April 5, 2018

Building Automation System Soft Start® BAS – Sample Review

The sample review by a BAS Analyst of the screen image labeled **RTU-1 – Town** on the last page is an example of the level of data analysis available from a BAS (Building Automation System) graphical display. This is not intended to be a complete review, but the first step in a process. The BAS Analyst should utilize as-built documentation and sequences of operation, providing a foundation for recommendations by a Certified Energy Manager and the use of additional data analysis tools.

1. RTU Command vs. Status

- Fan Command - Start
- Fan Status – On

The displayed values of "Start/On" for *Fan Command/ Fan Status* indicate the RTU is operating under automatic control. Displayed values of "Start/Off" or "Stop/On" for *Fan Command/ Fan Status* would indicate the automatic control was defeated.

2. Temperature Profile and Set-points

- Return Temp (Return Air Temp) ....75.66 F
- Mixed Temp (Mixed Air Temp) ....75.18 F
- Supply Temp (Supply Air Temp) ....123.58 F
- Supply SP (Supply Air Temp Set-point).........114 F
- OA Temp (Outside Air Temp)....................50.48 F
- Heating Valve (Heating Valve)...........100% Closed

Return Temp / Mixed Temp comparison

With a *Mixed Air Dampers* command of 0% (indicating 0% outside air) the *Return Temp* and *Mixed Temp* sensors are expected to report similar values.

Mixed Temp / Supply Temp comparison

When the *Heating Valve* is 100% closed, the *Supply Temp* is expected to be 1-2F higher than the *Mixed Temp*. This ~40F temperature rise is an indication of a leaking or stuck open *Heating Valve.*

Supply SP / Supply Temp comparison

The *Supply Temp* of 123.58 is ~10F higher than the *Supply SP* of 114F and also indicates a potential problem with the *Heating Valve*.

3. Static Pressure and Set-point

- Supply Press (Supply Static Pressure) .... 1.00 in/wc
- Static Press SP (Static Pressure Set-point) ...... 1.00 in/wc

Supply Press / Static Press SP comparison

These match, but when a sensor matches a set-point to two decimal points, additional monitoring is expected to ensure the BAS screen is presenting updated data.

4. Exhaust Fans

Exhaust Fans 1 & 2 are both commanded "stop". Is this the desired state?

5. AHU Operating Mode

The *Overrides* section indicates the RTU is in the *Heat* mode, which is expected at an *OA Temp* (Outside Air Temp) of 50.48F. The design documents will provide recommendations for *Heat / Cool / Changeover* mode set-points.

6. CO2 Sensor and Set-point

- CO2 Ventilation SP (Set-point) .... 1200 ppm
- Return Air CO2 .... 767.58 ppm
- OA Air (Outside Air) 0%

Return Air CO2 / CO2 Ventilation SP comparison

It is typically not desirable to introduce outside air greater than the minimum calculated cfm (cubic feet/minute) when the CO2 sensor is ~250 ppm below the set-point. Design documents will identify the minimum outside air cfm and the *CO2 Ventilation SP*. A *Mixed Air Dampers* value of 0 % typically indicates 0 % *OA Air* which could be appropriate when a separate dedicated outside air unit supplies the minimum outside air cfm for the space.

7. VFD Speed Analysis

VFD – Speed – 54.1%

This is lower than the average 75% *VFD Speed* we see across a large sample of air handlers. This lower-than-average speed indicates a need to verify that 1.00 is the recommended *Static Pressure SP*.   It is also important to verify the units are 0-100 % speed and not 0-60 Hz. A unit measurement of Hz. would correlate to 90 % speed and raise questions about a blocked or leaking air duct.

8. DX Cooling Stage Analysis

- AC Lockout Setpoint..50 F
- OA Temp (Outside Air Temp)................... 50.48 F

AC Lockout Setpoint/ AC Locked Out / OA Temp

The display of "Yes" for *AC Locked Out* is expected at an *OA Temp* of 50.48 F and the *AC Lockout Setpoint* of 50 F.

The *Clg St 1* and *Clg St 2* notations (with no indication of chilled water valves) typically refers to 2 stages of DX cooling. The *AC Lockout Setpoint* of 50 F refers to the lowest value of *OA Temp* that will allow the DX cooling stages to be energized.

9. Outside Air Weather Display

The outside air humidity should also be displayed on the BAS graphics screen so an analyst can evaluate an airside economizer operation. The BAS analyst should validate the outside weather sensors with a local weather station since many control sequences are dependent on outside air temperature. The rated accuracy of the *Return Humidity* sensor should be known and a calibrated portable humidity sensor should be periodically used to validate the *Return Humidity* sensor.   Humidity sensors are typically not as reliable as temperature sensors.