Wireless Pneumatic Direct Digital Control for the Energy Smart Building

How can the pneumatically controlled building advance with the times to be more sustainable without a disruptive and costly overhaul?

The Answer: By converting a building with working but outdated pneumatic control system to a Direct Digital Control (DDC), using wireless technology. Wireless pneumatic Direct Digital Control (DDC) provides rapid payback and minimal disruption to gain ongoing energy and maintenance cost savings, while improving comfort and operations.

Companies are always seeking ways to reduce costs and gain better economic advantages. A large number of buildings with pneumatic control infrastructure are falling behind in energy management as digital systems and networks become more common and critical. Their operating expenses and asset valuations are severely impacted as energy and maintenance costs rise and more value is attributed to energy efficiency and sustainability.

The conventional wisdom is that full conversion from pneumatics to DDC is the only path. Clearly DDC enables better control and optimization, but in most cases the existing pneumatic systems themselves are still functioning properly. DDC provides the flexibility over pneumatics that buildings need to operate intelligently (e.g. simple zone level control, scheduled setbacks, system coordination and load shedding). But the conversion path is too expensive and disruptive to existing tenants to be followed by most building owners. Their focus on financial performance and limited capital make it nearly impossible to entertain the five to ten year payback estimated for such a conversion. One public schools official described a 15 year plan to replace the pneumatic controls in its 30 school buildings.

The ideal solution would be a middle ground where the existing pneumatic system could be utilized with a DDC system, like a digital pneumatic version of a thermostat, but without having to install network wiring.

Millennial Net Wireless Pneumatic DDC Thermostat

Developing the recently released Wi-Stat IIIp wireless pneumatic DDC thermostat, Millennial Net has completely rethought how to address the challenges of pneumatically controlled buildings. It sought to cost-effectively combine the best proven technologies, not just add a wireless radio to the old-style mechanical pneumatic thermostat. Unlike conventional bi-metal pneumatic (mechanical) thermostats, the Wi-Stat IIIp is a solid state technology, operating without mechanical parts. It does not utilize the maintenance-intensive control mechanisms of the pneumatic thermostat that is to be replaced. The solid state technology improves control quality and responsiveness. Routine maintenance and recalibration are eliminated. Time and cost of installation are reduced as there are no wires, no adjustment screws and no

need for calibration. The wireless network forms itself and data communications enable remote monitoring, adjustment and trending to ensure long term performance. Devices are immediately accessible bi-directionally via the internet and easily integrated with other automation systems.

Like Millennial Net's first wireless pneumatic thermostat, introduced in 2008, the Wi-Stat IIIp is part of an extensive family of interoperating wireless controllers, sensors, meters and supervisory systems which utilize the IEEE 802.15.4 standard and 2.4 GHz radio band. The product is a major leap forward with advancements such as:

- Continuous branch-line pressure monitoring
- Leak detection and status notification
- Leak compensating operation

Wireless Helps

Wireless mesh network solutions are gaining acceptance as a reliable, practical and highly affordable means to retrofit existing buildings for monitoring, control and energy management. Several important capabilities are enabled by retrofitting buildings whether electric or pneumatic with wireless technology.

- Remote wireless set point control
- Programmable temperature setbacks
- No wiring or cable installation

Wireless lends itself particularly well for retrofit of pneumatic buildings because no power or network cables are present at the thermostat. Recently innovators and early adopters have stepped up to demonstrate in pneumatic buildings that significant energy efficient benefits can be achieved using wireless thermostats and sensors. Primarily these wireless devices focus on lowering the cost of retrofitting over conversion to DDC and the benefits of connectivity and visibility. One demonstrated that such a retrofit can be achieved with an install rate of less than 20 minutes, with the total install cost being a third of a wired solution.

Paybacks of 2, or even less than one year are certainly attractive, but is wireless communications added to fundamentally antiquated controls enough?

Advantages of Wireless and DDC Combined

Millennial Net's wireless pneumatic DDC combines wireless communications, local processing, local and remote sensing, and closed/open loop controls. DDC and Wireless combine to reduce the time and cost of installation, operation and maintenance. Investment payback (typically 1-2 years) and sustainable energy efficiency are important reasons for this comprehensive control capability.

DDC helps better deliver occupant comfort while optimizing energy consumption and cost. This is important when seeking utility energy efficiency programs offering incentives and performance contracts that need assurances that expected energy reductions are enforced. Load management and automated demand response are also driven by policies. For example, the Millennial Net system implements such programs through a number of user-defined energy policies that are managed through the internet and distributed to each site and communicated wirelessly to each control device.

Important DDC features/capabilities to look for include:

- Modulation of pneumatic branch line pressure, acting on multiple inputs to accurately and responsively control zone temperature
- Detection of pneumatic leaks (supply and branch)
- Compensation of leak employing various strategies depending on severity
- Restriction to avoid simultaneous reheat and cooling
- Remote adjustment of control parameters (e.g. gain, proportional…) to refine controls based on performance trend data
- No adjustment screws, so need for calibration to reduce the cost of maintenance is eliminated
- Software configuration (e.g. reverse/direct acting units)
- Low power (long battery-life) operation of set point adjustment, modulated control and mesh communications,

For more information on the Wi-Stat IIIp see http://www.millennialnet.com/psi.

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