# Accessing your Heating System over the Internet

## *Taking advantage of modern technology for enhanced control and communication*

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Accessing your heating system over the internet is becoming a reality to more and more homeowners. Several different thermostat companies offer "apps"; the homeowner purchases a "Wi-Fi" thermostat, downloads the app and has access to seeing and adjusting the set-point on the thermostat. The homeowner says, "Wow, that's pretty cool," but what happens if the house has several zones? Then you will need to install several of these "Wi-Fi" thermostats and possibly download an app for each one. Alternatives already exist in the hydronic market place.

One of the many benefits of a hydronic system is the ability to zone or "cut-up" the heating system. People like to be able to control individual areas of the house, sometimes even room by room. From the homeowner's perspective, this micro-zoning is viewed as a benefit; they can control the room temperature in all areas of their house.

From an efficiency standpoint, all of this micro-zoning can lead to significant short-cycling of the boiler. That is because the boiler operates best when it runs long enough to reach its steady-state efficiency. Unfortunately, when one or two smaller zones are calling for heat, the boiler is grossly over-sized relative to the loads that are looking for heat. Therefore, the boiler reaches its limit very quickly and shuts down. It short cycles and never reaches that steady state. The result is an inefficient use of the fuel for that cycle.

What I have described is nothing new. A lot of systems have operated like this and many continue to. The issue, though, is as energy costs continue to rise, consumers are looking for ways to reduce their fuel consumption.

One of the benefits of communicating thermostats is that they have the ability to offer zone synchronization to the system. Synchronization means all of the thermostats start at the same time at the beginning of each heating cycle. Of course, the on-time of each thermostat can and will be different during each heating cycle, but the boiler benefits from this synchronization because all the zones are calling at the beginning of each cycle. Therefore, it has a load to work against each time it fires. This loading helps the boiler prevent short-cycling from occurring, thus increasing the efficiency of the boiler plant.

This is an important feature you gain by using communicating thermostats, because non-communicating thermostats operate independently of each other. In fact, they do not even know the others exist. This results in random calls for heat to the boiler. The boiler then experiences significantly fluctuating flow rates, leading to severe short-cycling.

Communicating thermostats offer superior comfort to the zones they control because they calculate a desired water temperature to maintain the space set point. They don't simply make and break a switch, but rather calculate a specific water temperature and then request this temperature onto a communicating "bus" that is sent to the "brain" of the system, the reset control. So, in essence, these communicating thermostats take an already good system (i.e. an outdoor reset control) and make it better. They do this by directly influencing the final water temperature that the control calculates and provides from the boiler out to the zones.

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Of course, each zone may be experiencing a slightly different heat loss compared to the others, and so the requested water temperatures will be different. The "brain" of the system takes all of these requests, determines the zone with the greatest demand and then fires the boiler up to this water temperature. The control broadcasts this temperature out to all the thermostats as well as the predicted length of the heating cycle. The thermostats then figure out how long they need to operate at this higher water

temperature during the next heating cycle to maintain the zone's thermostat setting.

This operation continually repeats itself for every heating cycle, constantly "tweaking" its water temperature and/or its on-times during the heating cycle. All of this is happening "behind the scenes;" the homeowner doesn't see any of this, only that they set their thermostat to a particular setting and the room constantly maintains that setting.

The other nice feature of these new communicating thermostats is they only need two wires, which makes it very easy to upgrade the existing hot water heating systems. By simply upgrading the older thermostats to the new communicating thermostats and new communicating boiler reset control, you can provide your customer with an integrated heating control system that increases the efficiency of the boiler by reducing short cycling (thus saving money) and maintaining space temperatures by requesting the lowest water temperature needed to maintain the room's set temperature (thus keeping your customer very comfortable).

The communication that takes place between the controllers, the zoning managers and sensors is very different. With older "stand alone" controls, you would set a heating curve for each control. This heating curve would then be responsible for calculating the required water temperature for that given control under specific conditions. Each one of these controls would operate independently of the others.

The newer communicating controls operate differently. The water temperatures operate on individual "buses." For example, a larger system may have some high temperature baseboard or fan coil zones, a domestic hot water (DHW) load, a pool heating set point load and three different designed radiant water temperatures. Each one of these water temperatures represents a "bus." On each bus, there may be one or several dozen zones of that specific water temperature. This communication "bus" consists of a two-wire connection that runs between the devices on each bus. Each of these buses then terminates at the main controller, whose function is to respond to the requests it has received from these buses. It may have to increase the water temperature coming from the boiler or speed up an injection pump to satisfy a call from a radiant zone or any number of functions it is capable of handling. However, the response is coordinated because all of these buses, although independent from each other due to different design water temperatures, are all on the network. Also, each device on each bus has its own digital address.

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All of this is necessary for communication to take place in an orderly and integrated manner. When a particular device—a communicating thermostat, for example—calls for heat, the main controller receives this information over the two-wire bus; it needs to know who the request is coming from. Then it acknowledges the request and sends out a signal letting the device know it has received its information and is responding. This two-way communication takes place all the time with the various devices on the heating and cooling network. In this manner, there is constant feedback occurring from the zones so that from the homeowner's point of view, every zone is maintaining its desired setting.

The information that flows back and forth through the communicating lines (buses) passes at a very high rate of speed. You can have some devices looking at information hundreds of times a second. Based upon how most heating and cooling systems work, this speed of communication is more than adequate to make sure all space temperatures are maintained. Of course, for all of this to work properly, every device must be a "communicating capable" device. This means that the mixing devices, boiler controls and thermostats must have micro-processors on-board to support the necessary hardware and software needed to perform their functions. All of these components now exist in the marketplace.

Another feature that is available with these communicating controls is the ability to access the system over a "gateway." By creating an internet protocol (IP) address for the heating and cooling system, the homeowner can look at their system with the use of a smartphone or tablet, as long as it has internet access. Once online, the homeowner can view, adjust and monitor any of the temperature settings the system is controlling. This means that whether the home has 4–5 thermostats or 30–40, the homeowner can access all of them with one IP address. The "gateway" can also e-mail daily status reports, temperature related warnings and error messages to the appropriate people. These communicating controls are also compatible with several of the major home automation companies. This type of gateway allows a homeowner to view temperatures and make adjustments through the touch screen pads provided by the home automation system.

Homeowners will continue to want to gain access to their heating and cooling systems just as they can access their security systems, garage doors and online banking. It is in your best interest to become comfortable with the expanding internet-accessible heating controls.

If you have any questions or comments, e-mail me at gcarey@fiainc.com or call me at FIA 1-800-423-7187 or follow me on Twitter at @Ask_Gcarey. ICM