

Rethinking Environment Control System Installation

By Jeff Tilleman

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The Data Center Facilities Management Team has a sizable job: maintaining 100 percent uptime and managing all the variables to keep systems operational, including the environmental infrastructure. The last thing the team wants to worry about is rewiring panels or decrypting schematics for new hardware or system retrofits. Having comprehensive details as to how control systems are installed and wired can eliminate a substantial amount of time when performing a system upgrade or implementing changes in a data center. However, control systems have traditionally been difficult for the facilities team to manage. It takes time to work the bugs out of control systems once the data center goes live, and upgrades and changes are challenging because control systems tend to be poorly documented.

In any construction project, including data centers, control systems are typically the last to be installed. In fact, installing control systems can often delay completion of a construction project, so the approach has been a rushed installation process which, in turn, leads to short cuts being taken. Control systems are critical to effective facilities management and it's not unusual for the contractor responsible to receive numerous callbacks to fix wiring and installation problems.

Whether it's a new data center installation or a retrofit, the facilities management team inherits the problems created by the control system installers. The dilemma is that control systems have long been an afterthought by contractors. For effective data center facilities management, the control systems have to not only be correctly installed but meticulously documented to accommodate future changes and upgrades. For maximum efficiency, control systems engineering should be part of data center construction from the earliest planning stages. Data center designers and contractors need to acknowledge that adopting new procedures will ensure flawless system operations and comprehensive documentation.

Include Control System Planning Before You Break Ground

When it comes to designing control systems for data centers, the greatest challenge is the project size. There are numerous points to track and manage – so many that the design and installation of control systems is becoming increasingly complex. Yet, control engineering and control system installation are commonly delegated to the mechanical contractor at the end of the project, leading to wiring and termination issues as well as last minute changes when equipment shows up that hasn't been built to integrate with the control system.

A common practice for data center installation is to wait until the chillers and other equipment are installed before pulling cable for the control systems. Once the equipment is placed, and the contractor has the specs for hardware, they begin finalizing the control systems. This process not only creates unnecessary delays, but adds complications. For example, end points have the potential to be moved to accommodate the equipment wiring layout, and equipment placement can make running the necessary cable more complex.

A better approach is to address control engineering from the outset, before construction begins, by making every job part of the BIM design. This allows for the establishment of cable routing and locates panels. The risk of complications during final connections is eliminated when control engineering is included as part of the initial design process. The control systems team can then concentrate on laying out their own systems separately from the other contractors and prioritize branch circuits to critical control panels to facilitate commissioning early. This allows the team to push for specific 20 amp circuits, which are always a very low priority for the electrical contractor.

Planning control systems work in the design stage along with close collaboration with the General Contractor, electrical contractor, HVAC specialists, and other members of the construction team saves hundreds of man hours and shortens time to completion. For example, one can start modeling wiring pathways, locating panels, and planning work prior to sending anyone into the field, making more efficient use of the time required for complete installation.

As part of preplanning, it is beneficial to have specifications for the control systems in advance, including drawings. For example, all the equipment manufacturers should be contacted for specifications as soon as the systems have been selected. Ensuring that cable and connections are in place when the equipment is installed means the only step remaining is the final connection, and no additional cabling or connectors are required.

Document Everything

By starting in the design phase and carefully laying out systems in advance, everything is mapped out by the time the control systems team is in the field. As part of a preplanning strategy, our team has developed a comprehensive wire numbering scheme uniquely identifying each connection. We are then able to use the BIM drawings to ensure the correct cables are laid in each raceway.

There is a great deal of repetitive work involved in the installation process. By predesigning the control system with exact drawings we are able to delegate this work to less skilled, and therefore less expensive labor.

As an example, our team worked on a data center installation that required the wiring of 160 air handling units. By creating comprehensive drawings in advance and planning and purchasing factory labeled cables, we reduced termination time by three hours per unit for a crew of three. This added up to a substantial savings in time and money and allowed our team to stay ahead of the commissioning team.

For this early control systems design strategy to succeed, one must be capable of tracking unique wires from end to end. In our experience, the best strategy is to maintain a Cloud based database. When the BIM design is complete, all data for the wiring and parts is fed into the database and associated with the appropriate workflow, which is then installed and checked on the job site. As part of the QA/QC process, each installation and wiring step must be reviewed and logged before the system will move to the next step.

Supervisors, equipped with wireless data access tablets, record and track the work as it is completed. Keep in mind, however, that many data center sites are in remote areas where Web access is not readily available. The installation tracking application can be used offline, storing the latest layout drawings for

reference and synching with the cloud database when connectivity is available. Using the tablet, supervisors are able to monitor and record progress, including validating each wire and connection.

Although not completely foolproof, this approach ensures that every wire and part is accounted for, labeled, and tested. We have a high success rate utilizing this process with virtually no call-backs once the job is complete.

“Get Off the Critical Path”

Vast savings in data center installations can be gained by utilizing this methodology; the biggest being time. There are savings on initial installation, but a bigger savings is during the commissioning process. By having a real time database, updates to the commissioning team can be done daily, helping the entire team to plan. The team also has the ability to prioritize specific cables and terminations to get ahead of the critical path. Data center wiring typically goes through three phases of testing: Level 1 continuity testing; Level 2 point-to-point testing from end device through to the final control screen; and Level 3 testing for to ensure proper operation. By carefully mapping out designs in advance, cataloging every wire and connection, and using a structured check system to ensure proper installation, there are seldom wiring issues by the time Level 3 testing is reached.

An additional advantage is that this process holds team members accountable for their work and eliminates finger-pointing. Should an issue arise, the system can be accessed to identify exactly when the original installation was signed off and by whom. The accountability guesswork is removed.

For the data center management team, this approach not only ensures plug-and-play installation of hardware from the outset, it simplifies modifications and upgrades. Since there is a database that tracks each wire and termination point in the control system, it's simple to map the proper connections and ensure changes to the system are properly installed with minimal required troubleshooting.

The control systems engineering team at Rosendin Electric has been utilizing this approach with our data center customers. It's part of our overall commitment to improve efficiency and outcomes through careful planning. We live by the motto, “Get off the critical path.” By using the right planning tools and wiring database, and building QA/QC checks and balances into the installation process, we avoid costly delays and improve efficiency throughout the job. By efficiently preplanning we are eliminating mistakes and while our team is still typically one of the last subcontractors on the construction site, we have developed a habit of being the first one done and off site.