Variable Refrigerant Flow (VRF) systems optimize energy savings by monitoring airflow and super-heat. Based on the airflow, the Air Handlers Electronic Expansion Valve (EEV), reduces or increases the refrigerant flow. This airflow generated information is sent to the inverter in the outdoor unit. The inverter generates a reduced or increased Hertz (cycles per second) to the Compressor causing the outdoor unit to reduce or increase its speed and volume of refrigerant being delivered to the indoor Air Handler. A Single or Multiple Air Handlers may be connected to one outdoor unit. Allowing multiple zone control from one Air Handler.

VRF-VAV systems using up to 20 Smart Air Valves (SAV) monitor and control 20 zones. These zones are connected to one VRF Air Handler. VRF-VAV allows up to 20 independent SAV zones to be connected to a single air handler.

Using VRF Manufacturers 24 volt thermostat interface, Zonex VRF-VAV will place calls for COOL, HEAT, or VENT based on thermostat inputs from each zone. SAV's are self balancing pressure independent dampers that will automatically adjust to provide target CFM based on duct size and system operation.

 VRF-VAV is designed to use SAV's to control an Air Handling Units airflow. This allows the VRF Outdoor Unit to control refrigerant flow. Exactly the way VRF systems are designed to do. Zonex SAV's control each Air Handlers air flow. VRF systems control refrigerant flow to each Air Handler.

A group of SAV's on an Air Handlers duct system automatically form a discharge damper which regulates the air volume or CFM that can flow through the Air Handler. This airflow regulates the EEV refrigerant flow to the Air Handler.
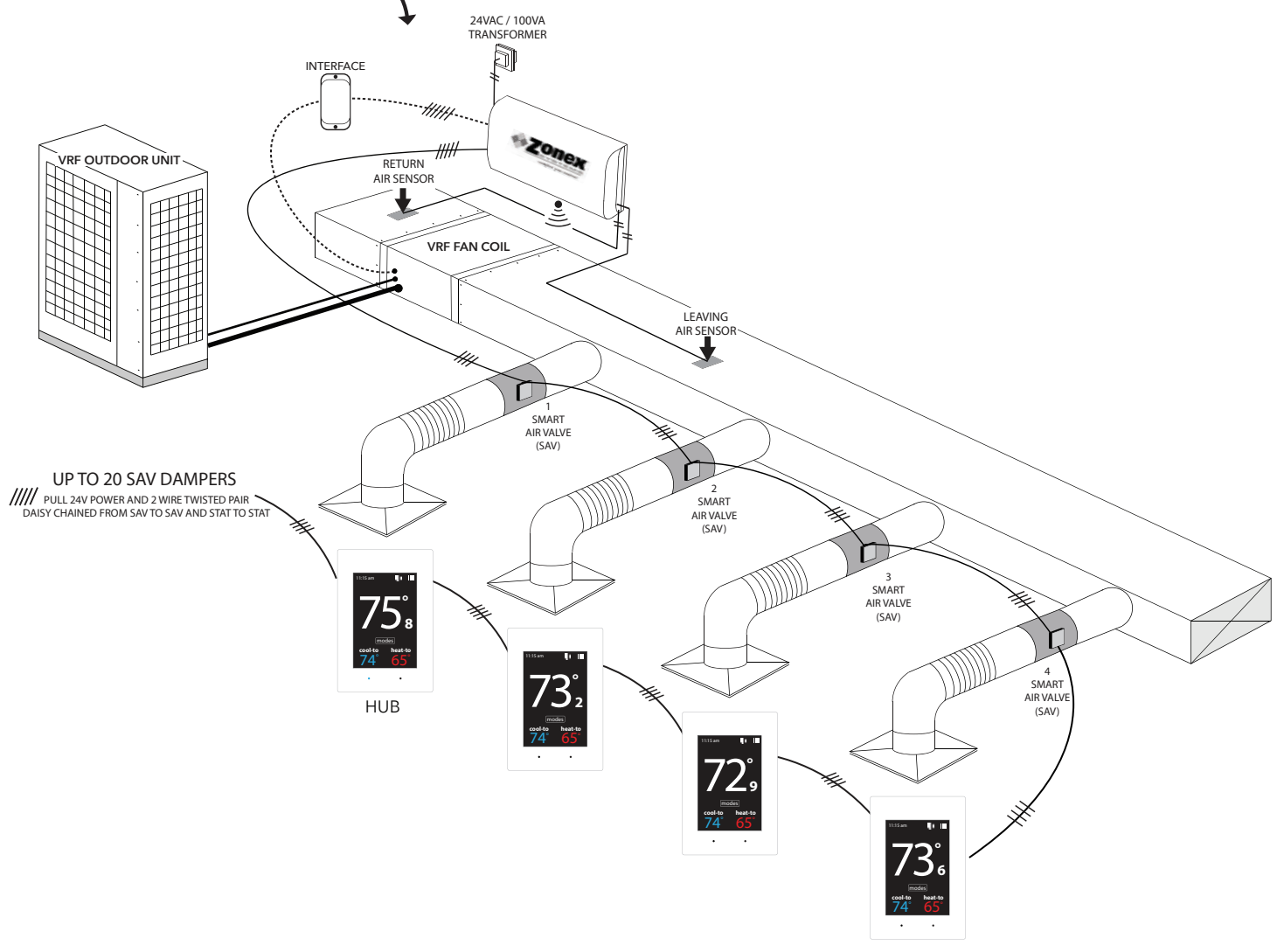
Why Zonex System VRF - VAV

Standard Ducted VRF Application
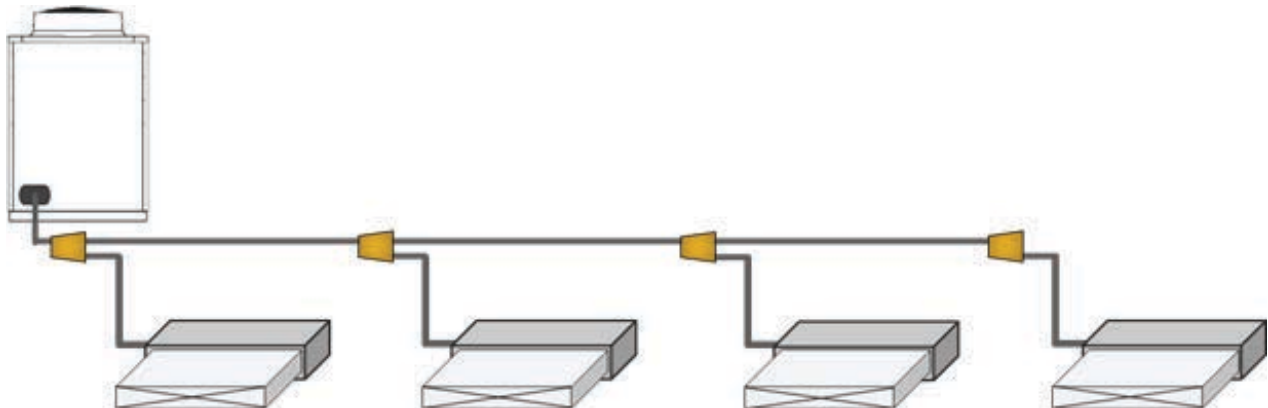
A standard installation of VRF systems has an Outdoor Unit providing refrigerant to multiple Air Handlers or Cassettes, with each device controlling a single zone. This approach will work, but requires an excessive number of air handlers. Each additional air handler requires, copper lines, electrical wiring, condensate lines, and labor, not to mention the ongoing maintenance required to keep the system working properly.

THERE IS A BETTER WAY

24VAC / 100VA
TRANSFORMER

INTERFACE

VRF OUTDOOR UNIT

RETURN
AIR SENSOR

VRF FAN COIL

LEAVING
AIR SENSOR

1
SMART
AIR VALVE
(SAV)

2
SMART
AIR VALVE
(SAV)

3
SMART
AIR VALVE
(SAV)

4
SMART
AIR VALVE
(SAV)

UP TO 20 SAV DAMPERS
PULL 24V POWER AND 2 WIRE TWISTED PAIR
DAISY CHAINED FROM SAV TO SAV AND STAT TO STAT

HUB

The Zonex Systems VRF-VAV System provides a solution that will reduce installation and mainte-nance cost and works with VRF units to maximize efficiency and comfort. Zonex with Smart Air Valves control air flow while the VRF outdoor units maintain and manage refrigerant flow.

Benefits:

Lower equipment cost	Lower installation cost
Mitigate ASHRAE 15 and 34 concerns	Energy Efficiency
Meets ventilation codes	Reduced refrigerant lines
Reduced condensate drain lines	Reduce electrical installation cost
Reduced maintenance cost	Individual control of even the smallest zones
Maximize VRF Operations	Control it all from the HUB thermostat

Due to VRF fan coil design, many small areas with reduced heat/cool loads cannot be controlled effectively. VRF-VAV provides a solution, allowing for the smallest of areas to be served, SAVs pro-vide air needed to every zone.

Manufacturers Interface – Most VRF manufacturers have a 24 volt thermostatic interface controller. These controllers allow the use of standard 24 volt legacy style thermostats, R Y W G C, to be used with fan coil units. VRF-VAV by Zonex provides 24 volt legacy style outputs to manufacturer interface allowing for calls of COOL, HEAT or Ventilation.

GEN V Controller – Each VRF system will have a Communicating GEN V controller to place calls via unit interface for cool, heat or ventilation. This controller also acts as the master control for all SAVs attached to this fan coil, polls thermostats for majority vote to set demand for cooling, heating or vent operations. GEN V controller has supply and return air temperature sensors and provides high low limit protection.

EzTouchV – Central control & management HUB that is a programmable communicating zone thermostat used with one SAV device. One EzTouchV is required per GEN V system.

EzTouchX – Programmable communicating zone thermostat used with each SAV device.

SATouchX – Programmable stand alone thermostat used for non-zoned VRF fan coil. Also requires Manufacturer's 24 volt thermostat interface.

SAV – Round Smart Air Valve – Self balancing pressure independent damper designed to deliver targeted CFM based on velocity and duct size.

SAV WxH – Rectangular Smart Air Valve - Self balancing pressure independent damper designed to deliver targeted CFM based on velocity and duct size.

STPR – Plenum rated communications wire specialized for RS485 control systems. **No wire substitutions can be made.**

COMMERCIAL APPLICATIONS

1. Complete load calculation for each zone area.
2. Total all loads and size outdoor unit using manufacturers guide.
3. If a single ducted air handler can be used, determine the number of independent zones required for the application.
4. Using load calculations for each zone and compare with SAV CFM sizing chart to determine size of SAV and duct. You may have up to 20 SAVs on a single VRF Ducted Air Handler.
5. If application is using multiple VRF Fan Coils, use manufacturers guide to size air handlers to outdoor unit and then use load calculation for each zone and Zonex SAV sizing chart to determine size of SAV and duct for each zone.
6. All outlets require an SAV damper.
7. Slaving of dampers is not allowed, one SAV per thermostat.

Once you have determined needed cooling/heating capacity and determined proper sizes for VRF Air Handlers, you need to size ductwork for each independent zone. Use the SAV sizing chart to determine the proper size of each duct to deliver desired amount of air to meet zone requirement.

CHOOSING SAV DAMPERS FOR EACH ZONE

Carefully calculate the CFM required for each zone that will be connected to each VRF Air Handler.

Use ASHRAE or other load calculations for the space you intend to cool or heat.

Choose the correct SAV from the attached sizing tables for round or rectangular SAV's. Using required CFM or BTU.

Total the CFM for each SAV to be connected to each Air Handler. Choose a Manufacturers CFM at 400 CFM per ton to select a fan coil.

For ESP External Static Pressure be sure the following duct losses are covered.

Layout the duct system for .1" WC per 100 feet of metal duct run. When flex duct is used be sure to follow Manufacturers static pressure losses per 100 feet of run is used.

Add .2"WC loss for the SAV in the longest run including fitting and elbow losses to determine total ESP required by the Air Handler Fan. Do not forget to add Return Air, and register losses.

The SAV's are pressure independent and self balancing if adequate pressure is available.

Check to be sure that the Air Handler has adequate External Static Pressure for the total static pressure loss of the duct system.

Check Local Codes to be sure adequate Ventilation air is available.

Typical Capacities for Round SAVs

	Diameter	*CFM HI	Velocity FPM	BTU HI
SAV05	5"	120	800	3,677
SAV06	6"	172	800	5,155
SAV07	7"	234	800	7,016
SAV08	8"	305	800	9,164
SAV09	9"	387	800	11,598
SAV10	10"	477	800	14,319
SAV12	12"	687	800	20,619
SAV14	14"	936	800	28,065

*Air delivery may very +/- 10% based on altitude, air density or installation. These air quantities were derived from duct sizing chart .1" friction loss per 100' duct. All CFM's listed are approximate. The pressure drop for these dampers is .2"

## Typical Capacities for Rectangular SAVs

Designing a Rectangular Smart Air Valve (SAV)

CFM x .205 = Area in Square Inches Divide Square Inches by desired duct Height to find the duct Width

BTU	*CFM	SQ inches	SAV WxH		SAV WxH		SAV WxH		SAV WxH
16,745	558	102	13x8	or	10x10	or	9x12	or	7x14
17,894	596	109	13x8	or	11x10	or	9x12	or	8x14
18,551	618	113	14x8	or	11x10	or	9x12	or	8x14
19,536	651	119	15x8	or	12x10	or	10x12	or	8x14
20,439	681	125	15x8	or	12x10	or	10x12	or	9x14
21,342	711	130	16x8	or	13x10	or	11x12	or	9x14
22,245	741	136	17x8	or	13x10	or	11x12	or	10x14
23,148	772	141	17x8	or	14x10	or	12x12	or	10x14
24,050	802	147	18x8	or	14x10	or	12x12	or	10x14
24,953	832	152	19x8	or	15x10	or	12x12	or	11x14
25,856	862	158	19x8	or	15x10	or	13x12	or	11x14
26,759	892	163	20x8	or	16x10	or	13x12	or	11x14
27,662	922	169	20x8	or	16x10	or	14x12	or	12x14
28,656	952	174	21x8	or	17x10	or	14x12	or	12x14
29,468	982	180	22x8	or	17x10	or	15x12	or	12x14
30,371	1012	185	22x8	or	18x10	or	15x12	or	13x14
31,274	1042	191	23x8	or	18x10	or	15x12	or	13x14
32,177	1073	196	24x8	or	19x10	or	16x12	or	14x14
33,080	1103	202	24x8	or	19x10	or	16x12	or	14x14
33,983	1133	207	25x8	or	20x10	or	17x12	or	14x14
34,885	1163	213	26x8	or	20x10	or	17x12	or	15x14
35,788	1193	218	26x8	or	21x10	or	17x12	or	15x14
36,691	1223	224	27x8	or	22x10	or	18x12	or	15x14
37,594	1253	229	28x8	or	22x10	or	18x12	or	16x14
38,497	1283	235	28x8	or	23x10	or	19x12	or	16x14
39,400	1313	240	29x8	or	23x10	or	19x12	or	16x14
40,303	1343	246	29x8	or	24x10	or	20x12	or	17x14
41,206	1374	251	30x8	or	24x10	or	20x12	or	17x14
42,109	1404	257	31x8	or	25x10	or	20x12	or	18x14

*Air delivery may very +/- 10% based on altitude, air density or installation. These air quantities were derived from duct sizing chart .1″ friction loss per 100′ of duct. All CFMs listed are approximate. The pressure drop for these dampers is .2″

1. Perform load calculation for each zone
2. Calculate required airflow per zone
3. Determine which zones will be associated with each fan coil (Proximity, BTU requirement, Type of Load, etc. should be used to determine fan coil association)
4. Determine how many fan coils will be used in building
5. Total zone air flow requirements and verify air flow requirement to select VRF fan coil
6. Use peak load calculation to select fan coil – VRF Fan Coil
7. Use air flow per zone to size SAV and duct to match required air flow per zone
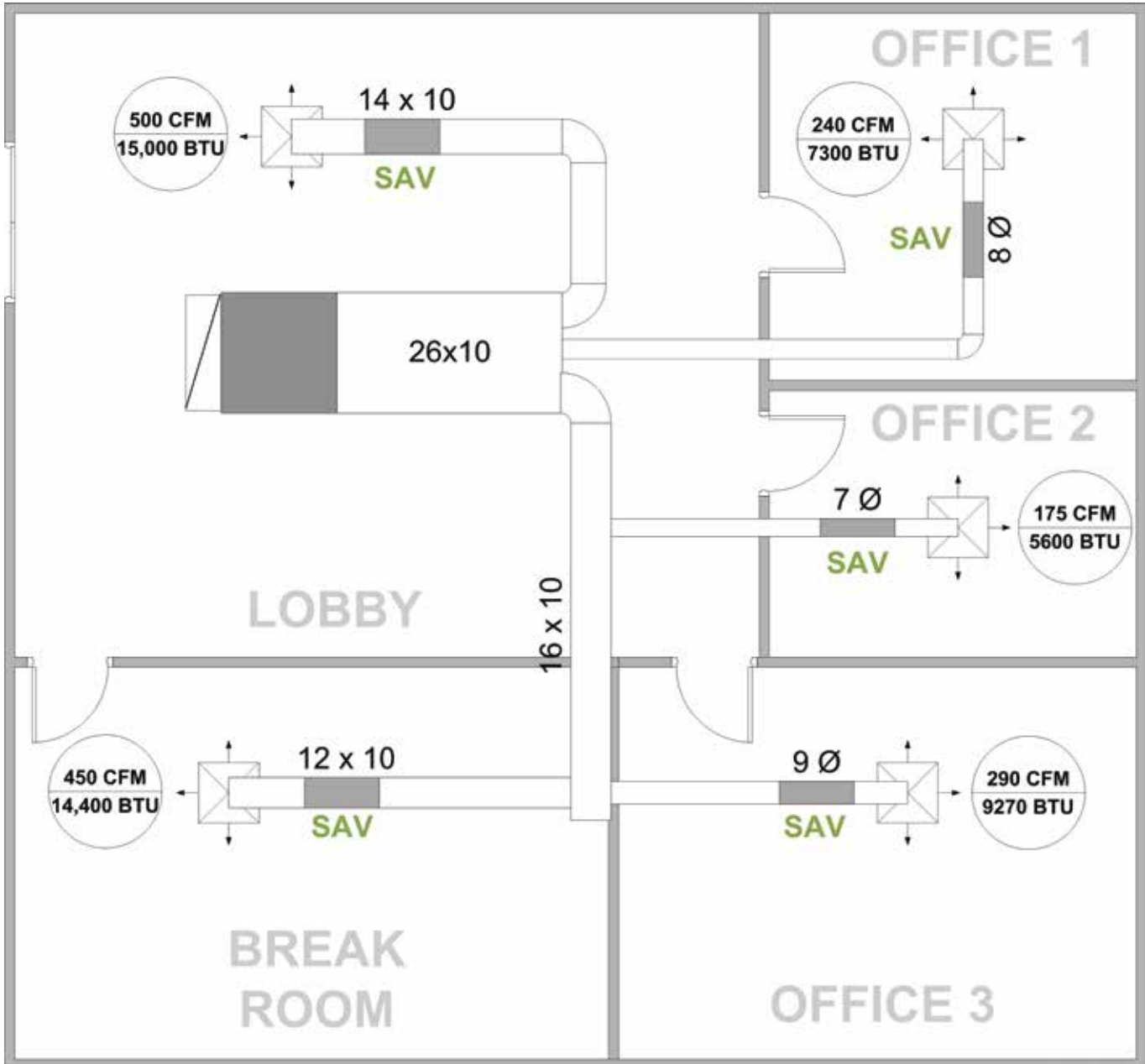
WARNING:
Every duct connected to the air handler MUST have an SAV. One SAV per thermostat.

WARNING:
Do not connect external and internal zones to the same air handler

Explanation –

In this application a single air handler connected to an outdoor unit is being used to condition a lobby, break room, and three offices. A load calculation has been completed and determined the loads for each space as follows:

Lobby - 15,000 BTUs or 500 CFM

Break Room - 14,400 BTUs or 450 CFM

Office 1 – 7,300 BTUs or 240 CFM

Office 2 – 5,600 BTUs or 175 CFM

Office 3 – 9,270 BTUs or 290 CFM

Using the SAV charts, the proper SAV can be found to service each zone:

Lobby – Rectangular SAV sized for 500 CFM – SAV14x10

Break Room - Rectangular SAV sized for 450 CFM – SAV12x10

Office 1 – Round SAV sized for 240 CFM – SAV8

Office 2 – Round SAV sized for 175 CFM – SAV7

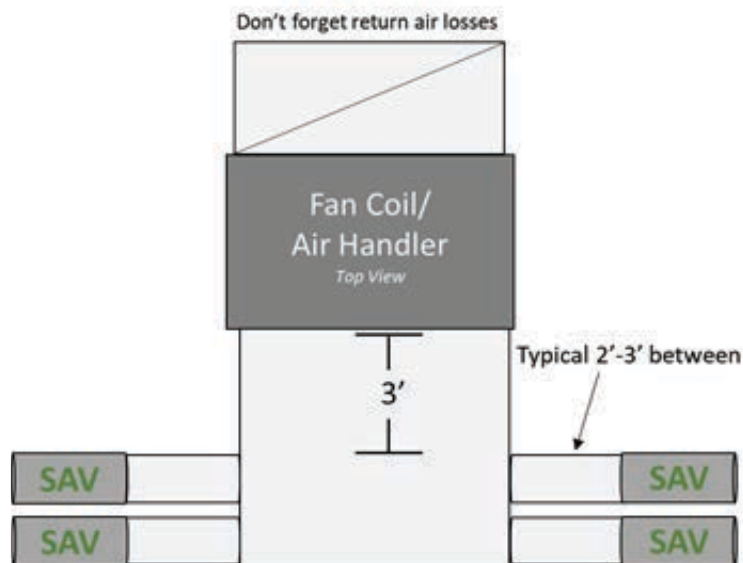Office 3 – Round SAV sized for 290 CFM – SAV9

When designing ductwork, a supply air plenum and trunk line are needed, **SAV's are never installed in line with an Air Handlers discharge air outlet**, they are to be connected to a trunk duct. SAV's must be installed 24" to 36" from the trunk duct line, install a short duct from trunk line 24" to 36" long. Then install the SAV. From the SAV continue duct to the supply register.

WRONG WAY

Fan Coil/
Air Handler
Top View
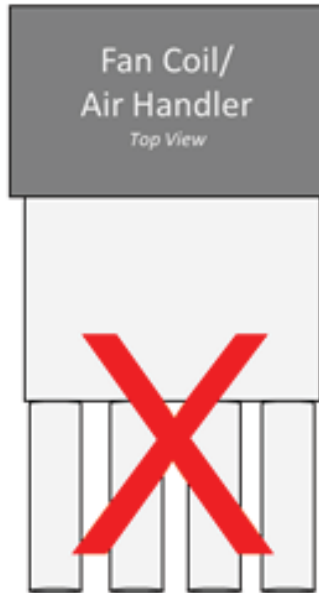
Wrong way to connect dampers
Never connect dampers in line with the
air handler. The SAV pressure switch
measures excessive velocity pressures
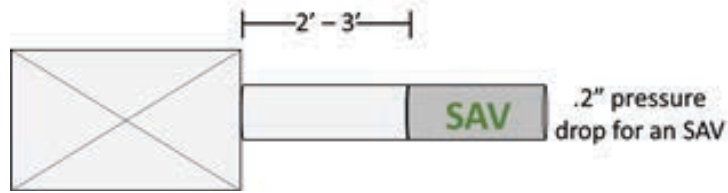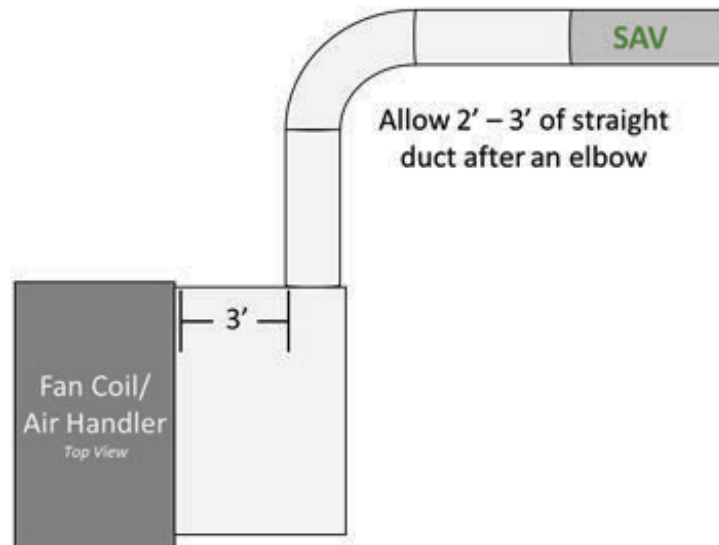when installed in line with the fan coil

CORRECT WAY

Don't forget return air losses

Fan Coil/
Air Handler
Top View

3'

Typical 2'-3' between

SAV
SAV

SAV
SAV

Correct way to connect SAV's
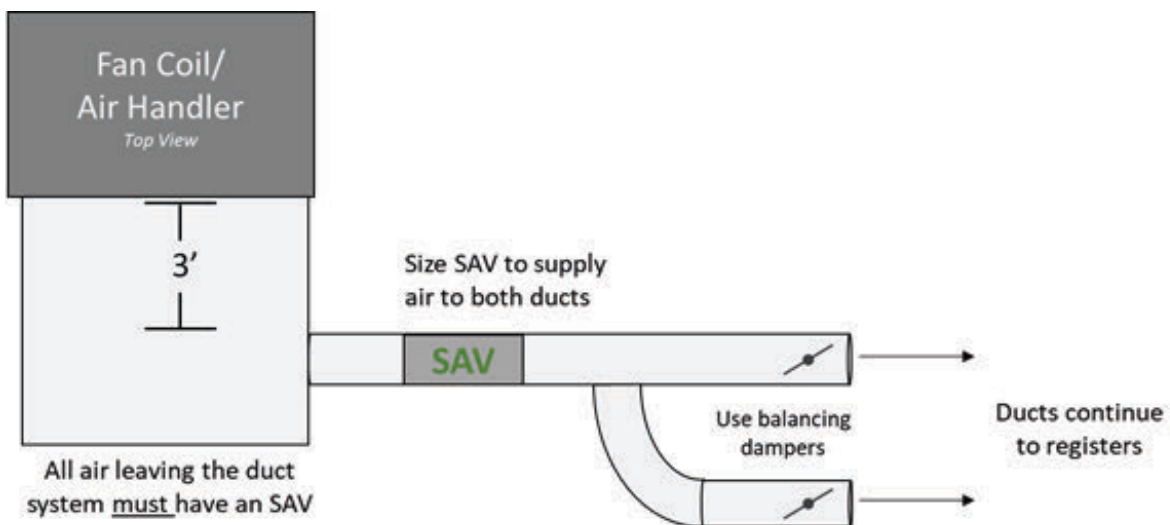to a duct trunk line

SAV and Duct Installation

Allow 2'-3' of straight duct between the trunk and SAV

Allow 3' before the first take-off

For multiple registers use balancing dampers
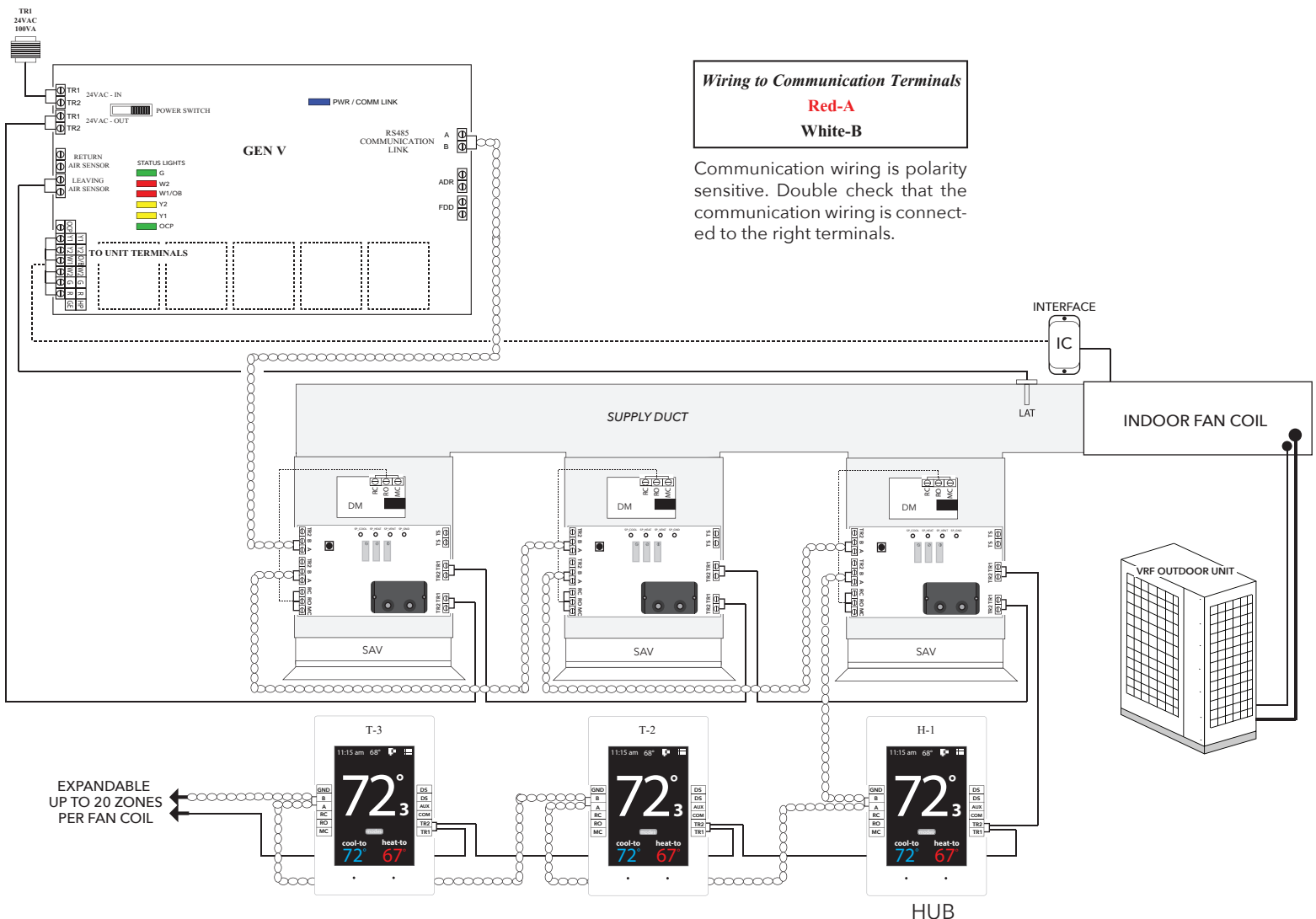
Smart Air Valve (SAV) Installation

Install dampers into HVAC duct so damper actuators are easily accessible. Smart Air Valve may be mounted in an area where the ambient temperature is between 32 and 140 degrees Fahrenheit. Round dampers should be mounted with damper actuators between 9 and 3 O'clock position.

Installing 24VAC wiring

Once GEN V controller and Smart Air Valves are installed, install one 24VAC 100va transformer, and wire secondary 24 volts to the TR1 / TR2 bottom terminals on GEN V controller. Using 18 ga. thermostat wire, wire TR1 / TR2 top terminals and daisy chain power wires to the first SAV board. Continue daisy chain wiring from first SAV board to second, third, etc., until all SAV boards are wired with power. Continue daisy chain wiring from last SAV baord to the first zone thermostat and to the second, third, etc., until all thermostats are wired with power. **Note: Maintain TR1 and TR2 wiring polarity throughout the system to improve communications. DO NOT ground out the transformer.**

Installing Communication Wire RS485

Once power wiring is daisy chained to all SAV boards and zone thermostats in the system, use Zonex STPR plenum rated twisted communications wire to install communications loop. Install communications wire using the A and B terminals on GEN V controller and daisy chain to the first SAV board in the system and wire to A and B. Continue daisy chain to the next SAV board using A and B boards. Continue daisy chain wiring from last SAV board to the first zone thermostat and to the second, third, etc., until all thermostats are wired into to the communications loop. Communications wiring is polarity specific, if RED communications wire is on A at the GEN V controller, then RED wire is connected to A throughout the system.

Wiring to Communication Terminals
Red-A
White-B

Communication wiring is polarity sensitive. Double check that the communication wiring is connected to the right terminals.

COMPONENT SELECTION GUIDE

GEN V Control Solutions
Manage the entire system from one central HUB

Part # - **GEN V**

1 - VRF Coil or VRF RTU
Supports 2 - 20 **Smart Air Valves (SAV)**
*Requires manufacturer's thermostat interface

Daisy Chain: Zonex communications wire and 24VAC from SAV to SAV and Stat to Stat
1-24VAC / 100VA Transformer Powers the GEN V, All the SAV's, and Thermostats in the system

HUB - Touch Screen Thermostat
Part # - **EzTouchV**
Need 1 Hub Thermostat per GEN V system

Zone Touch Screen Thermostat
Part # - **EzTouchX**
1 - Thermostat per Smart Air Valve (SAV)

Smart Air Valves (SAV)
Part #

SAV + Damper Size - Round (up to 1.75 S.P)
SAV WxH - Rectangular (up to 1.75 S.P)

Thermostat to Control Standalone Units
Part # - **SATouchX**
Controls and Networks Standalone RTU or Split systems
with SA / RA / RH reporting
*Requires manufacturer's thermostat interface

THIS COMPLETES YOUR GEN V SYSTEM

**For assistance, contact Zonex at (800) 228-2966
or visit** zonexproducts.com **for more information**

ZONEX
SYSTEMS
comfort you control