Advantages of Using Integrated Thermal Controls Versus Third-Party Controls

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Data center managers have many choices when choosing thermal controls, either those that come pre-installed and integrated with cooling units, or third-party controls requiring installation on units and additional integration programming. Emerson Network Power believes that using thermal controls that come integrated with cooling units helps ensure fast, trouble-free, and efficient thermal management and easier integration to building management systems (BMS).
In contrast, some of the biggest mistakes we have seen in the thermal controls arena have resulted from using third-party controls requiring complex programming and integration to units and the BMS.

Companies traditionally turned to third-party controls because pre-programmed, integrated unit controls were not easily configured to accommodate desired cooling operating sequences or routines. Fortunately, that's changed. New generations of integrated controls, such as the Liebert® iCOM™ system pre-installed on Emerson Network Power cooling units, now include multiple operating sequences for many types of applications and automated routines designed for the units on which they are installed.

Moreover, a new class of thermal controls, such as the Liebert iCOM-S, operates as a supervisory control at the system level to monitor and manage multiple cooling units, eliminating the need for programming between units and the BMS and providing an additional layer of security for the cooling units.

We commonly see four pitfalls in using third-party controls over integrated controls:

1. Higher Installation Costs
2. Improper Programming
3. Complex Integration into Building Management Systems (BMS) Integration
4. At-risk Lifecycle Sustainability

Costly Installation

The process of programming third-party controls for specific unit operations, multi-unit routines and BMS integration is complex. It can take months to complete, at a very high cost.

In contrast, integrated unit controls can be configured and tuned across a large data center in just days, because they offer these advantages:

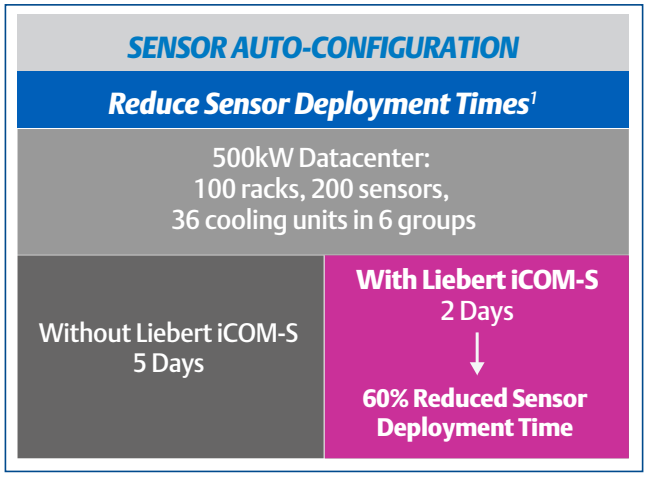
- They require relatively few on-site changes, because they are programmed for specific units.
- The same configuration files can be used between units to maintain consistency in settings, reducing installation times.
- Unit retrofits, if needed, can be done in less than an hour.

At the system level, supervisory controls automatically integrate with cooling units and sensors, offering these advantages:

- New configurations and floor layouts can be added in minutes.
- Auto sensor detection and configuration cuts sensor deployment times in half. (*See chart 1*)
- Monitoring, alerts and controls routines are automatically mapped to each unit, requiring little additional configuration.

Today's integrated controls provide companies with the benefits of easier, lower cost installation, plus the advantages of greater configuration flexibility.

Chart 1



Easy configuration and binding of sensors and cooling units cut deployment times by days.

Improper Programming

Controls do only what they are programmed to do. Companies taking responsibility for programming set points, sensitivities and other cooling unit operating parameters, should be aware that changes in these may come with risks.

Poorly tuned controls can put operating routines, thresholds and failure scenarios at risk, leading to downtime, inefficient operation and excessive component wear and tear. Errors in programming can potentially reduce system protection and efficiency, sometimes at great cost.

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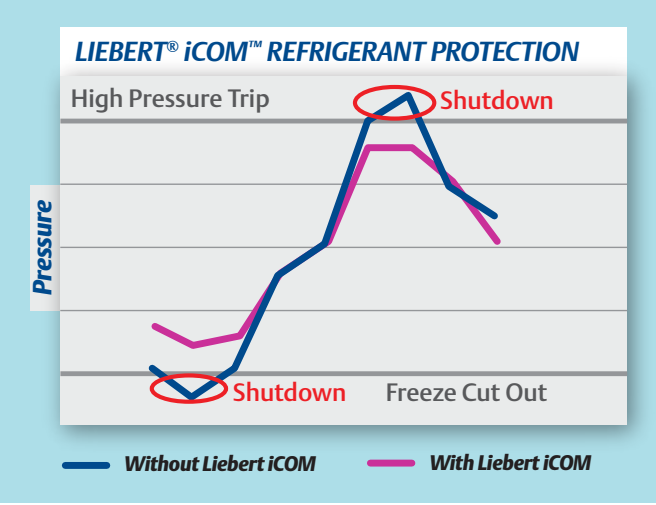
For example, our technicians visited a company that had replaced preinstalled, integrated cooling unit controls in its direct expansion (DX) cooling systems with third-party controls. These third-party controls did not come pre-programmed with prescribed unit failure scenarios, and so the scenarios had to be programmed.

One of their units went into a low-pressure condition, and its controls failed to respond with a capacity change to avoided unit downtime. This resulted in a coil freeze condition, which shut down the unit, at substantial cost to the customer.

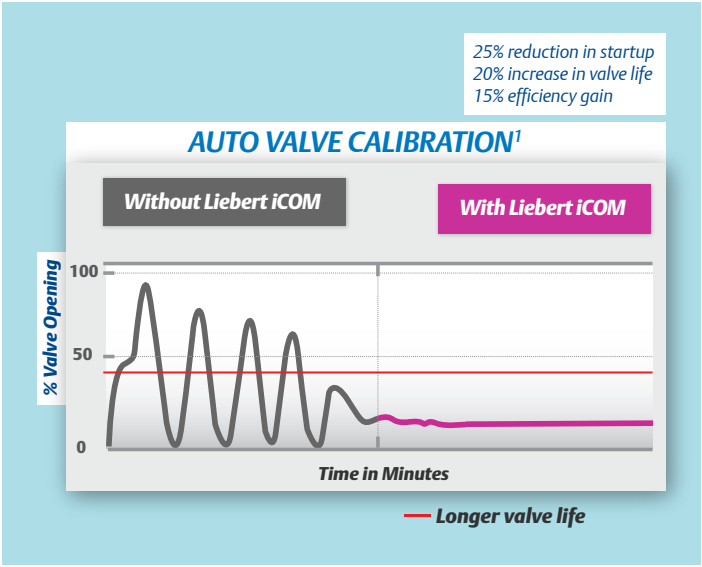
Had the company used the integrated unit controls, the problem would have been avoided, because the unit controls were pre-programmed with unit-specific operating parameters and routines. As the unit approached the low-pressure condition, the controls would have engaged self-healing routines and reduced capacity to extend runtime, and then notified the user in time to prevent downtime. (*See chart 2*)

Chart 2



Self-healing routines prevent DX refrigerant freeze. As refrigerant pressure approaches thresholds, the controls lower fan speed and compressor capacity so cooling is not disabled due to a low-pressure cut out. At the other end of the spectrum, the controls adjust the compressor down and raise fan speed so cooling is not disabled due to a high pressure condition.

Chart 3



Automatic valve calibration and valve type detection reduce valve "hunting" to increase valve backlash and valve gear wear.

A second problem we encounter with third-party controls is excessive wear and tear on unit components, because the controls are not properly mapped to unit routines. For instance, in chilled water systems, poorly tuned controls can lead to unwanted conditions, such as wide fluctuations in temperature and humidity, and to frequent oscillations in water valves as they continually "hunt" to find the correct open position. Each of these problems reduces equipment life and wastes energy.

Integrated controls, however, are pre-programmed for specific setpoints and operate the valves and other unit componets as required to meet setpoints. Additionally, these controls can provide valve auto-tuning that minimize valve hunt times, thereby saving wear and tear and improving efficiency. (*See chart 3*)

A third potential programming problem we sometimes see with third-party controls results from setting return air temperatures higher than allowed by a given refrigerant and compressor. While running return air temperatures at 95°F might work well for a unit using R410 refrigerant, programming that same temperature in a unit running R407c refrigerant will likely result in unit failure.

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BMS Integration

In some data centers, the BMS is programmed to control cooling units. Data center managers may do this for a number of reasons, such as wanting to maintain a specific proprietary control strategy, use a standard user interface across different makes of cooling units or to attain functionality provided by the BMS that is not available in the integrated unit controls.

However, integrating third-party unit control operations into a BMS requires significant on-site programming and testing. Companies going this route might find that they have to extend implementation times beyond desired deadlines.

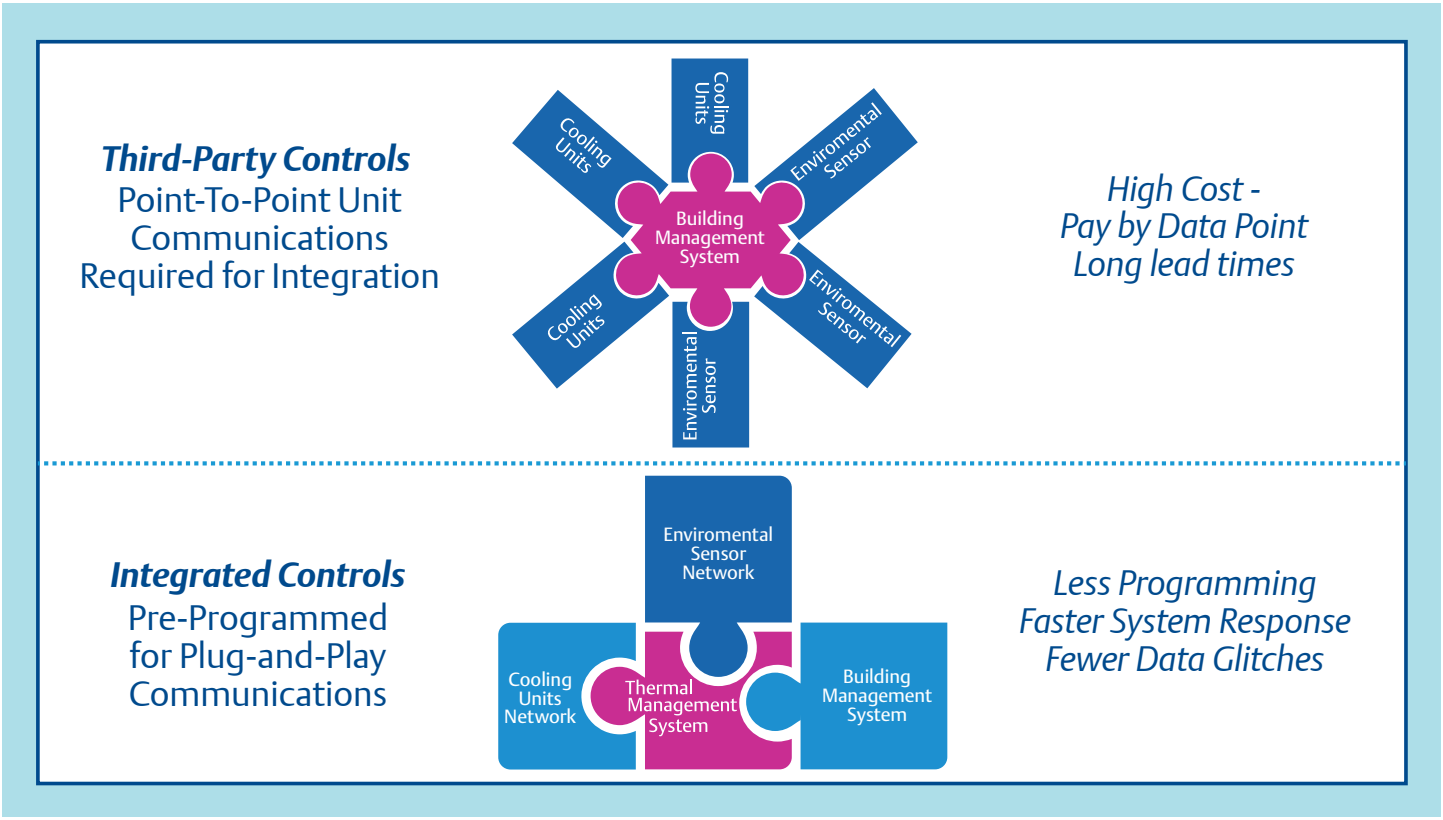
Moreover, since data centers often have multiple types of cooling units, and each unit requires separate programming to the BMS, point-to-point integration can result in in a lack of consistency in how units communicate. Trying to scale such a system is difficult and expensive, because of the additional programming required. Getting it right requires a significant amount of engineering time and effort.

Communications between the units and the BMS can also create data bottlenecks. Delays in monitoring unit-level and sensor inputs can lead to delays in unit response times. These bottleneck can create lags in moving units into and out of standby mode, resulting in ongoing hot spots and other problems.

By comparison, integrated unit controls eliminate reliance on BMS control,because they can form a cooling unit network that operates through through M2M (machine-to-machine) communications. A supervisory thermal system control can be implemented to easily integrate the unit network and environmental sensor network. This simplifies data communications and cut deployment costs by up to 80 percent, compared to using a BMS. The supervisory system control also provides insight into all cooling unit operations and room environmental conditions, while still maintaining unit control for redundancy.

If desired, the system control can be easily integrated to the BMS through a more streamlined configuration process. *(See Chart 4)*

Chart 4



Using a thermal system supervisor eliminates the need for costly integration between the BMS and each cooling unit and speeds response times.

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Lifecycle Sustainability

Commissioning unit controls optimizes them for conditions that exist at the time of installation. As time goes on, companiesalso need to ensure their data center thermal systems will function as desired in changing operating states, such as low-load conditions, or in the case of economization, fluctuating outdoor temperatures.

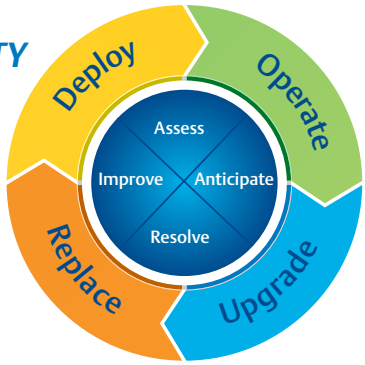
Finding the right company to provide commissioning and follow-on tuning and maintenance can be challenging. There are many companies with controls experience, but relatively few have personnel with specific experience in data center thermal controls. Oftentimes, original programming activities and subsequent upgrades are not consistently documented, leading to future mistakes and mishaps. To avoid this, some companies go as far as to keep a controls vendor technician on site. Or course, this is costly.

Integrated Liebert® iCOM™ controls support lifecycle sustainability by providing digital maintenance logs, troubleshooting instructions and automated routines that simplify programming and maintenance. Every system activity and change is documented and is readily available to a technician. Additionally, our network of local service experts ensures rapid response without the need to keep a third-party technician on site.

THERMAL SYSTEM LIFECYCLE SUSTAINABILITY

Role of Thermal Controls

As your data center thermal system evolves, integrated thermal controls enable you to better assess conditions, anticipate events, resolve challenges and improve performance.



Avoid the Pitfalls

Emerson Network Power has spent decades innovating controls for datacenter cooling systems. While integrated controls once lacked functionality desired by some data center managers, today's generation of cooling unit and thermal system controls now provide superior functionality, such as advanced machine-to-machine communications, teamwork, powerful analytics and self-healing routines. Programming routines are much more flexible and can be performed much faster and at lower cost than using previous generations.

Using third-party controls might have some advantages in certain situations. However, new advanced, integrated controls in most cases can ensure greater protection, efficiency and insight.

1. Calculations by Emerson Network Power. Energy and costs savings analysis are provided for illustration and estimation purposes only. Actual savings are subject to varying conditions.

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