**Out-of-Control Controls**

Why do we tolerate a controls industry characterized by mediocre software and unreliable sensors?

September 2011

By Peter Rumsey

Imagine buying a new high-end car that doesn’t work. You have it inspected by an specialist to diagnose problems that take weeks to fix. Finally you take possession of your car after most, but not all, problems have been repaired and you are told you need a service contract. You wonder why you bothered buying new. Car buyers wouldn’t put up with this, yet the building sector tolerates a similar situation with commissioning controls systems. Owners shouldn’t have to commission new buildings. The controls industry business model includes selling inadequate software and sensors that don’t work effectively as installed. This industry needs a makeover.

Controls don’t deliver on the promise of optimizing building performance. Nighttime commercial building energy use is 20 to 40 percent of daytime levels, but with lights off, empty buildings should use less. UC Berkeley’s Center for the Built Environment reported that only 11 percent of buildings meet ASHRAE criteria that 80 percent of occupants be comfortable. A study funded by the California Energy Commission found that over half of air-side economizer dampers were not working as intended due to factors including bad sensors and bad control logic. The Lawrence Berkeley National Laboratory determined that 90 percent of buildings have HVAC controls and systems that don’t work properly in the first year of occupancy.

In generic mid-sized office buildings, controls commonly function off intent. Green and innovative low-energy buildings fare even worse: Canned controls solutions don’t mesh well with nonstandard techniques. Poor performance with a radiant heating system might be a controls issue, but it can leave project participants reluctant to try new approaches. It’s hard to pinpoint the source of this breakdown, but in my experience software implementation problems are usually key. System performance varies with the quality of the installer and programmer and bad code compounds poor implementation. Control loops that don’t work correctly cause valves, dampers, fans, and pumps to cycle uncontrollably for years at a time. Faulty sensors are another factor. The controls contractors I work with are often installers with electrical or programming backgrounds, not well versed in HVAC systems.

Illustration by Yarek Waszul

I don’t blame building operator error or insufficient training for failures. Controls need a more user-friendly interface that points out problems and opportunities. The system has to work; operators don’t have time to debug it. Controls should be like smart phones: reliable, intuitive, easy-to-use, automatically diagnosing problems and self-healing them. In the rare event that my iPhone crashes, I don’t have to hack its source code. Perhaps someday artificial intelligence innovation will yield controls breakthroughs.

I look forward to the day when commissioning is no longer necessary. I won’t have to explain to owners why they must pay to verify that the system they just purchased is working. We need a better controls paradigm where a project’s success no longer hinges on who installs the system or which software is used. In the venture capital world investors seek disruptive technologies that will transform an industry. The controls industry is ripe for disruption. Controls should work properly the first time and consistently deliver comfort and energy savings. Building owners and occupants deserve no less.

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