In today’s world of VRF air conditioning systems, building and home automation has often become the deciding factor when selecting a VRF manufacturer for a project. The old question of “why incur the added expense of integration?” has been replaced with “which manufacturer offers the best, easiest and most reliable devices to integrate with an existing building management system (BMS)?” It could also be as simple as adding Wi-Fi control to the home or small business. With the range of options available today, this decision can seem overwhelming.

In the end, the goal is to minimize utility expenses and increase comfort level, while enjoying a quick return on investment. Think of it as creating an ecosystem in an office, building or home. This article will try to pull back the curtain and explain the options to help guide HVACR contractors, techs and facility managers through the sea of myths and misconceptions.

The language of open protocols
An open protocol is the “language” that a BMS uses to communicate with all of the devices on the network. Since these protocols are standardized, any device for HVAC, lighting, security etc., can communicate over a specific protocol regardless of who developed the device.

The protocol most often used in VRF applications is BACnet. However, Modbus and LonWorks are protocols that are still popular. Converting protocols is an option that has become less expensive and easier than ever. For example, converting BACnet to Modbus translates BACnet protocol into the standard Modbus protocol, which offers solutions to fit the specific application.

History of VRF controls
When the author first entered the world of VRF controls, very few manufacturers offered products to fill the growing needs of building automation for certifications like LEED. Owners and facility managers also wanted the ability to monitor, control and collect data on their new systems. As with any new technology, early versions left much to be desired. Reliability could often be affected by intermittent wiring issues or simple power outages.

The biggest factor affecting the experiences of owners and facility managers, along with overall comfort performance and efficiency was, and still to some degree is, the third-party integrator. This is mostly due to the lack of familiarity with VRF controls and the nuances of controlling VRF equipment, which all too often can result in over control.

When working with a third-party to develop the next generation of controls hardware, the author brought years of support and field experience with an understanding of the common pitfalls that ensnare integrators working with VRF controls.

The next generation of VRF controls
When developing VRF controls the author sought to reduce commissioning time, problems and cost. His team needed to make the commissioning of controls hardware so easy anyone could do it. The team used a small software program that is installed on a Windows-based computer and easily connects to the controls gateway. Once connected, the software imports the system layout to the gateway.

The software program also works as a troubleshooting tool. It has the ability to see the VRF and BACnet communication bus, so it dramatically improves the ability to identify communication issues often associated with newly installed projects. The gateway experiences little to no downtime and even more importantly, reduces the amount of finger pointing often associated with a project that has two, three or four different contractors.

The next challenge was one of the most important: how to reduce the learning curve and the amount of custom programming for a third-party integrator with little to no...
experience with VRF controls? The biggest issues integrators have with VRF controls come down to correctly programming auto changeover and setback temperatures.

All VRF manufacturers use an auto changeover system that, for the most part, is challenging for integrators to understand. To eliminate changeover and setback issues and reduce programming time, the logic (a string of commands) to simplify and correctly control the equipment can be created. This logic is built into the controls gateway which gives integrators occupied, unoccupied, heating and cooling setpoint options.

Logic and a controls gateway were introduced to the industry in 2014. Slowly but surely, it replaced first-generation controls gateway. All of this has made commissioning easier, reduced integrator programming time, and increased efficiency and comfort performance.

Many controls integrators have had some type of bad experience with VRF controls. New logic and a controls gateway eliminate many of the issues previously experienced.

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Integration

The terms “controls integrator” and “integration” have appeared many times in this article. Let's define these terms and the roles they play in deciding if building automation for HVAC equipment fits a project's needs and budget.

For an existing building management system, there is probably a controls company that may have integrated lighting, security, ERV (energy recovery ventilator) or HVAC units, to name a few. There may already be an understanding of the benefits and the return on investment a building automation system provides.

Once the decision is made to automate the infrastructure of a building and begin constructing an ecosystem, a controls company can sell, install and configure the hardware and software that is needed to begin the automation process. There are many controls manufacturers to choose from and controls companies usually offer several options. As discussed earlier, these manufacturers use standardized protocols. So, the question often asked, “will your VRF equipment work with manufacturer X’s control system?” no longer applies.

The biggest benefit of building automation is utility cost control. Depending on the climate zone, heating and cooling costs will comprise the lion's share of operating expenses. For the purposes of this example, let's automate a new VRF system.

As the controls integrator, there needs to be a discussion on the needs of the business. Every building and operation is different, so there needs to be customization of the climate control system around client needs and budget to effectively implement a controls scheme. This scheme will increase the efficiency of the equipment and give the occupants consistent and reliable comfort.

Regardless of whether or not the controls integrator has VRF controls experience, a solution can be provided that does not entail a steep learning curve and ultimately gives the end user exactly what they want without the trial and error period often associated with VRF controls.

One size does not fit all

There are so many controls solutions to choose from these days that selecting the right one for the application and budget has become more and more difficult. Perhaps the client wants more advanced options like controlling space temperature with motion sensors. Thermostats now have passive infrared (PIR) sensors that can also utilize wireless motion sensors and door contacts. These advanced options are very flexible, but require more programming.

Or, perhaps they want to enter the world of building automation without the added expense of using dedicated controls. Lite versions of the software used by controls manufacturers are typically built into their hardware. These lite versions are simple enough to allow a facilities manager to program schedules and other functions with all of the monitoring capabilities and performance data they could ever need.
Figure 1 In this example, the HVAC controls utilize the VRF communication bus to integrate into the building automation system. Additional wiring is not needed and commissioning becomes easier and quicker.

Figure 2 In this example, each thermostat connected to an indoor unit also acts as a BACnet node. This method requires additional wiring to daisy chain the thermostats to an existing or field-supplied controls gateway. Commissioning time may increase due to the additional BACnet configuration settings. This works well in hospitality and large residential buildings.

If they want the benefits of a building automation system without all of the complexity and expense, they can always use VRF air handlers and thermostats with add-on PIR sensors. Air handlers featuring this option arrive from the factory with PIR sensors installed, so they can detect when a space is unoccupied and slowly raise or lower the setpoint depending on the current mode. They can also detect activity level, which allows the air handler to recognize the increased load and respond before the occupant’s comfort level is affected. Thermostats with add-on sensors provide the same functionality as the built-in options.

Author’s note: Throughout this article, I’ve clarified some of the open protocols, VRF controls and BMS integration options available. As technology seems to improve by leaps and bounds on a daily basis, it is not a question of if, but when the next innovation arrives. When you’ve committed to investing in a VRF system, I recommend contacting a VRF manufacturer for suggestions on integrating with existing BMS systems for increased comfort, greater visibility into energy consumption and lower utility expenses.

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