

# Cost Effective Independent Monitoring

## ANIMAL CARE

January 2004

### Case History

When planning a new vivarium project and discussing building automation, a debate often arises between the Facility Operations and Animal Care staff. On the typical research campus the mission of the Facility Operations staff is usually to deliver properly conditioned air, water, and steam to a wide range of facilities including laboratories, vivariums, and offices. The primary goal is a comfortable and safe work space. Facility Operations therefore approaches any project from the vantage point of how the new building fits into the overall campus. Facility operators want tools that help them manage the major systems that condition the environment in each building and today's Building Automation Systems surely provide that capability.

When it comes to vivariums, the Animal Care staff naturally takes a more parochial view of the conditions in their facility. One important distinction being the need to protect the animals within their care and likewise the past, present, and future value of the science that is in progress. Unlike people who can pick up the phone and call in a complaint when it gets hot, the animal population offers no feedback and so it becomes the responsibility of the care givers to assure that the environment is maintained within prescribed limits at all times. Human nature is such that animal care people feel reluctant to delegate the responsibility for the success of their mission to Facility Operations and maintenance people who must constantly juggle the demands of many users and departments.

The classical solution to this problem has been to put an "Independent Monitoring System" in place. This requires essentially doubling the temperature and humidity monitoring infrastructure and therefore comes at added cost. When it came time to plan a new +150K square foot facility, a large global pharmaceutical manufacturer decided to look for more cost effective alternatives that did not compromise their desire to have independent monitoring, but leveraged some of the Building Automation System (BAS) infrastructure. This article discusses how the innovative solution the project team developed and implemented can provide the best of both worlds. It also highlights the broadest range of capabilities this next generation system can provide.

### Design Goals

Independent monitoring systems usually have features which provide the specific benefits animal care people need to run their facilities. These benefits include:

**Independence-** the system, including displays, alarms, lighting schedules, and data archiving are to be provided by a system wholly owned and operated by Animal Care.

**Accuracy-**As the accuracy of the measurement is highly dependent on the quality of the measurement device, industrial quality devices are to be used in lieu of the traditional 'comfort control' quality sensors.

**Alarming-** alarm activity must be brought quickly and directly to the attention of the Animal Care staff, independent of the alarms generated by the BAS system owned by Facility Operations.

**Notification-** Animal Care staff requires instant notification to any place where phones, cell phones, pagers, or email are available.

*"Independent monitoring systems usually have features which provide the specific benefits animal care givers want and need"*

*The Innovative approach utilized for this project was more cost effective and did not compromise the desire to have an independent system.*

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**Access without Borders-** the system should be accessible using a web browser from anywhere the staff has access to the corporate intranet or extranet. Because access is typically not available within the holding and procedure rooms in the building, touch screen kiosks can be utilized to allow local access to the system.

**Reporting-** it is desirable to be able to get reports documenting the occurrence and presence of alarm conditions, as well as records of changes made to alarm settings and lighting schedules.

**Data Archiving-** all environmental conditions must be recorded and archived in a secure data server. Data archives should be accessible to researchers and measurement data capable of being downloaded if need be by the research or Animal Care staff. Data should be capable of being migrated to Microsoft Excel spreadsheets.

**Lighting Control-** in addition to alarming on lighting failures, it is desirable to allow animal care gives the ability to change daily schedules.

**21CFR Part 11 Compliance-** while not a requirement for all projects, many Pharmaceutical applications require that the system provide an audit trail for record keeping, changes and secure electronic signatures to meet these FDA regulations.

**Validation-** while BAS systems are typically commissioned and not validated, in a pharmaceutical application the system may need to be validated.

## The "Independent" Solution

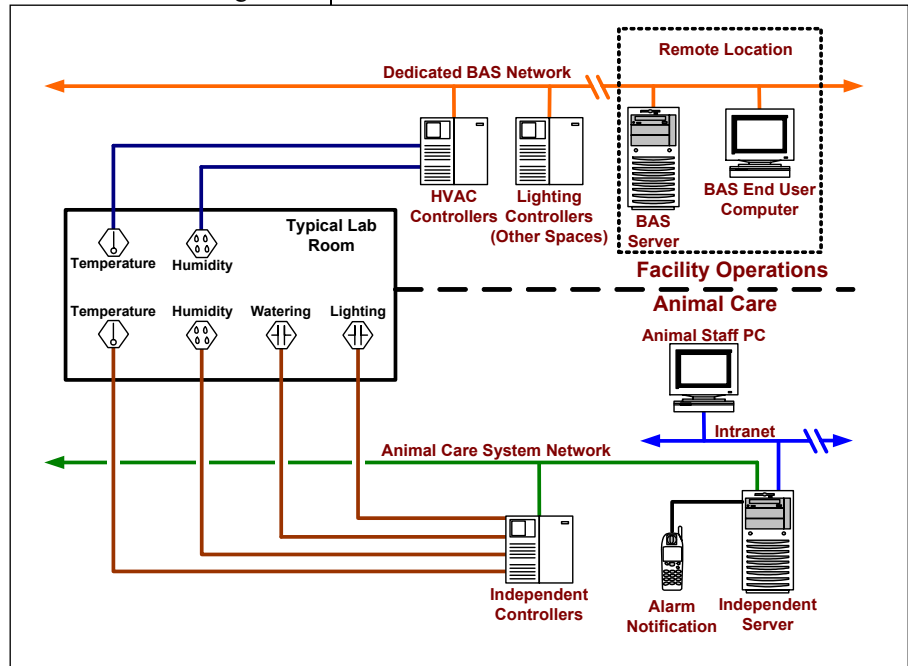
It is worth describing the 'two system' solution where a totally independent monitoring system is put in place. There are two approaches to independent monitoring; one is the 'two sensor solution' and the other the 'shared sensor solution'. The shared sensor solution is essentially the same as the two sensor solution except that a signal splitter with an isolator allows the BAS and independent system to share the same measurement device.

In either case, in addition to the BAS field panels, network, server, and workstations; a second set of "Independent" field data gathering panels, a network, server, and workstations are required. This equipment requires added mounting space and essentially doubles the installation and maintenance costs associated with remotely measuring space conditions.

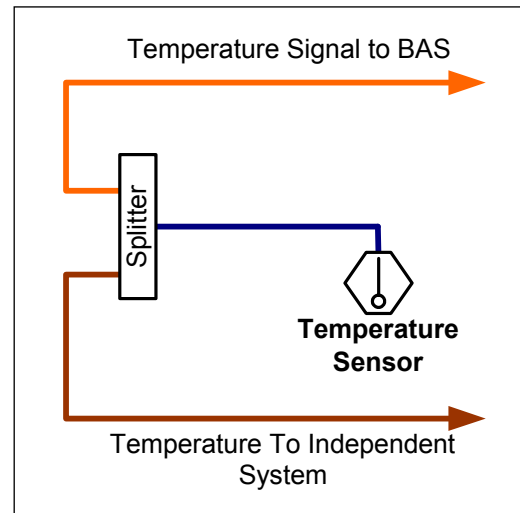
Often lighting and card access capabilities are added to the independent monitoring system, yet these are also key subsystems of Building Automation. Again, because the BAS equipment is usually purchased anyway, the infrastructure requirements and costs may double.

## Why Not Just Use the BAS?

Given the fact that the Building Automation System needs to be purchased under any circumstance, why not just utilize that system? That animal care people generally do not like to use the BAS may have more to do with the human nature than technology. Over the years animal care people have developed a reluctance to delegate the responsibility for the animals in their care, to others.



Independent System Architecture



Schematic of Shared Sensor

What are their specific concerns?

- Facility Operations owns and controls the BAS system, not those responsible for animal care.
- Often located in a remote part of the building or campus, the BAS operator has no idea of the importance of any particular alarm.
- Facility Operations has to deal with a myriad of problems and the fact is that some days they just can't get to every problem.
- If they want setpoints or schedules changed, animal care people must rely on Facility Operations to make the changes.
- BAS data is generally archived only for short durations to facilitate troubleshooting. Longer term storage requirements present a problem, not to mention issues with 21CFR Part 11. Facilities people generally don't want to be responsible for research data.
- The BAS supplier is beholden to Facility Operations and may not be responsive to animal care people when problems arise.

*Facility Operations typically must juggle a wide range of problems, not just those that are critical to the Animal Care people.*

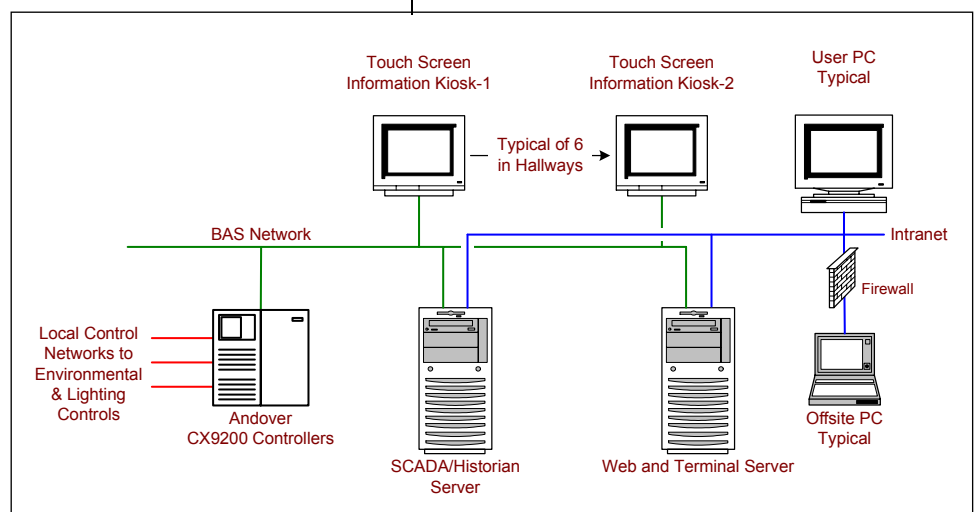
## Innovation; Leveraging the BAS

The elegance of the innovative solution is that it makes maximum use of the BAS infrastructure the owner must in all cases purchase for HVAC and lighting control. Comfort quality sensors are replaced with more accurate industrial grade but are wired into the BAS for control purposes; simultaneously improving the regulatory control as well as monitoring accuracy. The same lighting control systems are provided for the animal spaces and offices although light level sensing can be incorporated in the animal spaces for determining absolute adherence to the commanded lighting level.

Just like the Classical Solution, the innovative approach utilizes a dedicated server that 'belongs' to Animal Care. The generic name for this is a Supervisory Control and Data Acquisition, or "SCADA" server. The principal difference is that this SCADA server connects directly to the BAS network and extracts data directly from the BAS field panels using an available "open protocol". Using this method the operator workstations which comprise the BAS display interface are bypassed and the critical information of concern to the animal staff is directed right to the animal care world.

The SCADA system can provide all of the features listed in the previous list of "Design Goals". Animal Care establishes their own alarm parameters and lighting schedules. When setpoints are exceeded or alarms occur, the SCADA system alerts go directly to the Animal Care staff. Animal Care has access to their historical data. By adding a web server, all data from the system can be read anywhere the company intranet can be accessed. Remote kiosk style touch screen displays can be located in the facility corridors for easy access.

Because the SCADA system is designed for connectivity it can simultaneously communicate with other stand alone systems commonly found in animal facilities; ventilated cage racks, cage washers, autoclaves, environmental chambers, automated drinking water, water treatment, and card access systems.



Customer's SCADA System Architecture



Top Level Display Screen

Note: Quatro Labs is a fictitious company name used to protect client confidentiality.

As for compliance issues, the SCADA system is available with full 21CFR Part 11 capabilities including audit trails, electronic signatures, and protected record storage. Archived data can be utilized to demonstrate AAALAC compliance.

## Implemented SCADA Solution

The SCADA approach was implemented in a recently completed four story animal care facility on a major research campus. Building Automation Controls were provided by Andover Controls and included the control of temperature, humidity, airflow in and out of the animal holding rooms, lighting levels, and lighting override. The SCADA system provided by Facility Diagnostics tied in directly to the BAS network and extracted data using Andover's "OPC" capability.

The Animal Care staff chose to have touch screen displays located throughout the facility, placed in corridors and adjacent to the animal holding rooms. These displays provide local alarming and allow the staff to 'drill down' to the room level to see what conditions are and display historical trends of the past few hours, days, or months.

Graphics are intuitive and users can navigate the system with little or no instruction. Room data includes status and current values for temperature, humidity, and airflow. Space pressure direction is shown for each room. Lighting levels are shown as well as ON/OFF times, delay periods, and whether lights are being controlled by the schedule, or are in local over-ride.

System status is also available through the web using a standard browser. Some areas of the system are open to guest users, and others require specific user names and passwords before access is granted. User's are assigned permissions based on functions they are authorized and trained to perform such as changing lighting schedules and alarm settings, or downloading historical data

Trend data is displayed for temperature, humidity, and lighting levels. Trends can be scrolled back in time and time scales can be reset with a touch of the finger or a click of the mouse. When a trend is accessed from a user's desk, the values in the trend window can be saved in an Excel compatible CSV file format by simply clicking a button. With over 2500 monitored data values, the system is capable of storing more than a year's worth of minute by minute data without archiving to CD or tape.

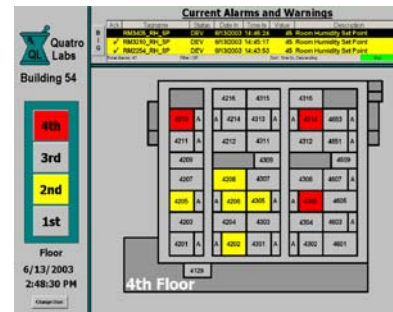
System advisories alert the staff to alarm conditions and alarms are logged and archived for future reference. The integrity of the communication link between the BAS and SCADA systems is continuously monitored right down to the sensor level and operators are advised if ever a link is lost.

After six months of operation the staff is pleased with the performance, and the construction team is pleased with the fact the system cost less than one fifth the cost of the alternative 'Independent' system. In the future the system will likely be expanded to include an adjacent building and the automated drinking water system.

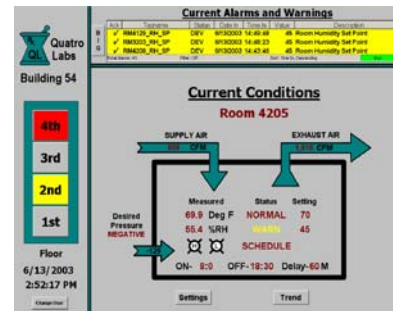
## Conclusions

Using SCADA technology it is possible to provide animal care staff with all of the benefits of an independent monitoring system at a fraction of the lifecycle cost of a stand alone system.

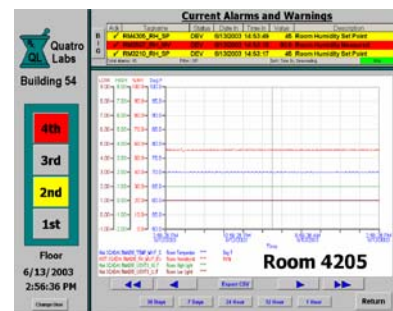
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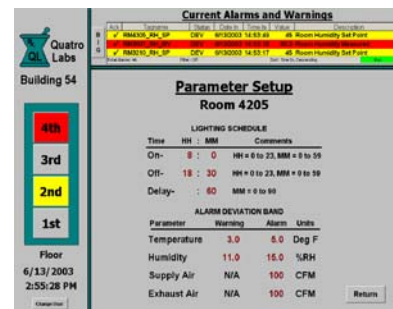
Typical Floor Display Screen



Typical Room Display Screen



Typical Trend Display



Typical Parameter Setup Screen

## For Additional Information

Facility Diagnostics provides consulting services and specialized system integration to owners of complicated buildings, be they laboratories, vivariums, or regulated manufacturing facilities.



PO Box 32, Harrington Park, NJ 07640  
Tel: 201.784.8700 Fax: 201.784.5515  
[www.facilitydiagnostics.com](http://www.facilitydiagnostics.com)