is mandatory by NA standards. It is however the choice of the installer to decide if in some cases removing it or lowering it to a value below standard may solves a system design issue. A good example of this would be an internal zone with a grossly oversized VAV unit.

How to test and balance the Minimum, Maximum and Heat Flow values:

Balancing Minimum Air Flow

1. Be sure local system heating is allowed by setting the outdoor heating lockout value at the RTU thermostat (H Lock)
2. Be sure the system is currently in heating mode. As viewed locally at the RTU thermostat by pressing the manual scroll button and displaying the local Zone Sequence = Heat message prompt.
3. Be sure that the master voting zones are calling for heating by setting the appropriate set points accordingly.
4. Set the currently balanced thermostat set point to its minimum value. An example of this would be 60F or when the set point is at least 7-8 F lower than the current room temperature. This will drive the VAV zone to its minimum value.
5. Set the (Min Pos) configuration parameter to the desired value as required by balancing.

Balancing Maximum Air Flow

1. Be sure local system heating is allowed by setting the outdoor heating lockout value at the RTU thermostat (H Lock)
2. Be sure the system is currently in heating mode. As viewed locally at the RTU thermostat by pressing the manual scroll button and displaying the local Zone Sequence = Heat message prompt.
3. Be sure that the master voting zones are calling for heating by setting the appropriate set points accordingly.
4. Set the currently balanced thermostat set point to its minimum value. An example of this would be 60F or when the set point is at least 7-8 F lower than the current room temperature. This will drive the VAV zone to its minimum value.
5. Set the (Max Pos) configuration parameter to the desired value as required by balancing.

Balancing Maximum Heat Flow

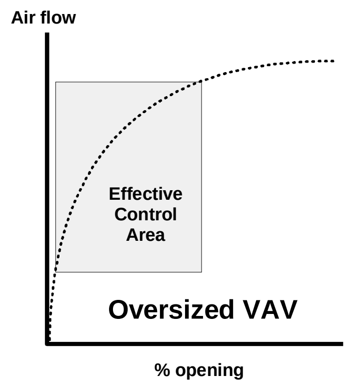
1. Be sure local system cooling is allowed by setting the outdoor cooling lockout value at the RTU thermostat (C Lock).
2. Be sure local reheat is allowed by appropriately setting the outdoor reheat lockout value at the Zone thermostat (AO2 OALK or BO5 OALK).
3. Be sure the system is currently in cooling mode. As viewed locally at the RTU thermostat by pressing the manual scroll button and displaying the local Zone Sequence = Cool message prompt.
4. Be sure that the master voting zones are calling for cooling by setting the appropriate set points accordingly.
5. Set the currently balanced thermostat set point to its minimum value. An example of this would be 60F or when the set point is at least 7-8 F lower than the current room temperature. This will drive the VAV zone to its minimum value.
6. Set the (MaxHTPos) configuration parameter to the desired value as required by balancing.

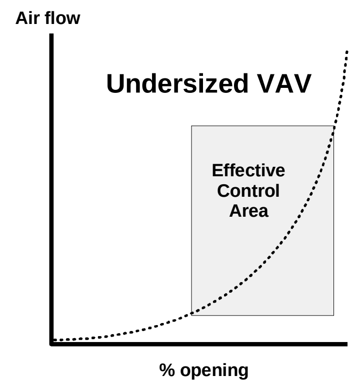
Please note:

- 0 to 100 % is directly converted to 0 to 10 Vdc on the VAV damper output. If the actuator has a positioning input range of 2 to 10 Vdc, then entering 50% minimum position is not directly converted to 50% VAV damper position. Please refer to table below

VAV damper position required	0%	10%	20%	30%	40%	50%	60%	70%	80%	100%
Setting for 0-10 Vdc Actuator	0%	10%	20%	30%	40%	50%	60%	70%	80%	100%
Setting for 2-10 Vdc Actuator	0 to 20%	28%	36%	44%	52%	60%	68%	76%	84%	100%

- The damper position is never linear or proportional to airflow in a pressure dependent application. Depending on how the zone damper was sized, a box may best slightly oversized, or slightly undersized. In all cases, the PI loop (Proportional Integral) of the zone thermostat will always compensate to find the proper required position to satisfy the current zone demand.





Be sure the VAV actuator is properly installed and set-up so the VAV damper blade is able to rotate from the fully opened, to fully closed position with no restriction to its mechanical rotation.

2F) Terminal Reheat Lockout

It is possible to lockout out the local terminal reheat function of the zones during hot seasons or when no longer required. This prevents users from using the local reheat function simply based on a configured outside air temperature value.

If RehtConf is set to	AO2 OALK	BO5 OALK
0 = None	N/A, reheat not used	N/A, reheat not used
1 = Analog Duct Reheat Only	Set to desired value	N/A BO5 not used by this reheat sequence
2 = On/Off Duct Reheat Only	N/A AO2 not used by this reheat sequence	Set to desired value
3 = On/Off Perimeter Reheat Only	N/A AO2 not used by this reheat sequence	Set to desired value
4 = Analog Duct Reheat & On/Off Perimeter Reheat	Set to desired value. Can be different than BO5 OALK	Set to desired value. Can be different than AO2 OALK

2 G) Passive Infra Red Motion Detector Cover (PIR)

The Viconics zone thermostats are compatible with the new Viconics PIR (Passive Infra Red) cover accessory. Thermostats equipped with a PIR cover provide advanced active occupancy logic, which can automatically switch occupancy levels from occupied to stand-by as required when local activity is detected in the room.

This advanced occupancy functionality provides advantageous energy savings during occupied hours without sacrificing occupant comfort. All zone thermostats can be ordered with or without a factory installed PIR cover.

This allows zones, which are infrequently occupied such as a conference room, storage areas or other rooms to use relaxed set points during periods when there are no occupants present in the zone.

The advantage of using stand-by set points is to permit the system to recover fairly rapidly from stand-by to occupied set points once movements are detected in a zone. The relaxed values of the stand-by setpoints need to be far enough from occupied set points to optimise the energy savings a PIR cover can provide yet close enough for the system to recover quickly and be within the occupants comfort zone in as short a time as possible. If the span (Delta Temperature) from occupied to stand-by setpoints is too large, the zone will not be able to recover quickly and the occupants will be left uncomfortable for the duration of the occupied periods initiated by the PIR.

In order for the PIR logic function to be enabled, the following settings must be enabled at the zone thermostat.

- If a local PIR cover is used, be sure to set the (**PIR Func**) parameter to **ON.**
- If a remote PIR sensor is used on BI1, be sure to set the (BI1) parameter to **Motion NO** or **Motion NC**.

PIR logic

The PIR function is only used during occupied periods. If occupancy is desired during an unoccupied period, simply press the local override button (if allowed by the local lockout level configuration). Then local occupancy will toggle to override (local occupied) as per the ToccTimer time value for overrides.

	Zone commanded occupied by the RTU schedule
Initial state when no movements are detected by the PIR sensor	Stand-by
Initial movement detected by the thermostat (PIR cover or remote PIR)	Occupied for 60 minutes after the last movement has been detected. When the 60 minute timer value has expired and no new movements have been detected, the thermostat will resume the stand-by mode.

3) RTU Thermostats VZ7656B1000B Operation

The following information needs to be carefully read and properly understood if proper system commissioning is to be achieved.

Unlike low end commercial or residential zoning thermostats which typically only use two position demand or non- demand logic to initialize heating and cooling functions, Viconics VZ7656B1000B uses local PI zone demand(s) to operate heating and cooling stages. Accurate temperature control in the zones is achieved by the time proportional control algorithm. This enables performances and control sequences much closer to what is normally found in DDC application specific control devices.

The operation of the RTU thermostat is linked with the operation of the attached zone thermostats. Although the thermostat it will operate in a stand-alone mode if the communication network is down, normal operation of the system as a whole requires that communication with the attached zone thermostats is functional.

3A) Operation Data Exchanged

Independently of the network layer being BACnet MS-TP or Wireless, the flow of data exchanged between the zones and the RTU thermostat can be summarized as follow:

Heating and cooling demand data is first exchanged from the zone thermostats to the RTU thermostat:

- Current PI heating demand (output value is based on PI heating weight configuration)
- Current PI cooling demand (output value is based on PI cooling weight configuration)

Each voting thermostat will also calculate its demand values based on the current occupancy mode and set points in use: Unoccupied, Stand-By or Occupied.

Based on the control type function setting **(CntrlTyp)**, the RTU thermostat will calculate the resulting heating and cooling zone demands. (See section 2A) Demand Based Heating and Cooling System).

Proper action to the heating or cooling stages using the time proportional control algorithm is accomplished based on heating or cooling values.

- If resulting calculated PI heating demand > resulting calculated PI cooling demand, then zone sequence is heating
- If resulting calculated PI cooling demand > resulting calculated PI heating demand, then zone sequence is cooling
- If resulting calculated PI cooling demand = resulting calculated PI heating demand, then zone sequence stays in last selected mode

Many configuration and operating factors can limit action to the heating and cooling stages. Some example of this would be:

- Heating or cooling lockout based on outdoor air temperature (configuration)
- Heating or cooling lockout based on supply air temperature (configuration)
- Heating or cooling lockout based on anti-cycling (configuration or RTU control card)
- Fixed two minute delay when RTU toggles from heating to cooling and vice-versa (operation)

The RTU thermostat will then forward data to the zone thermostats. An example of the types of data relayed would be:

- Current central system occupancy
- Current zone sequence to use (hot air or cold air being delivered)
- Outdoor air temperature

3B) Occupancy and Overrides

The occupancy of the zones is controlled by the schedule in the RTU thermostat.

- When this schedule output value is unoccupied (as shown on the RTU thermostat display), then the attached zones will be unoccupied mode.
- When this schedule output value is occupied (as shown on the per RTU thermostat display), then the attached zones will be either in occupied mode or stand-by mode if local PIR function is used.

It is possible to use remote scheduling though either BI1 or to use a remote time clock contact closure or a BACnet network occupancy command. This will disable the local schedule occupancy function to the zones. For more information on BACnet, please refer to global override section of the zoning system integration guide. The whole system and all attached zones can only be initiated at the RTU thermostat level. This is done by using the local user menu at the RTU thermostat or by configuring the extra digital input (DI1) for a remote override button if it is required to be installed centrally.

Any zone overrides will trigger the necessary heating or cooling action for the required zones only. All other attached zones not requiring an override will remain in the unoccupied state.

3C) RTU interface Lockouts

RTU thermostat can have functions locked out for the local user. This can prevent unwanted inputs to the system as a whole when the RTU thermostats are installed in public areas or when certain local user interface functions of the RTU thermostats are to be prevented.

Lock level is access through the Lockout configuration parameter. Please set the appropriate level for each individual zone in the system according to their requirements.

VZ76 Thermostat Lockout Level Configuration Value	0	1	2
Global override function through the user menu	Yes	Yes	No
System mode access through the user menu	Yes	No	No
Local schedule access through the user menu	Yes	No	No
Local clock setting through the user menu	Yes	Yes	Yes

3D) RTU Heating and Cooling Supply Air Temperature Lockouts

One problematic aspect of any VAV zoning system is high demand for (heating or cooling) when most of the zone VAV dampers are closed. This leads to most of the supply air being re-circulated through the pressure by-pass and can lead to extremely hot or cold supply temperature.

- To prevent high supply temperatures (specifically with gas heating RTU), adjust discharge air temperature high limit to required value.
  Discharge air temperature high limit default value is: **80°F**
  Range is: 70°F to 150°F (21°C to 65°C) (increments: 0.5° or 5°)

- To prevent low supply temperatures (specifically to prevent freezing of RTU DX coils when a high by-pass ratio is in effect), adjust discharge air temperature low limit to required value.
  Discharge air temperature low limit default value is: **55°F**
  Range is: 35 to 65°F (2.0°C to 19.0°C) (increments: 0.5° or 5°)

3E) RTU Heating and Cooling Outdoor Air Temperature Lockouts

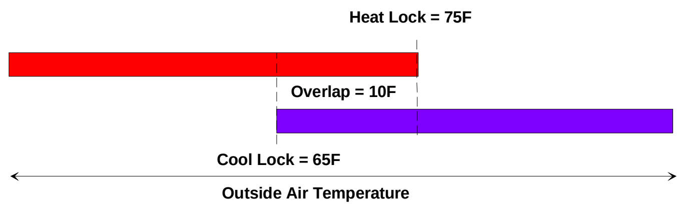
H Lock and C Lock

- Parameter C Lock temperature disables the cooling stages based on the outdoor temperature.
- Parameter H Lock temperature disables the heating stages based on the outdoor temperature.

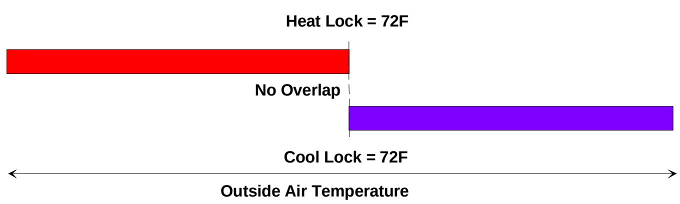
RTU mode lockouts need to be properly set to keep heating or cooling equipment cycling to a minimum. It is the responsibility of the installer to decide if priority of the system will be given to comfort or not. The adjustments for both lockouts will be different based on specific regions load requirements.

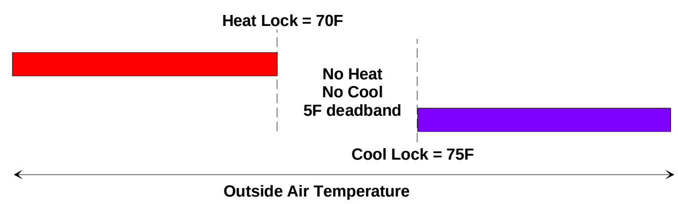
- A system located far north may require the RTU to deliver heating until a 75F outside air value is attained due to the inertia of the building mass which will require heating during a cold night and then will transition to a hot mid-season day.
- A southern system application may require the RTU to always deliver cooling and never lock up the cooling mode while imposing strong restrictions on the heating side of the system.

Heating and cooling RTU equipment cycling will only happen within the overlapping dead band value left between the H Lock and C Lock parameter adjustments. The tighter the value between these two parameters, the less cycling will be encountered.



It is also possible to set the system to completely eliminate heating and cooling equipment cycling based on outdoor air limitations if this type of operation is required. This of will have an impact on specific zone performances.





3F) Critical Mid-Season Changeover

Heating and cooling RTU equipment cycling during mid-seasons is inevitable with a zoning VAV system if any degree of comfort is to be maintained.

A properly setup system will be able to deliver comfort to conflicting zone demands during the mid-season period by alternating heating and cooling at the RTU.

Normally, a lot of the unwanted heating and cooling switchovers can be eliminated by authorizing terminal reheat or by limiting the RTU heating or cooling capacity throughput based on the outdoor temperature **(H Lock and C Lock)**. However, limiting the RTU heating or cooling throughput based on outdoor temperature will have an impact on control performance of certain zones when the required heating or cooling capacity is not available due to the lockout conditions.

Typically, the number of RTU heating or cooling switchovers cycles during conflicting demand situations will be around the same as the RTU CPH settings **(Default of 4 cycles per hour for both heating and cooling).** This will translate into two cooling and two heating cycle periods per hour.

Also, the recorded RTU supply delta temperature and demand variances will always be higher when using a highest demand control type operation versus an average demand method. Energy consumption is also expected to be higher with a highest demand control type operation versus an average demand method of calculating the system requirements.

3G) By-Pass Damper Control and Operation

The RTU thermostat has a built in static pressure control loop with an analog 0 to 10 Vdc by-pass damper output. In order to operate, the static pressure control loop needs to have a static pressure sensor connected to the static pressure input on the RTU thermostat (terminal SP).

The type of pressure transducer used needs to be of voltage type (0 to 5 Vdc) and have a 24 Vac half-bridge power supply.

The range of the pressure transducer needs to be one of the following and needs to be properly configured using the static pressure configuration parameter (SP range).

Static pressure transducer range.
Voltage input range is 0 to 5 Vdc.

- 0 = 0 to 1.5 in WC
- 1 = 0 to 2 in WC
- 2 = 0 to 3 in WC
- 3 = 0 to 4 in WC
- 4 = 0 to 5 in WC

Typically, the static pressure sensor probe is installed 2/3 of the way down the main ventilation duct.

The static pressure set point is set by the configuration parameter (Pressure). The default value is 0.8” WC. The range and adjustability of the set point is: 0 to 2 in WC (0 Pa to 500 Pa) (increments: 0.1” WC or 25 Pa).

Please note that the static pressure scale will automatically change from inches of WC to PA (Pascals) when the local units configuration parameter is changed.

- **0 = SI** for Celsius / Pa pressure scale
- **1 = Imp** for Fahrenheit / in. WC pressure scale

Operation of the static pressure control loop is dependent on the fan running or not. For proper operation of the control loop, the static pressure control actuator needs to be properly installed.

- Control signal = 0 Vdc = Static pressure damper fully closed = No air recirculation from supply to return
- Control signal = 10 Vdc = Static pressure damper fully opened = Maximum air recirculation from supply to return

Operation:

When the fan output is off (Terminal G), the static pressure control loop is off and the by-pass damper is fully opened to 10 Vdc output. This will minimize the air pressure related noise during initial fan start-up. Please note that the fan is ALWAYS on during occupied periods and that it will cycle on demand with the heating and cooling staged only during unoccupied periods.

When the fan output is on (Terminal G), the static pressure control loop is enabled and the by-pass damper will modulate to maintain the desired static pressure set point according to the static pressure input reading at the RTU thermostat. The current static pressure value can be read at the RTU thermostat at any time by using the manual scroll function and displaying the pressure prompt.

4) BACnet Communication Overview

The Viconics VZ7200F5x00B and VZ7656B1000B thermostats use a local BACnet RS485 MS-TP communication bus between all devices to insure proper communication and smooth data exchange of all required information for proper system operation.

BACnet is "a data communication protocol for Building Automation and Control networks." A data communication protocol is a set of rules governing the exchange of data over a computer network. The rules take the form of a written specification that spells out what is required to conform to the protocol.

BACnet is a registered trademark of ASHRAE North America. For more information on BACnet please visit www.bacnet.org.

What does this mean for us ?: It simply means that BACnet is the communication protocol or language the thermostats use to exchange information or data on a peer to peer network (thermostat to thermostat) in order for the system to operate correctly.

RS485 (officially known as EIA-485) specifies the electrical characteristics of the serial half-duplex transceiver and receiver user for communication between each device.

MS-TP is the physical layer used for communication between all the devices. It stands for Master Slave – Token Passing where each of the devices on the network gets to passed a token. When a device has the token, it is then the master of the communication system on the network and it gets permission to read and write values to other devices. At this point, all the other devices are considered slaves to the current master and will answer or acknowledge any request from the current master.

When the current thermostat is done with the token, it will pass it to the next thermostat in the network and so on.

Baud-Rate. All thermostats in the network need to communicate at the same speed in order to properly exchange information. The speed rate is called baud rate. Each individual thermostat can be assigned a specific baud-rate. But all thermostats on the same network need to use the same baud rate.

The Baud rate is a configuration parameter and its default value is set to (4 = Auto Bauding). The actual range of communication speeds available are:

- **0 =** 9600 KBps
- **1 =** 19200 KBps
- **2 =** 38400 KBps
- **3 =** 76800 KBps
- **4 =** Auto Bauding (Baud Rate will match detected Baud Rate

Baud-Rate Notes:

At least one of the thermostat needs to have a pre-selected baud rate for the network to operate properly when all other thermostats are left with their default value of 4 = Auto Bauding.

In stand-alone application for small and large systems is recommended to use 38400 KBps.

The lower speeds (9600, and 19200 KBps) are typically used then other existing BACnet devices are integrated and need to co-exist on the same network.

The highest speed (76800 KBps) is typically used on large networks (80+ devices) tied in with a supervision device where rapid turnaround is expected to refresh graphical views.

If speed is required to be changed on the whole network; first modify the baud rate configuration property on all thermostats. Then perform a full power down of all the thermostats before re-applying power. This will insure that none of the thermostats will not remain in token pass mode between each other and stay locked to the previous baud rate selected.

4A) 3rd Party BACnet Integration

BACnet being an open protocol also means that the Viconics zoning system products can be seamlessly integrated into any 3rd party BACnet supervision system.

This enables the whole system to be integrated into an open building automation DDC system. From there options are endless for advanced added functionality: Full graphic interface of RTU units and ZONE zones, trends, charts and logs, automatic responses to alarms, advanced energy management, Etc……

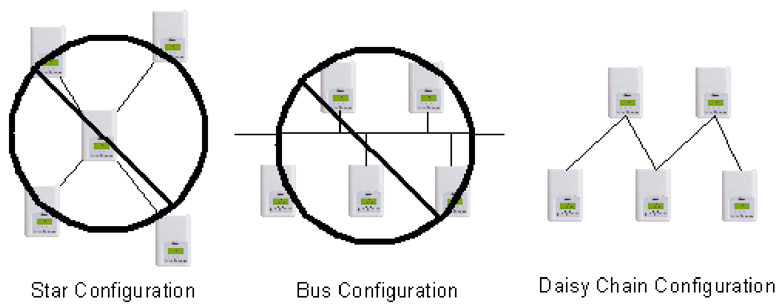
Information on 3rd party BACnet integration is available on document *ITG-VZ7xxx-BAC-Exx.*

4B) Communication Wiring and Layout

Wire: Viconics recommends the use of balanced 22-24 AWG twisted pair with a characteristic impedance of 100-130 ohms, capacitance of 17 pF/ft or lower, with a braided shield.

Layout: RS485 networks use a daisy chain configuration. A daisy chain means that there is only one main cable and every network device is connected directly along its path.

Other methods of wiring an RS485 network may give unreliable or unpredictable results. There are no troubleshooting methods for these types of networks. Therefore, a great deal of site experimentation may have to be done, making this a difficult task with no guarantee of success. Viconics will only support daisy chain configurations. The following illustrates two improper network configurations and the proper daisy chain configuration.



A daisy-chain wiring scheme does not allow for T connections. I.E. the network wire needs to be wired down to each thermostat communication terminals before going to the next device. No junctions of any kind are recommended to be installed. Except for the first and the last devices on the network, all thermostats should have 4 wires connected to the + and – network connection.

- The + connection should have a wire going to the previous device and a wire going to the next device
- The - connection should have a wire going to the previous device and a wire going to the next device

The best layout for the communication network is the one that will result in the shortest possible network wire length. The allowed maximum network wire length is 1200 meters (4000 feet). It is not necessary to have the wire follow each thermostat MAC address in sequence. The wire can be connected from one device to the next closest without any specific preset architecture. The same applies to the RTU thermostat; it can be physically located anywhere on the network and is not required to be at the beginning or at the end of the communication wire.

Polarity: The polarity of the network connections to the cable is important and needs to be respected. From one thermostat network connection to the other it is important that the same coloured wire be connected to “plus” or “+” and the other coloured wire be connected to the “minus” or”-“.

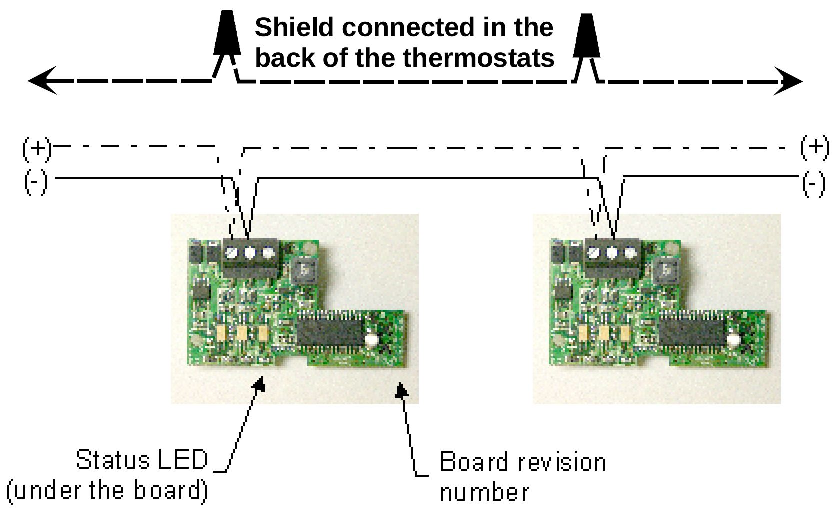
EOL: MS-TP network must be properly terminated. For daisy chain configurations, you must install an EOL (End of Line) resistor at each end of the daisy chain (The first and the last device). For a stand-alone system with only Viconics thermostats installed on the communication network the value of the EOL resistor is 120 Ohms ¼ watt. For EOL values used with other non-Viconics devices on the network, please refer to the Viconics Integration Guide.

The two resistances are installed across the + and – communication terminals on both the first and last devices on the wire. Please note that these do not necessarily represent the lowest and highest MAC addresses given to the thermostats.

Shield: The purpose of the shield is to protect the communication network from external radio noise sources. **DO NOT WIRE THE SHIELD(s) TO THE (Ref) COMMUNICATION TERMINAL.**

- The shield for the first and the last devices located behind the thermostat must be fully protected to prevent accidental shorting to the ground.

- The shields for any middle device (there are two wires. One in and one out for a total of two shields) which need to be connected together in the back of the thermostat while making sure they are fully protected to prevent accidental wiring to the ground.



All the shield(s) attached and wired together need to be connected to the ground only at one location on the whole network.

4C) Communication Status LED and Troubleshooting

Each thermostat has a communication status service LED for troubleshooting purposes. Monitoring this LED will determine the network conditions for each individual device and will tell you if they are communicating properly with other devices on the network.

Condition of the Status LED	Possible Cause	Solution
➢ 1 short blink	A VZ7600 BACnet communication module is wrongly installed on a VZ7200 thermostat	Install a VZ7200 BACnet module on the thermostat
	A VZ7200 BACnet communication module is wrongly installed on a VZ7600 thermostat	Install a VZ7600 BACnet module on the thermostat
➢ 2 short blink (no network wires connected to the module)	The right module has been installed on the right thermostat model	N/A
➢ 2 short blink (network wires connected to the module)	Module is not at the same baud rate as the network	Power off and on the thermostat
	Faulty of wrong wiring	Verify network wire connections
➢ 2 short blinks and a longer blink (wires connected to the module)	The module has detected the presence of a network and is communicating	N/A
➢ Right after power is applied: 2 long blinks and then no blinking	+ and - polarity has been reversed at the module	Reverse polarity and be sure proper polarity is respected on the whole network

5) System Commissioning

It cannot be stressed enough that if proper system operation is expected, then proper system commissioning should be done at all levels.

A zoning system has a huge dependency on demand and response being fully functional both at the RTU and the zone level.

5A) Proper Commissioning of Zone Thermostats

At the zone level, care should be applied to insure the following have been properly set up:

- Proper sizing of the VAV zone damper and the design of the air distribution to insure that peak load demands can be meet when the RTU delivers the capacity.
- VAV Damper operation. Insure that the VAV damper blade can rotate completely. There should be no mechanical limits as those are set by the thermostat parameters.
- DA/RA setting of the VAV actuator is not set reversed, when improperly set it will result in a zone that can never be satisfied and a demand to the RTU that will always be present if the zone is a master zone.
- Min, Max and HeatMax flow must be set during balancing. Also, adjustments may need to be done to the main trunk side-take-off balancing damper if the local VAV trunk is equipped with one.
- Proper setup of the following important configuration parameters: Reheat lockouts, setpoint limits, user interface lockout and demand weight adjustments to the RTU. All of these need to be properly evaluated and set according to the specifics of the installation.
- Addressing of both the MAC zone numbers to a specific RTU thermostat needs to be planned prior to the installation.

5B) Proper Commissioning RTU Thermostats

At the **RTU level**, care should be applied to insure the following:

- Proper sizing of the RTU heating and cooling capacity to insure it will meet the highest instantaneous peak loads of the areas being served by the system.
- Proper strategy and system layout of the mechanical system architecture.
- Proper commissioning and verification of the by-pass system. A incorrectly set-up by-pass damper system can result in all of the zones being properly commissioned and all equipment being properly sized, but can still cause the system to not receive the proper RTU capacity down to the zones.
- Proper setup of the following important configuration parameters: Heating lockout, cooling lockout, control type strategy, discharge air low and high limits, static pressure sensor range and static pressure setpoint. All of which need to be properly evaluated and set according to the specifications of the installation.
- Proper verification of RTU I/O operation including the RTU on board economizer operation.

5C) Operational System Checklist

It is recommended to keep a checklist of all milestones and configuration settings during start-up. This list should be kept as a reference with the system when it is fully commissioned. The following is only provided as a guideline template but can be extremely helpful for servicing issues and questions.

RTU Unit			
Manufacturer:		Serial number	
Model number:		Year of manufacture	
Location:		Date of original installation	
Cooling tonnage:		Cooling number of stages:	
Heating capacity:		Heating number of stages:	
Maximum CFMs:		Total number of zones:	

RTU Configuration, critical operational configuration parameters are in bold			
RTC MAC		cal RS	
RTC Baud		cal OS	
Lockout		H stage	
Pwr del		C stage	
CntrlTyp		**H Lock**	
Dis HL		**C Lock**	
Dis LL		2/4event	
Anticycl		Aux cont	
Heat cph		Prog rec	
Cool cph		Occ CL	
Deadband		Occ HT	
Units		Unocc CL	
Fan del		Unocc HT	
BI 1		**Sp range**	
TOccTime		**Pressure**	

RTU Local Schedule Settings			2 events		4 events
	Occupied day?	1st Occ event	2nd Unocc event	3rd Occ event	4th Unocc event
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

Bold items are critical for proper system operation

RTU Commissioning	
RTU mechanical cooling functional verification done	
Maximum Delta temperature (return to supply temp) for cooling stage #1:	
Maximum Delta temperature (return to supply temp) for cooling stage #1 & 2:	
Economizer cooling functional verification done	
Minimum position of economizer properly set?	
RTU thermostat Aux output used to disable minimum position of economizer check?	
RTU heating functional verification done	
Maximum Delta temperature (return to supply temp) for heating stage #1:	
Maximum Delta temperature (return to supply temp) for heating stage #1 & 2:	
Static pressure transducer input reading fan Off (should be 0 "WC or 0 PA):	
Maximum static pressure transducer input reading fan On (all VAV closed):	
Static pressure damper actuator properly rigged and verified?	

Important configuration property set?		
- RTC MAC value:		
- RTC Baud value:		
- CntrlTyp:		
- Dis HL:		
- Dis LL:		
- H Lock:		
- C Lock:		
- Sp range:		
- Pressure:		

Communication with zones is active? (Status LED & manual scroll display)	
Local time clock set?	
Local schedule set?	
Local system mode set to Auto? (System On)	
Outdoor air sensor properly connected and displaying value? (manual scroll display)	
Supply air sensor properly connected and displaying value? (manual scroll display)	
Return air sensor properly connected and displaying value? (manual scroll display)	

Zone Number ( ) , use MAC address for zone name and repeat for ALL other zones			
Location:		Date of original installation	
VAV inlet diameter Ø in Inches:		Zone vocation and use:	
Perimeter zone?		VAV actuator brand:	
Internal zone?		VAV actuator model:	
Type of reheat if installed:		Capacity of reheat if installed:	

Zone Configuration, critical operational configuration parameters are in bold			
Zone MAC		Unocc HT	
RTC Baud		Unocc CL	
RTC MAC		St-By HT	
Get From		St-By CL	
MenuScro		Set Type	
C or F		TOccTime	
PIR Func		Cal RS	
Lockout		Deadband	
BI1		**Heat max**	
RehtConf		**Cool min**	
AO2RA/DA		**Min Pos**	
AO2 OALK		**Max Pos**	
BO5 OALK		**MaxHTPos**	
BO5 Time		**PIHT Wei**	
BO5 cont		**PICL Wei**	

Bold items are critical for proper system operation

Zone Number ( ) Commissioning			
VAV damper actuator properly rigged and verified? (opens & closes with demand)			
Proper adjustments of zone side take off balancing damper?			
Proper balancing of zone minimum position?		CFM =	
Proper balancing of zone maximum position?		CFM =	
Proper balancing of zone MaxHeatflow position? (If reheat is used)		CFM =	
Verification of Reheat (If reheat is used)			
Maximum Delta temperature of Reheat (If duct reheat is used)			
Important configuration property set?			
- **Zone MAC:**			
- **ZoneBaud:**			
- **RTC MAC:**			
- Lockout:			
- RehtConf:		If reheat is used	
- AO2 OALK:		If reheat is used	
- BO5 OALK:		If reheat is used	
- **Heat max:**			
- **Cool min:**			
- **Min Pos:**			
- **Max Pos:**			
- **MaxHTPos:**			
- **PIHT Wei:**		Is this zone a master in heating ?	
- **PICL Wei:**		Is this zone a master in heating ?	
Communication with RTU is active? (Status LED & outdoor temperature display)			

Items shown in bold are critical for proper system operation

6) Things You Need to Know

6A) Single 24 Vac Zone Transformer vs. Multi 24 Vac Zone Transformers

It is possible to use a single 24 Vac transformer for each zone thermostat or you may use a single large central 24 Vac transformer for many zone thermostats.

If using a single 24 Vac for each zone thermostat.

- Use a 20 VA or more Class2 self protected transformer to power all components attached to the zone thermostat.
- Be sure to respect the polarity of all components in the circuit: analog VAV actuator, analog reheat, etc…
- Be sure that if a ground is required, the common side of the circuit is the one connected to earth (0 V ~ Com). Grounding is required only at one location to prevent ground loops.

If using a large central 24 Vac transformer for many zones.

- If using a Class1 unprotected transformer to power all components attached to the zone thermostat, be sure that the installed fuse or circuit protection is sized according to the maximum required load specified. This is not necessarily the same as the maximum current available from the transformer. Ex.: If a 100 VA transformer is installed and the maximum installed load is 45 VA for all devices attached, then the fused value should be 2 amps maximum at 24 Vac.
- Be sure to respect the polarity of all components in the circuit: All analog VAV actuator(s), all analog reheat devices, etc…
- Be sure that if a ground is required, the common side of the circuit is the one connected to earth (0 V ~ Com). Grounding is required only at one location to prevent ground loops.

6B) Critical Point Checks

To insure proper and reliable operation of the system, it is the responsibility of the system designer and or installer to properly verify all important milestones of the project.

This includes all other contractual aspects for the system performed outside of the control system scope of work:

- Design phase: load calculations and ductwork layout and sizing, equipment selection, etc…..
- Construction phase: RTU installation, ductwork installation, electrical work required, etc…
- Commissioning and delivery phase: Operational system checklist, balancing, proper RTU commissioning, etc….

In order to successfully deliver a fully functional system that will keep customer happy, proper initial design and proper commissioning are mandatory.

6C) Balancing and Capacity

It is not the mandate of a zoning control system to correct for an incorrect mechanical layout or for improper load calculations of the mechanical zoning equipment. The control system will deliver the loads required by the master demanding zones by appropriately distributing the total available capacity of the installed equipment to the required demanding zones.

It should also be noted that even when the equipment is undersized, the control system will distribute the available capacity according to the priorities requested making most of the areas comfortable.

However, proper air balancing of the main trunks and zones must be done for optimal system operation. This includes the following:

- Min, Max and HeatMaxflow properly adjusted during balancing.
- Adjustments may need to be done to the main trunk side-take-off directional adjustment blade of the local VAV trunk is equipped with one.