



# The Benefits of Communicating Thermostats

By George Carey

**A**s energy costs continue to play an important role in the heating industry, an ever-increasing pressure will continue to exist to provide the best, most efficient, comfortable and low-cost heating system for your customer. One very effective option is to incorporate an outdoor reset control. Outdoor reset is when you increase or decrease the water temperature going out to the system based on the outdoor temperature.

The system incorporates an outdoor sensor to inform the indoor temperature control of the temperature outside, since this has the greatest impact on the building's heating load. When you reduce the supply water temperature, you reduce the Btu/h output of the heating terminal unit (baseboard). This is because you are changing the difference between the air temperature surrounding the baseboard and the water temperature inside the baseboard. By lowering the supply water temperature, you can input the right amount of heat, offsetting the heat loss of the building.

A lower water temperature will also create a more comfortable environment for the homeowner because the wide temperature swings that normally occur will be eliminated. A typical heating system uses a thermostat, which is a switch that sends a signal to the boiler and a circulator saying it is cold. The circulator turns on and sends 180°F water out to the baseboard zone. And this happens whether it is 10°F or 50°F.

Most of the time, the 180°F water heats up the zone quickly and the thermostat, sensing this temperature rise, shuts off the circulator. However, remember the heat loss from the building has not stopped. It continues as long as the outdoor temperature is below the desired indoor temperature. Therefore, the system continues to cycle on and off, becoming too cold and then too warm. With reset however, when you change the temperature of the water to match the load, the circulators and/or zone valves stay on for longer periods. This keeps the radiation warm all the time instead of cycling on and off. This more constant supply of cooler, comfortable water also eliminates the creaking and groaning noises usually heard in systems that cycle 180°F water into a zone. The room temperature will not override due to the excessive wa-

ter temperatures. Another benefit of resetting a hydronic system is fuel savings. By lowering the water temperature in the boiler and piping system, the stand-by losses and stack losses are minimized.

The concept of changing the water temperature to match the load of the heating system is very logical and has been around for quite some time. Recently however, control technology has advanced considerably. This has provided some reasonably priced, yet very effective residential and commercial hydronic controls.

These newer controls take the benefits of outdoor reset one step further—they use thermostats that have the ability to communicate with each other as well as with the “main brain”, the outdoor reset control. This ability to communicate provides the most comfortable, affordable and energy-efficient system available.

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/zone individual areas of the house and sometimes even control/zone 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. But from an efficiency standpoint, all of this micro-zoning can lead to significant short-cycling of the boiler.



Thermostats that talk to each other and to the outdoor reset control are the coming thing. This example shows two Honeywell communicating thermostats (Honeywell VisionPRO IAQ) flanking the outdoor reset (a Honeywell AquaReset). (Image courtesy Honeywell.)

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 oversized relative to the loads that are looking for heat. Therefore, the boiler reaches its limit very quickly and shuts down. It short cycles, never reaching that steady state of higher efficiency.

The result is an inefficient use of the fuel oil for that cycle. Compound that over hundreds, if not thousands of cycles during the course of a heating season and then even worse, consider years of operating like this—the result is a very inefficient heating system that is wasting money for your customer.

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

One of the benefits of these new communicating thermostats is that they have the ability to offer zone synchronization to the system. *Synchroni-what?* Synchronization means all the thermostats line up (like at the beginning of a race) and 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. The on-time of each thermostat is controlled by that zone's load during that 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 decent load to work against every time it has to come on. And this loading helps the boiler prevent short-cycling from occurring, thus increasing the efficiency of the customer's 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 "sees" significantly fluctuating flow rates which lead 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.

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 both this temperature 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.

And all of this is happening behind the scenes—the homeowner doesn't see any of this; they only know that they set their thermostat to a particular setting and the room constantly stays at 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.) This "new" technology is here to stay and something you should become familiar with and be able to offer your customers!

If you have any questions or comments call me at FIA at 1-800-423-7187 or email me at [gcarey@fiainc.com](mailto:gcarey@fiainc.com).