Wireless Sensor Platform

AFCOM

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Control and Sensing Improvements Over the Years

Sensor Monitoring of Rack: 2007
Control and Sensing Improvements Over the Years

Fan Control by Rack Sensors: 2011
Control and Sensing Improvements Over the Years

Control Based on CPU Temp: Future
Why Emerson Wireless?

- Lower Deployment Cost
  - Quick to Deploy - Less Labor
  - Integrates w/ Existing Infrastructure
  - Very Low Maintenance

- Easy To Deploy
  - Ultra Low Power Consumption
  - 3+ Year Battery Life

- Optimized Run Time
  - Built In and Always ON AES 128-bit encryption
  - Key Mgt, End-to-End Security & Message Integrity Checks

- Reliable Data Transmission
  - WirelessHART Based, >99% Data Reliability
  - Self-Organizing, Self Healing Network

- Secure Network Communication
Wireless Applications Are Everywhere

But There Have Been Doubts About Security, Reliability and Battery Life
Emerson Wireless: Globally Proven

- 2.5+ Billion Hours Operating Experience
- Tens of Thousands of Wireless Field Devices
- 16,000+ networks

Emerson Wireless Devices Has Been Deployed Globally To Monitor and Control Critical Applications
WirelessHART Based on IEEE Standard 802.15.4

Security & Reliability

- Coexistence with Wi-Fi and other wireless networks
- Built In and Always On AES 128-Bit Encryption
- Self-Organizing, Self-Healing Networks

Provisioning Provides:
- **Network ID** (Similar To WiFi SSID)
- **Join Key** (Network Password)

WirelessHART Advantages
- **Security** - Recommended By U.S. Homeland Security
- **Reliability** - Achieves >99% Data Reliability
Emerson Wireless Solutions Provide Comprehensive Security

- **Built In and Always On AES 128-Bit Encryption**
- For Authentication:
  - Each Gateway Maintains A [List of Devices Allowed To Communicate](#) With It
  - Individual Devices [Only Accept Messages From Previously Identified](#) Gateway or Other Gateway-Validated Devices
- **Automatically Rotating Encryption Keys**
- **Message Integrity Codes Are Used To Verify Messages**
- **Includes Channel Hopping, Multi-Path Routing & Anti-Jamming Technologies To Sidestep Noise**

Emerson Wireless Solutions Bring High Reliability

Self-Organizing, Self-Healing Networks That Automatically Optimize Connectivity To Achieve >99% Data Reliability

- Devices Talk To Each Other & Find Best Communication Path
- Network Continuously Monitors Path For Degradation and Repairs Itself
- No Single Point of Failure – Redundant Communication Paths
- No Need For Direct Line-of-Sight Between Radio and Gateway
Wireless Module Installation
Temperature and Humidity Supporting Environmental Mapping

Typical Install

Data Center

Wireless Sensor
1 Wire Cable

Global Data Center Emerson.com
Wireless Sensors Are Easier and Faster To Deploy Than Wired Sensors

Wireless Means Rapid Deployment
- “Ready To Deploy” Design
- Configure ➔ Install ➔ Go
- No Wiring Diagrams, I/O Design, Cabinet Design, Conduit & Cable Layout

Wireless Means Less Material
- No Wires
- Fewer Cabinets and Junction Boxes
- Rapid Deployment
Emerson Wireless Solutions Further Streamline Deployment

1. Emerson Wireless Sensors
   - Compatible with Liebert SN Sensor Strings
   - Intuitive Mounting To Top or Front of Server Rack
   - Quickly Deploy In Previously Inaccessible Areas

2. Wireless Gateway
   - Simple Network ID and Join Key Enables Fast Connection To Gateway
   - Self-Organizing, Self-Healing Network – No Direct Line of Sight Necessary
   - “Install and Go” In Minutes

3. Gateway Has Built-In Compatibility For Emerson Platforms
Applications & Solutions

What Happens After Prolifically Monitoring Your Data Center

Gregory Ratcliff
Monitor Web Sensor Data Visibility

Row 6
Row 5
Row 4
Row 3
Row 2
Row 1

Sensors in Average Calculation: 16
Temperature Control Point: 84.00°F
Manage Hot/Cold Spots in Data Center

- Floor plan view of the thermal health of the data center
- Thermal overview based on inlet temp sensor trending
- Inlet air temperature trending provided for all sensors
- Trending status defined by 5 different criteria & symbols
  - High inlet temps
  - Low inlet temp
  - Acceptable inlet temps
  - Temps trending upward
  - Temps trending downward

Figure 4.1.1 – Sensor Locations and Inlet Air Temperature Status
- Racks/CRAC Units with high inlet temperatures during the trending period
- Racks/CRAC Units with low inlet temperatures during trending period
- Racks/CRAC Units with acceptable inlet temperatures during trending period
- Racks/CRAC Units with inlet temperatures trending upward towards an availability issue
- Racks/CRAC Units with inlet temperatures trending downward
Receive Engineering Analysis

Capturing rack inlet temps at 3 different levels

Energy Waste details critical equipment being overcooled

IT Availability Risk details critical equipment not being cooled to your specifications

Rack Analysis details problems & recommended solutions for resolving trending hot spots issues & energy savings

Threshold Summary details duration rack inlet temps were in acceptable ranges

Event Summary identifies highest & lowest rack inlet temps, time, date and duration

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**4.3 – Rack BQ-33 Inlet Air Analysis**

- **Threshold Summary (Time within Temperature Ranges):**
  - **T < 64°F**
    - Top Sensor: 26d 9h 0m
    - Middle Sensor: 26d 10h 0m
    - Bottom Sensor: 0d 0h 0m
  - **64°F < T < 80.6°F**
    - Top Sensor: 0d 1h 0m
    - Middle Sensor: 0d 0h 0m
    - Bottom Sensor: 0d 0h 0m
  - **T > 80.6°F**
    - Top Sensor: 25d 22h 30m

- **Event Summary:**
  - Sensor Location: Start Time, Length of Event, Max/Min (°F), First Max/Min Event Time
  - **Top**
    - 3/1/12 12:08 AM
    - 6d 8h 45m
    - 62
    - 3/1/12 12:08 AM
  - **Middle**
    - 3/1/12 12:08 AM
    - 26d 10h 0m
    - 60
    - 3/1/12 12:38 AM
  - **Bottom**
    - 3/1/12 7h 23 AM
    - 8d 10h 30m
    - 83
    - 3/7/12 7:53 AM
  - **Top**
    - 3/7/12 5:38 PM
    - 20d 0h 15m
    - 62
    - 3/8/12 1:23 PM
  - **Bottom**
    - 3/9/12 8:53 PM
    - 17d 12h 0m
    - 82
    - 3/9/12 9:38 AM

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**Rack Analysis**

The high inlet air temperatures that reached 83 degrees F at the bottom of the rack were present for almost the entire month. The cause of this cannot be completely determined from this data. There may be an opening in the rack that is allowing hot exhaust air to short circuit back to the front side. Other problems such as misoriented equipment inside the rack and exhaust air short circuiting around the rack should also be checked.

**Problems**

1. There is a hot spot at rack BQ-33. The temperatures seen at these racks are creating a serious IT availability concern. The maximum temperature logged was 83 degrees F.

**Recommendations**

1. If needed, install blanking plates in any open U slots inside this rack. Find a way to prevent short circuiting exhaust air. Place additional perforated tiles if no other changes can be made.
**Additional Analysis**

- **Distribution Curve**
  - Quantitative value of efficiency gain potential
  - Shows extent of problems (hot spots)
- **Standard Deviation**
  - Support increasing temperature set points
  - Shows effectiveness of separation between hot and cold aisles
Visualization Permits Better Understanding

- Accurate Interpolation
- Accurate Extrapolation
- Integration with CFD
- Simultaneous Views
- Open Data For Other Systems

Embar go These Locations!
Wireless Hardware

50WM-3T
- 3 temperature sensors per module
- 3 year battery life

52WM-3T
- 3 Temperature sensor per module
- 5+ year life (no battery to replace)

1410 Gateway
- 100 Modules per Gateway Max
- Provides web interface for servicing
- Integrated with cooling control for
- Dynamic fan speed or staging
Wireless Kits

- Evaluation/Qualification Kit (See demo at Expo)
  - Gateway
  - 10 Nodes (50WM or 52WM or a combination)
  - Tablet used for setup and visualization
Real Customer Performance

- Major PUE Improvement 1.47 to 1.30 (-12%!)  
- Real Savings of $53 a year per rack  
- Real Capacity Gains

How Did We Do It?

- **Phase 1 – Unit Upgrade**
  - 36 iCOM retrofit
  - EC Fan retrofit
  - Change from Return to Supply Control (Cooling Capacity & Fan)
  - PGE Energy Rebate $218,000

- **Phase 2 - Wireless**
  - Wireless Sensors Installed
  - Control Methodology Change to Supply Control & Remote Sensor Fan
See It in Action Expo Booth #601

Thank You!
Questions??

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Wireless Stand-alone Monitoring

Customers Network

CAT-5

BMS

EMERSON
Network Power
Wireless Site Link / SiteScan Web

VNSA- Wireless SiteLink

Modbus

SiteScan Web
Needed to view and configure wireless data

CAT-5 cables

IS-485EXI One per unit in group. Up to 2 units.

2 wire twisted pair shielded

Group 1 (1-32)
• Room Dynamics…..
• How to make improvements through visibility
  – Dense sensor data
  – RAT → SUP → Decouple → ? CoolingCap & FanCntl → Make changes