Viconics Zoning System Application Guide
VZ7200F5x00W and VZ7656B1000W Thermostats

Wireless_Zoning_System_Guide-E10
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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-VZ7200W-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-VZ7600W-Exx*
- Information on 3rd party BACnet integration, is available on document *ITG-VZ7xxx-BAC-Exx*
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1) System Overview and Architecture

The Viconics Zoning System product is comprised of 2 thermostat types.

- The VZ7200F5x00W zoning thermostat
- The VZ7656B1000W 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).

The system can be used either in a stand-alone system mode or seamlessly integrated into Niagara AX® Workbench environment with the usage of a Viconics JACE communication and its associated driver.

The Viconics VZ7200F5x00W Wireless Zone thermostat family is specifically designed for local pressure dependent VAV zone control within the 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 **VZ7656B1000W Wireless Roof Top Unit (RTU) thermostat** is 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.

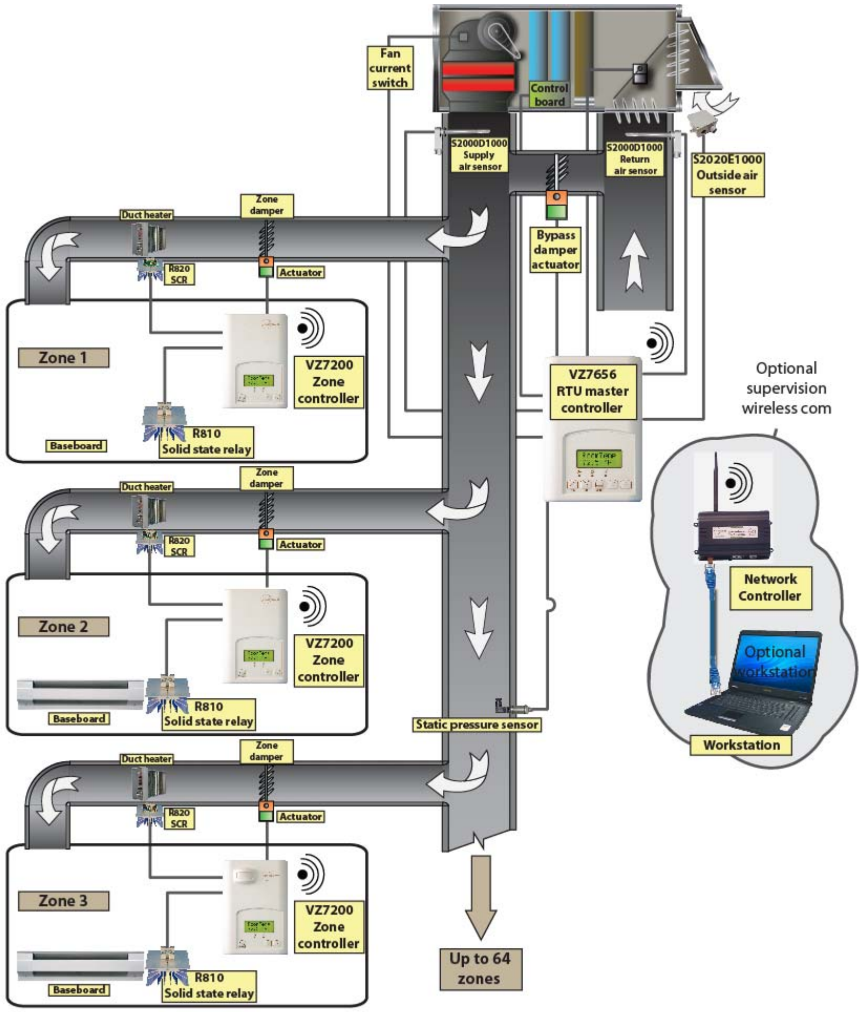
The thermostat also contains extra digital inputs, which can be set by the user to monitor filter status or can be used as a general purpose service indicator. All models contain a SPST auxiliary switch, which can be used to control lighting or disable the RTU economizer function during unoccupied periods. 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

Wireless System Overview

Viconics VZ72005x00W zone thermostats are used in conjunction with the VZ7656B1000W roof top controller thermostats. When combined, they operate typical single or multistage RTUs and their associated local zones. The system operates the same as in the BACnet MS-TP wired version, but operate using ZigBee/IEEE 802.15.4 physical layer for the communication bus.



Typical Wireless zoning system installation

Please refer to the following Viconics documents for detailed information and design guidelines for the wireless 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_W-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-VZ7656_W-Exx*
- PIR cover installation information is available on document: *PIR Cover Installation-Exx*
- Information on Wireless integration is available in the following documents: *MAN_Wireless Stat Driver Guide-Exx & ITG-VWG-50-BAC-Exx.*

The system can be used in fully stand-alone mode or in communication mode with the Viconics VWG / Jace-Driver set to expose the thermostat(s) objects externally.

(SA) Stand-Alone applications: Where zoning system(s) are self sufficient for communication and no external communication is required. In this configuration, the VZ76xx RTU thermostat acts as the network coordinator. (More than one can be installed in a typical building application).

(NS) Networked Systems: Where zoning system(s) are required to communication with the Viconics VWG and Jace-Driver set. In this configuration, the Viconics VWG and Jace-driver acts as the network coordinator. (More than one can be installed in a typical building application).

1A) Initial Design Criteria 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 always result in a job site being 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).

Wireless thermostat systems overview:

(SA) Stand-Alone systems. There are no supervisory devices installed in this configuration.

In this application, the VZ76xx thermostat(s) are the network coordinators to their own system. I.E. they are the network masters for each VZ72xx thermostat reporting to them. Each VZ76xx RTU thermostat and it's associated VZ72xx zone thermostats use the same PAN ID and channel. The range of PAN ID on all thermostats to use is 251 to 500. This range is reserved for stand-alone (SA) system operation.

	Smallest System Supported		**Largest System Supported**	
	Number of Zones	**Number of RTUs**	**Number of Zones**	**Number of RTUs**
Single network of 127 nodes maximum	1 ZN reporting to	1 RTU Minimum	63 ZN reporting to	1 RTU Minimum

There are no supervisory devices installed in this configuration. The system fully operates in stand-alone mode.

(NS) Networked Systems operation. There is a high-level supervisory device installed and used in this configuration.

In this application, a Viconics VWG and Jace-driver are the network coordinators for all thermostats associated to the system and reporting their data point values.

Each VZ76xx RTU thermostat and its associated VZ72xx zone thermostats will use the same PAN ID and channel as the Viconics VWG and Jace-driver. The range of PAN ID on all thermostats to use is 1 to 250. This range is reserved for the networked system (NS) operation.

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

In this configuration, there is a supervision device installed. The system will still fully operate in stand-alone mode, but allows for a remote access to thermostat objects. It is seamlessly integrated into Niagara AX® Workbench environment with the use of the Viconics JACE communication device and its associated driver.

Some added functions include:

- Detailed system graphics referred to as GUI's which stands for Graphic User Interfaces
- Capacity to run remote trends, logs and diagnostics
- Capacity to use remote alarms for system events such as failures or maintenance
- Advanced and centralized energy management functions
- Remote scheduling
- Global outdoor temperature for all thermostats

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.

1D) 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 VZ7200F5x00W 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 VZ7200F5x00X 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 System

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.

- RTU system mode calculations based on, average of the three highest demands or 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 setpoint access using the Up and Down arrow keys	Yes	Yes	Yes	No
Pressing the local override key will only 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 for effect of re-starting the central system and allow 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 setpoints.	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 you 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 setpoint limit	Default: **90 °F (32 °C)**	**75 °F (24 °C)**
Cool min Minimum local cooling setpoint limit	Default: **54 °F (12 °C)**	**68 °F (20 °C)**

2D) Heating and Cooling Weight Zone Selection

For any system to properly operate, care must be taken to select which zones will be driving the system and 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 Adjustment (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 Heatflow 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

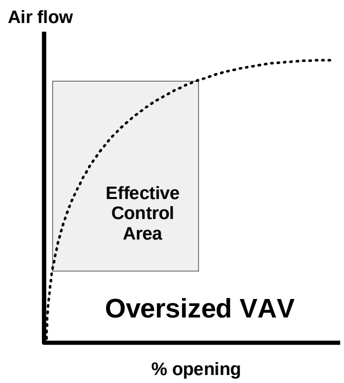
1. Be sure local system cooling is allowed by setting the outdoor cooling lockout value at the RTU thermostat (C Lock).
2. Be sure local reheat is allowed by appropriately setting the outdoor reheat lockout value at the Zone thermostat (AO2 OALK or BO5 OALK).
3. Be sure the system is currently in cooling 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.

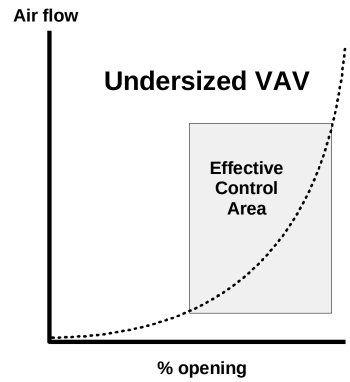
Please note that:

- 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

2G) 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 VZ7656B1000W 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 VZ7656B1000X 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 ZN 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 is demand values based on their current occupancy mode and setpoints currently in use: Unoccupied, Stand-By or Occupied.

Based on the control type configuration **(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 ZN 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 current mode

Many configuration and normal operation 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 2 minutes delay when RTU toggles from heating to cooling and vice-versa (operation)

The RTU thermostat will then forward data to the zone thermostats:

- 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

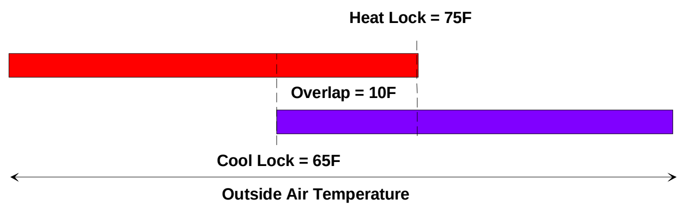
H Lock and C Lock

- 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.

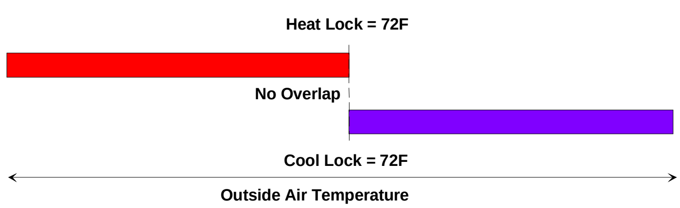
RTU mode lockouts need to be properly set to keep heating or cooling equipment cycling to a minimum. It is the responsibility of the installer to decide if priority of the system will be given to comfort or not. The adjustments for both lockouts will be different based on specific regions load requirements.

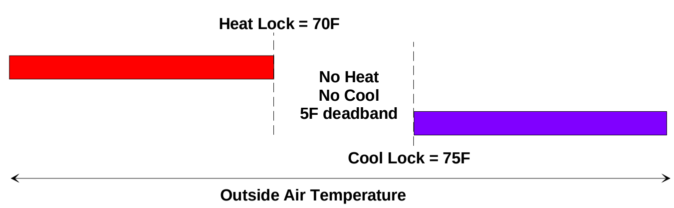
- A system located far north may require the RTU to deliver heating until a 75F outside air value is attained due to the inertia of the building mass which will require heating during a cold night and then will transition to a hot mid-season day.
- A southern system application may require the RTU to 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 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) Wireless Communication Overview

The Viconics VZ7200F5x00W and VZ7656B1000W thermostats, Viconics Wireless Gateway (VWG) and Jace-driver and other related wireless thermostat family (VT7xxxXxxxxW) networkable devices operate using ZigBee/IEEE 802.15.4 physical layer for communication.

General characteristics of the wireless physical communication layer are:

- Wireless physical layer of 2.4GHz with a data rates of 250 kbps
- Yields high throughput and low latency
- Automatic multiple topologies configuration: star, peer-to-peer, mesh
- Fully handshake protocol for transfer reliability
- Range: 30 feet / 10M typical (up to 100 feet / 30 M based on environment)

IEEE 802.15.4 along with ZigBee's Network and Application Support Layer provide:

- Low cost installation deployment
- Ease of implementation
- Reliable data transfer
- Short range operation
- Very low power consumption
- Appropriate levels of security

The main network coordinator for the wireless the IEEE 802.15.4/ZigBee network can be either:

- The VZ76xx RTU thermostat for **(SA)** Stand-Alone applications: Where zoning system(s) are self sufficient for communication and no external communication is required. In this layout, the VZ76xx RTU thermostat acts as the network coordinator.
- The Viconics Wireless Gateway (VWG / Jace-Driver for **(NS)** Networked Systems applications: Where zoning system(s) (more than one can be installed in a typical building application) are required to communicate with the Viconics VWG / Jace-Driver set. In this layout, the Viconics VWG / Jace-Driver acts as the network coordinator.

Many network specific features of the IEEE 802.15.4 standard are not covered in detail in this paper. However, these are necessary for the efficient operation of a ZigBee network. The features of the network physical layer include receiver energy detection, link quality indication and clear channel assessment. Both contention-based and contention-free channel access methods are supported with a maximum packet size of 128 bytes, which includes a variable payload up to 104 bytes. Also employed are 64-bit IEEE and 16-bit short addressing, supporting over 65,000 nodes per network. All the properties of the physical layer are used and employed by the Viconics mesh network but are hidden to the user for ease of configuration and commissioning of the network database.

4A) (SA) Stand-Alone applications

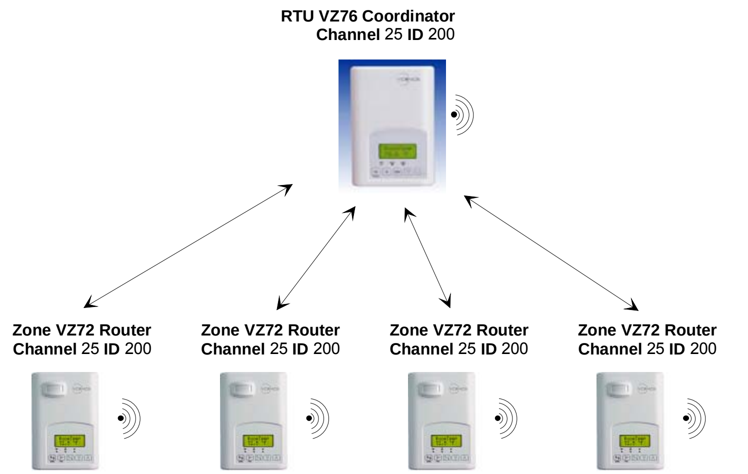
When PAN ID is used with a range of 251 to 500, for (SA) Stand-Alone Systems.

In this application, the VZ76xx thermostat(s) act as the coordinators to their own system. I.E. they are the network masters for each VZ72xx thermostat reporting to them when the whole zoning system(s) is self sufficient and communication and no external communication is required.

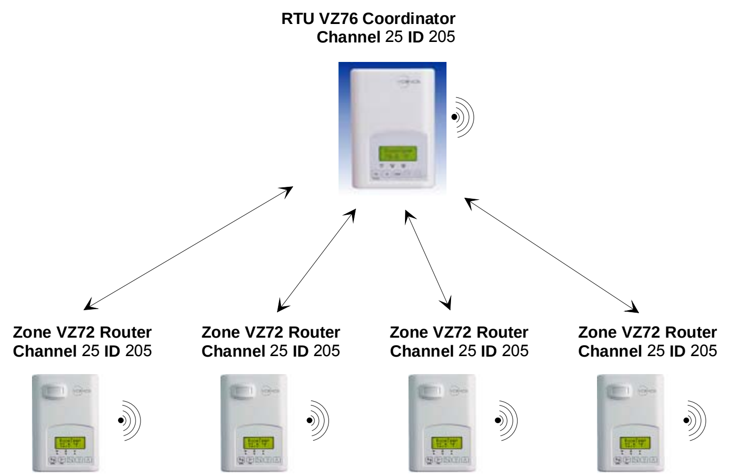
- Wireless thermostat factory default Channel and PAN ID = Thermostat(s) offline
- VZ76xx RTU thermostat is the network coordinator
- Range of PAN ID on all thermostats to use 251 to 500. This range is reserved for stand-alone system operation

Examples:

System 1



System 2



Notes:

· Each system with a VZ76xx RTU master will use a unique PAN ID and or channel settings

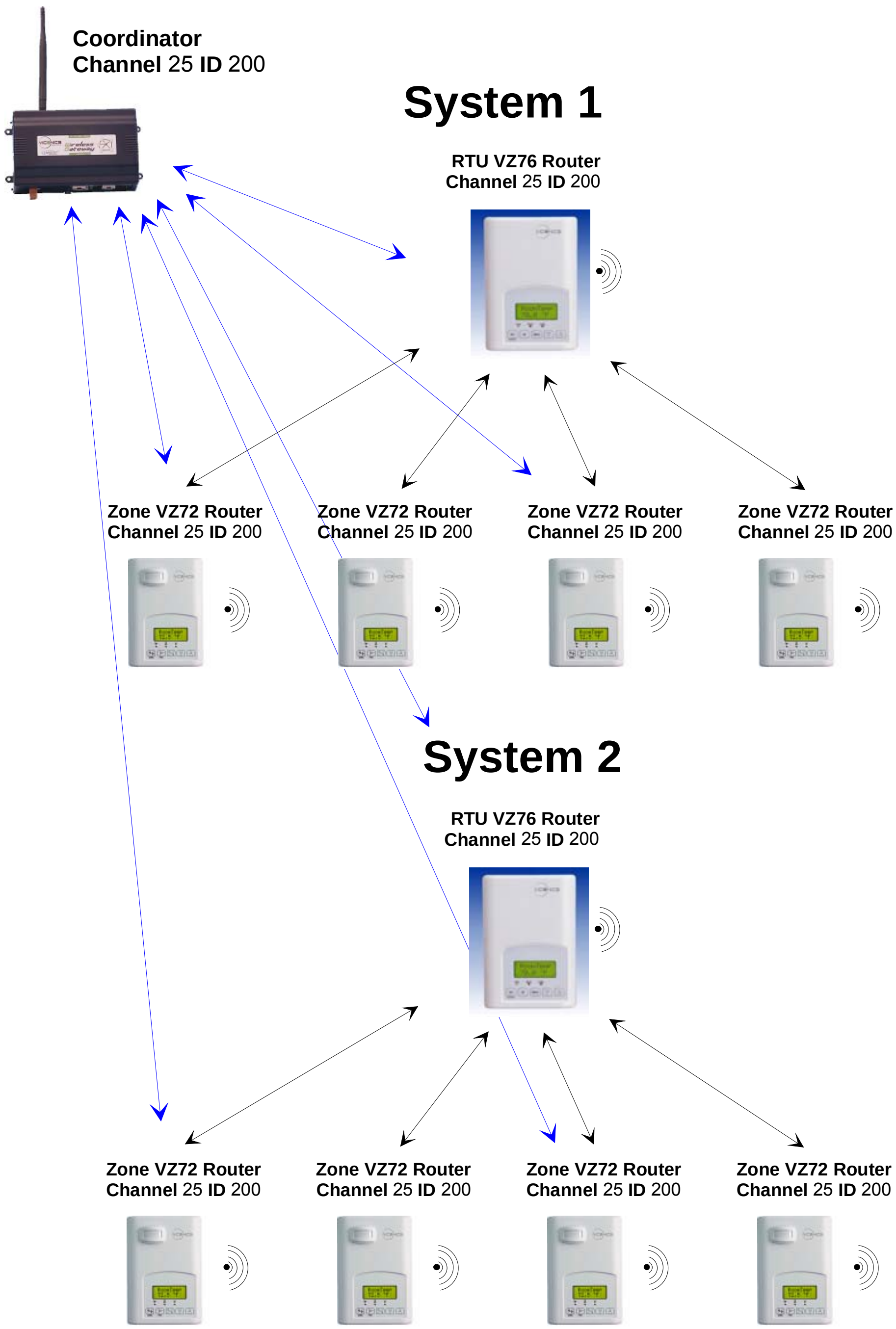
4B) (NS) Networked System applications

When PAN ID is used with a range of 1 to 250, for (NS) Networked Systems.

In this application, any thermostat(s) are simply routers to the system. The VWG and Jace-driver is the coordinators to the system. The VWG and Jace-driver are the network masters for any thermostat(s) reporting to them, where zoning system(s) are required to communicate and exchange data points with the Viconics VWG and Jace-driver set. (More than one can be installed in a typical building application).

- Wireless thermostat factory default channel and PAN ID = Thermostat(s) offline
- VWG Jace-Driver is the network coordinator
- Any thermostats (VZ72's, VZ76xx RTU's or any VT7xxx wireless thermostats) act as routers.
- Range of PAN ID on all thermostats to use 1 to 250. Reserved for networked system operation.

Examples:



Note:

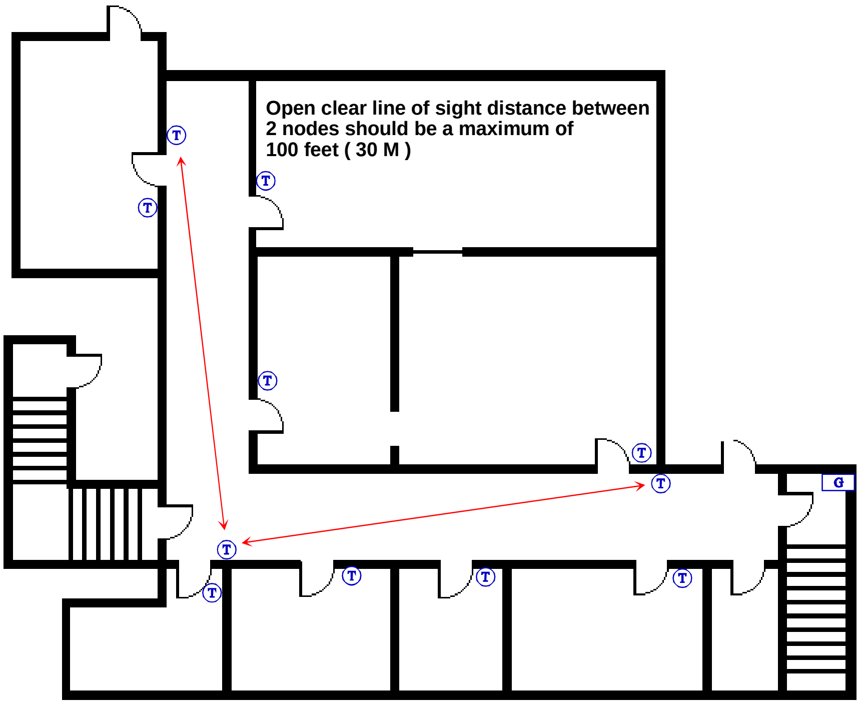
- Each thermostat(s) uses the same PAN ID and channel as VWG Jace-Driver coordinator.
- VWG and Jace-driver supports network integration for required GUI and system status objects.

4C) Basic Initial Design and Deployment Considerations

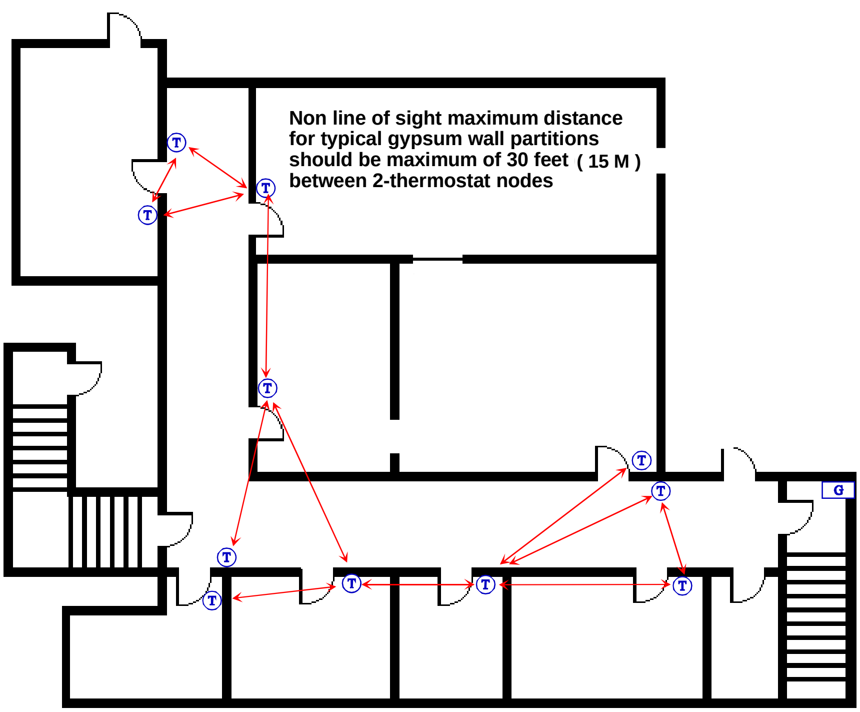
Proper design considerations need to be addressed prior to the installation of a Viconics wireless zoning system.

1. To avoid network interference with 802.11 Wi-Fi devices in the 2.4GHz spectrum range, Viconics recommends the use of 802.15.4 channels 15, 25 and 26 only. 802.11 Wi-Fi transmissions overlap and may interfere with other channel selections allowed by 802.15.4 (Channels 11 to 14 & 16 to 24)

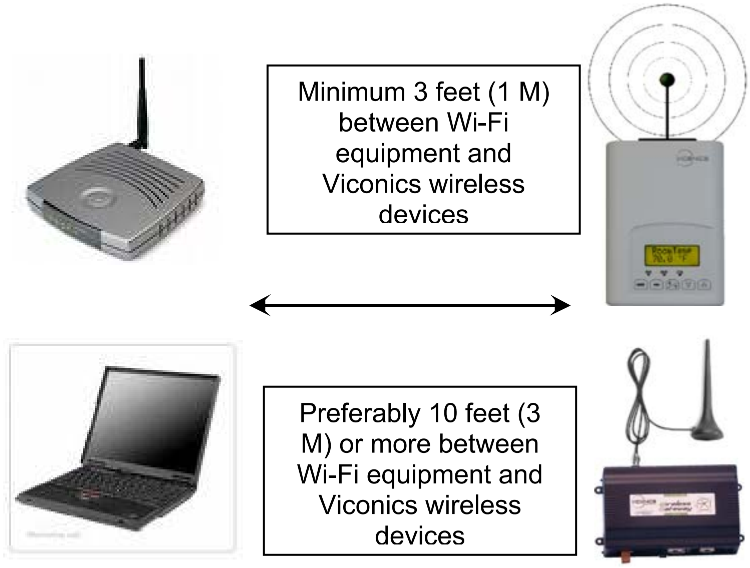
2. The maximum distance between each thermostat node should be 100 feet (30 M) or less between two thermostat nodes. (Clear line of sight).



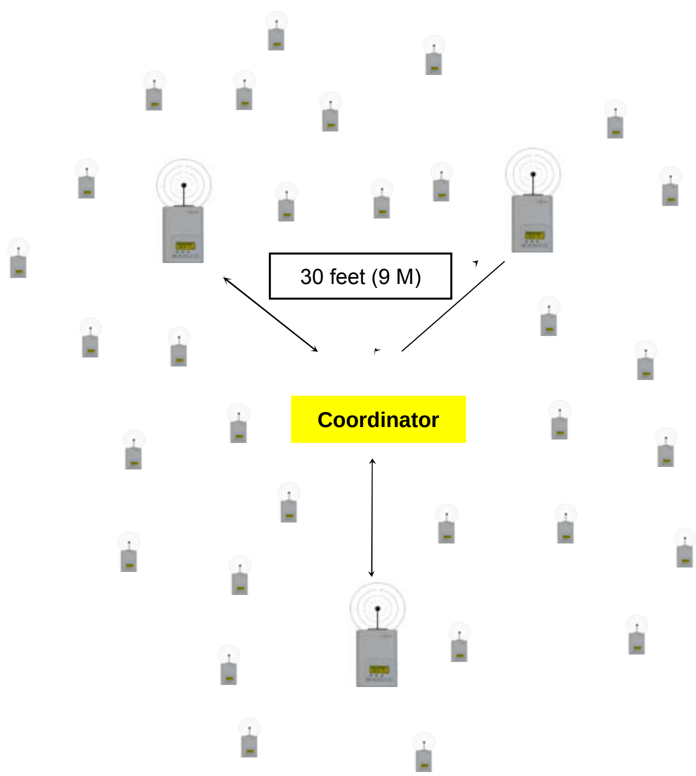
- Non line of sight should be less than 50 feet (15M). Typical gypsum wall partitions made with metal stud frame construction.



3. Ensure that the minimum distance between any Viconics node and any Wi-Fi devices (wireless routers, wireless adapters, lap-tops using wireless networks, etc.…) to be at least 3 feet (1 M) and preferably 10 feet (3 M) or more.



4. Ensure that at least one thermostat is within 30 feet of the coordinator (VZ76xx for (SA) or VWG and Jace-Driver for (NS)) for every cluster of 10 VZ72xx zone thermostats installed.
5. When possible, always try to locate the coordinator (VZ76xx for (SA) or VWG and Jace-driver for (NS)) near the center of all associated VZ72xx zone thermostats installed.
6. Always try to locate the coordinator (VZ76xx for (SA) or VWG and Jace-driver for (NS)) near or in the line of sight to as many wireless thermostats as possible.
7. Try to avoid metal, brick walls or concrete obstructions between wireless devices when possible.
8. For a 30 wireless thermostats installation. A minimum of three of them should be within 30 feet or 9 Meters of the coordinator (VZ76xx for (SA) or VWG and Jace-Driver for (NS)) range.



4D) Communication status LED and Troubleshooting

Each thermostat has a communication status service LED for troubleshooting purposes. Monitoring this LED will determine the network condition for each individual device and will tell you if they are successfully communicating with their peers on the network.

VZ76xx Adapter LED Status Indicators **(SA) Stand-Alone applications.** When a PAN ID is used with a range of 1 to 250, for (SA) or Stand-Alone Systems applications where the VZ76xx is used as a coordinator	
1 x 200ms short blink	Power on
2 x 200ms short blinks	Power on Communicating with thermostat base
3 x 200ms short blinks	Power on Communicating with thermostat base Valid Pan ID & Channel
4 x 200ms short blinks	Not Used
4 x 200ms short blinks **and** **1 x 1500ms long blink** →	Power on Card memory initialized properly Communicating with thermostat *Wireless networks started successfully*
4 x 200ms short blinks **and** **1 x 1500ms long blink** → **and** **1 x 3000ms long blink** →	Power on Card memory initialized properly Communicating with thermostat *Wireless networks started successfully* *Wireless communication with VZ72 Zone thermostats active*

VZ76 Adapter LED Status Indicators **(NS) Networked System applications.** When PAN ID is used with a range of 1 to 250, for (NS) or Networked Systems applications where the VWG and Jace-Driver is used as a coordinator	
1 x 200ms short blink	Power on
2 x 200ms short blinks	Power on Communicating with thermostat base
3 x 200ms short blinks	Power on Communicating with thermostat There is connectivity to wireless network
4 x 200ms short blinks	Power on Communicating with thermostat There is connectivity to wireless network VWG / Jace-Driver is communicating with Wireless thermostat
4 x 200ms short blinks **and** **1 x 1500ms long blink** →	Power on Communicating with thermostat There is connectivity to wireless network *VWG / Jace-Driver is communicating with Wireless thermostat is also added to the VWG / Jace-Drive database*
4 x 200ms short blinks **and** **1 x 1500ms long blink** → **and** **1 x 3000ms long blink** →	Power on Communicating with thermostat There is connectivity to wireless network *VWG / Jace-Driver is communicating with Wireless thermostat is also added to the VWG / Jace-Drive database* *Wireless communication with VZ72 Zone thermostats active*

The long 3000ms status flag is simply enabled by VZ72xx zone thermostats reporting PI demand value to the VZ76 RTU thermostat. As long as a single VZ72xx zone thermostat is registered at the VZ76xx RTU, the long 3000ms status flag will be enabled

If the long 3000ms status flag indicating communication with the VZ7xx wireless zones thermostat is disabled after one minute; the ComLost alarm flag will be displayed at the VZ76xx RTU thermostat.

VZ72 Adapter LED Status Indicators	
1 x 200ms short blink	Power on
2 x 200ms short blinks	Power on Communicating with thermostat base
3 x 200ms short blinks	Power on Communicating with thermostat There is connectivity to wireless network
4 x 200ms short blinks	Power on Communicating with thermostat There is connectivity to wireless network VZ76 or VWG / Jace-Driver is communicating with Wireless thermostat
4 x 200ms short blinks **and** **1 x 1500ms long blink** →	Power on Communicating with thermostat There is connectivity to wireless network *VWG / Jace-Driver is communicating with Wireless thermostat is also added to the VWG / Jace-Drive database*
4 x 200ms short blinks **and** **1 x 1500ms long blink** → **and** **1 x 3000ms long blink** →	Power on Communicating with thermostat There is connectivity to wireless network *VWG / Jace-Driver is communicating with Wireless thermostat is also added to the VWG / Jace-Drive database* *Wireless communication with VZ76 RTU thermostats active*

The 3000ms status flag is enabled when the VZ72xx zone thermostat successfully reads the required functional data points from its attached master VZ76xx RTU thermostat: Occupancy, Outdoor temperature, zone sequence, etc.…

5) System Commissioning

If proper system operation is expected, then proper system commissioning should be done at all levels.

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

5A) Proper Commissioning of the Zone Thermostats

At the zone level, care should be taken to insure that the following criteria(s) are met:

- Proper sizing of the VAV zone damper and the design of the air distribution system 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 without any mechanical limits as those are set by the thermostat parameters.
- Make sure the DA/RA setting of the VAV actuator is not set reversed. If 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, set point 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 conditions are met:

- Proper sizing of the RTU heating and cooling capacity to insure it will meet the highest instantaneous peak loads of the areas deserved by the system.
- Proper strategy and system layout of the mechanical system architecture.
- Proper commissioning and verification of the by-pass system. A wrongly configured by-pass system may cause all the zones in a section of the system unable to get the proper RTU capacity down to the zones. Even when all of the zones are properly commissioned and all equipment are properly sized.
- Proper setup of the 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 these 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		TOccTime	
RTC Baud		cal RS	
PAN ID		cal OS	
Channel		H stage	
Lockout		C stage	
Pwr del		**H Lock**	
CntrlTyp		**C Lock**	
Dis HL		2/4event	
Dis LL		Aux cont	
Anticycl		Prog rec	
Heat cph		Occ CL	
Cool cph		Occ HT	
Deadband		Unocc CL	
Units		Unocc HT	
Fan del		**Sp range**	
BI 1		**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					

RTC Baud *refers to BACnet models only*
PAN ID and Channel *refers to Wireless models only*

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:		
- PAN ID		
- Channel		
- 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	
PAN ID		Unocc CL	
Channel		St-By HT	
RTC MAC		St-By CL	
Get From		Set Type	
MenuScro		TOccTime	
C or F		Cal RS	
PIR Func		Deadband	
Lockout		**Heat max**	
BI1		**Cool min**	
RehtConf		**Min Pos**	
AO2RA/DA		**Max Pos**	
AO2 OALK		**MaxHTPos**	
BO5 OALK		**PIHT Wei**	
BO5 Time		**PICL Wei**	
BO5 cont			

Items in bold items are critical for proper system operation.

Zone Number ( ) Commissioning			
VAV damper actuator properly rigged and verified? (opens and 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:**			
- **PAN ID**			
- **Channel**			
- **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)			

Bold items 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 Class1 unprotected transformer to power all components attached to the ZN thermostat. Be sure that the installed fuse or circuit protection is sized according to the maximum installed required current load. 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 grounded 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 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 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.