Monitoring-Based Commissioning (MBCx)
An Overview and Best Practices

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Outline/Agenda

• MBCx/Analytics Overview
• MBCx Setup/Timeline
• Common Hurdles
• Examples
• Q+A
MBCx/Analytics Overview

- Using software to acquire and analyze HVAC performance data on a continuous basis
- How is this different than the BAS front end?
  - MBCx is a process
  - Alarms vs Analytics
MBCx/Analytics Overview

- Fault Detection/diagnostics
  - Is it Operating as Intended?

- Performance Analysis and Scoring
  - How well is it operating?

- Operational Tuning
  - How can I make it better

- Predicative Maintenance
  - Can we identify any issues early

- Failure Forensics
  - What Happened?
• Design
  • Confirms the performance criteria of the initial design
  • Owner – “We aren’t saving the energy we thought we would!”
  • Verification that design worked (or where it didn’t)
  • Small step towards data driven designs
MBCx/Analytics Overview

• Building Operations
  • Reactive vs Predictive Repairs
    • Identify and address issues before they become costly failures
  • Increased transparency into the building system performance
Measurement and Verification

- Issues with M&V
  - “I don’t have enough data”
  - “I don’t have the right data”
  - Lengthy and cumbersome process
  - Focuses on energy efficiency and struggles on maintenance opportunities
  - High initial investment in time, money, and effort to implement tools and technology

- Use MBCx to Support M&V
  - Little to no sub metering required
  - Continuously tracking and trending much easier
MBCx/Analytics Overview

- Energy Efficiency
  - More in depth than retro-commissioning (RCx)
MBCx Setup/Timeline

- MBCx Device
- BAS Work Station
- Programmable Logic Controller
- Boiler Controller
- Chiller Controller
- Pumps
- VAV Boxes
MBCx Setup/Timeline

- CLOUD
- BAS Work Station
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MBCx Setup/Timeline

• BAS System is Open Protocol BACnet
• Example Compatible Systems
  • Trane Tracer Summit
  • Niagara AX
  • Niagara N4
  • Trane – SC (BACnet) (Trane’s newest)
  • Siemens (BACnet)
  • Johnson Controls (Metasys with NAE and NCI building level controllers)
  • Johnson Controls (BACnet)
  • Automated Logic
  • Alerton BACtalk
  • Delta Controls – ORCA
  • Reliable – Third generation MACH-system or later
  • Others

• CSV Files/Trends
MBCx Setup/Timeline

- Work with IT Department on security and MBCx device setup/communication
- Deploy MBCx software/device on site
- Onsite investigation and information gathering
- Build and customize analytics
- Deliver findings and recommendations
- Refine analytics
- Repeat
Common Hurdles

- BAS control system is not BACnet (proprietary)
- BAS control system is a local network
- Equipment missing from network
- IT issues/coordination
- Network speed and quality issues
- Data security concerns
- Network device ID conflicts/naming issues
- Inconsistent point names
Corrective Measures
- Terminal Units reheating at a CFM above the reheat setpoint
- Airflow stations out of calibration
- Improper economizer operation
- Control valves are leaking and heating/cooling when valve is commanded 100% closed
- Minimum airflow fraction is out of calibration
- Excessive cycling

Improvement Measures
- Temperature and pressure reset sequences
- Identify critical zones and use to tune sequences and setpoints
- Demand control ventilation
Examples
Examples
AHU Leaking CHW Valve

D showed significant spikes in temperature between 01/20 and 01/22, with a peak around 01/21 at 12:00 AM. The temperature then dropped sharply, but remained elevated compared to the baseline. The PHT line remained relatively stable throughout the period, with slight fluctuations.
Examples

Pre-Heat Temperature Setpoint

CLG-O

PH-O
Examples

VAV HW Valve Signal Reversed

- DAT
- ZN-T
- ZNT-SP
- HTG-O

Temperature

HW Valve %

Date

12/27/2019
1/1/2020
1/6/2020
1/11/2020
1/16/2020
Questions?

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