|  |
| --- |
| Section 258000  Niagara Analytics |
| IAS Fault Detection and Diagnostics |

|  |
| --- |
| October 2022 |



SECTION 258000 – IAS FAULT DETECTION AND DIAGNOTICS

\*\* NOTE TO SPECIFIER \*\* Honeywell Building Control Systems; building management systems.  
This section is based on the products of Honeywell Building Control Systems, which is located at:

1985 Douglas Dr. N.  
Minneapolis, MN 55422  
Toll Free Tel: 888-793-8193  
Email:[request info (buildingcontrols@honeywell.com)](http://admin.arcat.com/users.pl?action=UserEmail&company=Honeywell+Building+Control+Systems&coid=49689&rep=&fax=&message=RE:%20Spec%20Question%20(15900hon):%20%20&mf=)  
Web:[buildingcontrols.honeywell.com](http://buildingcontrols.honeywell.com)

[[Click Here](http://www.arcat.com/arcatcos/cos49/arc49689.html)] for additional information.  
Honeywell Building Control Solutions provides integrated product solutions in heating and heating processes, ventilation, cooling and refrigeration, air purification, zoning, humidification, air conditioning, water controls and processes, electrical devices and systems, lighting control, switches, sensors and controllers. Our technologies are found in more than 10 million buildings and a multitude of manufacturing plants around the world. Customers include original equipment manufacturers, commercial, contractors, retail, trade building managers, consulting engineers and distributors.  
BACnet is a registered trademark of American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). LON®, LONMARK®, LONTALK®, and LONWORKS® are registered trademarks of Echelon Corporation. NiagaraAX Framework™ is a registered trademark of Honeywell International

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

All major FDDs which require historical comparisons for its computation shall be issued via the control system. The FDDs shall get respective data for the BAS system and could feed this into a cloud-based system or a local FDD application. Specifier should determine architecture prior to editing and determining FDDs.

The FDD analytics package can be provided by the IAS contractor in division 25 or in the mechanical contractor’s scope (HVAC BAS) in division 23.

**[NOTE: EDIT ITEMS SHOWN IN [BOLD] TEXT]**

1. GENERAL
   * + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
        2. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
        3. Refer to Divisions 1 through 28 for project related standards pertaining to installations that shall apply to this Division.
      1. SUMMARY OF WORK

This specification covers how the facility equipment and sub-systems are intended to operate on an integrated Smart Building control basis, and as specified under Division 25. Spec writer should edit this section based upon the scope of their project.

* + - * 1. Provide a fault detection and diagnostic system (FDD) that is fully integrated with the Tridium Niagara 4.0 **[Select One; Supervisor and Supporting JACE controllers; or JACE Controllers]** and directly accesses the Niagara database without API’s or intermediate middleware. The FDD work shall be comprised of the following tasks and components:

Tagging Niagara and BACnet Points as part of the N4 basic programming that allows for Niagara N4.x Analytics to take full account of hierarchical relationships.

Create fault algorithms for all systems and equipment types as outlined in Article 3.4.

Create alerts as a response to algorithms to automatically, send a maintenance notification, sound an alarm or trigger a remedy.

Create algorithms that query the Niagara database to look for data trends and patterns that identify pending equipment failures, equipment and system performance degradation; etc.

Create data visualization graphics to present algorithm data in an intuitive manner to aid in the diagnosis of system faults and alarms. Data visualization shall include fault dashboards, charts, graphs, spectrum charts and color-coded equipment icons to visually represent equipment health.

Provide data roll-up and aggregation features that permit data to be combined for improved data analysis

* + - * 1. Provide related system integration services to import building sub-system data into the Niagara N4 environment that exists in stand-alone installations and is listed as required for FDD in Part 3.0 Execution.
      1. RELATED WORK SPECIFIED ELESWHERE

Edit Divisions according to the specific details of the project.

Division 01 – General Requirements

Division 08 – Openings (for windows and security access doors)

Division 11 – Equipment (for Food Service Equipment)

Division 12 – Furnishings (Shades and blinds)

Division 14 – Conveying Equipment (Elevators and Escalators)

Division 21 – Fire Suppression

Division 22 - Plumbing

Division 23 – Heating Ventilating and Air Conditioning

Division 25 – Integrated Automation

Division 26 – Electrical

Division 27 – Communication Systems

Division 28 – Electronic Safety and Security

* + - 1. DEFINITIONS

Edit this section based upon specific details of the project and any terms which need further definition.

* + - * 1. Alarms: An alarm is activated when a device fails or a critical set point is exceeded. This warns the user that a device has exceeded or fallen below a certain range around the set point. These usually signal a failure or a process not a performance parameter notification.
        2. Alarm and Fault Classes: Alarm and Fault classification is a method for organizing alarms and faults based on common characteristics and requirements (e.g., level (minor, critical, etc.) Category (operational, environmental, etc.) and type (variable, sensor, report, function, etc).
        3. AOWS: Automation Operator Work Station.
        4. Closed-loop Control Systems. A Closed-loop Control System, also known as a feedback control system is a control system which uses the concept of an open loop system as its forward path but has one or more feedback loops (hence its name) or paths between its output and its input. Therefore, A closed loop control system considers the current output and alters the output based upon the desired condition directly. The control action in these systems is based on the output.
        5. DALI: Digital Addressable Lighting Interface.
        6. FACLAN: Facility Local Area Network
        7. FDD: Fault Detection and Diagnostics.
        8. Fault Diagnosis: Follows fault detection. Faults are isolated, identified and recorded. Diagnosis analyses the kind, size, location and time of the faults for the user.
        9. Faults: A fault is activated when a parameter deviates from a pre-defined acceptable (usual or standard) condition for a designated period of time.
        10. HTTP: HyperText Transfer Protocol. HTTP is the underlying protocol used by the World Wide Web and this protocol defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.
        11. IAS: Integrated Automation System.
        12. Tagging: Tagging is used to organize data points for future database analytics. Project Haystack is an open-source initiative to develop “tagging” conventions and taxonomies for building equipment and operational data. The community-based effort defines standardized data models for the data points related to energy, HVAC, lighting, and other environmental systems. A simple REST API is defined to facilitate exchange of Haystack data over HTTP.
        13. REST: Representational state transfer (REST) or RESTful web services are a way of providing interoperability between computer systems on the Internet.
        14. SCMS: Supervisory Control and Monitoring System.
      1. GENERAL CODE AND DIVISIONAL ADHERENCE

Edit Article A according to the specific details of the project. Check local code requirements.

* + - * 1. Apply to all state and local codes governing the location of this project identified to be with in the regulating body of the **[Location].**
        2. Adhere to applicable local codes as called out in section 250000.
      1. REFERENCE STANDARDS
         1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
         2. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
         3. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.
      2. GENERAL FUNCTIONAL SPECIFICATIONS DESCRIPTION
         1. Other contractors shall be responsible for providing complete, fully functional and operational systems within their respective scopes of work. They are also responsible for providing the means of integration and associated connections to the IAS. In addition, the contractors are responsible for ensuring the data and information sent to the IAS complies with the IAS tagging standards, is correctly formatted and achieves reliable and consistent data transfer.
         2. The IAS contractor shall be responsible for providing all AOWS configurations, programming and graphics development the installation of the IAS and attain the functionality described herein. The IAS contractor shall provide the FACLAN infrastructure to connect to the network controllers installed through other Divisions, learn the associated data and confirm the tagging and BACnet properties are acceptable.

1. PRODUCTS
   * + 1. NIAGARA ANALYTICS – GENERAL

Outline the systems which shall be monitored by the IAS fault detection and diagnostics. Systems may be windows, elevators, door access, plumbing, HVAC, Lighting, electrical, fire alarm, communications and others.

Specific projects such as schools, data centers, hospitals and office buildings may have different requirements. Review each project and adjust specification for the specific project.

* + - * 1. Provide a fault detection and analytic framework that utilizes a high-performance calculation engine. The engine shall permit real-time data to be combined with historical data using a set of wire and property sheets. The visual programming interface shall be used to define the algorithms (formulas) that analyzes the real-time and trend data collected from the following systems:
        2. Sub-system data to be analyzed. **[Specifier Note – Select the sub-system data to analyzed]**

**[Automated Blind/Shade Sun Control]**

**[Automated Window Tinting Control]**

**[Vertical Transportation System]**

**[Plumbing System]**

**[Fire Alarm and Detection System]**

**[HVAC Control System]**

**[Lighting and Plug Control System]**

**[Electrical Power Monitoring (Metering)]**

**[Emergency Generator Monitoring]**

**[Access Control System]**

**[Video Surveillance]**

**[Other BAS Systems]**

* + - * 1. The output from the analysis shall be able to be visualized in charts, graphs and dashboards and be used as inputs to standard Niagara logic. Faults shall be prioritized according to the associated system, location and the level of cost avoidance.
        2. When applied to historical and real-time data, the framework algorithms shall provide the following analysis features:

An open and extensible analytical environment that can easily customized.

Analytic tools that apply to any data types available from building sub-systems.

The ability to set-up complex analysis without custom programming.

Support for third party API visualization application programs.

* + - 1. SOFTWARE HOSTING PLATFORMS

Specifier Note: Pick one of the Software Hosting Platforms. Contact Tridium to verify the SaaS platform requirements. Pay attention to the N4.x Supervisor hardware specifications and make sure the server deployed has ample resources to support both Niagara 4.x Supervisor and Analytics. An enterprise class server may be required. Refer to section 230900 for software provided with the JACE.

* + - * 1. On-Premise Application Server:
        2. Software as a Service (SaaS)

1. EXECUTION
   * + 1. GENERAL FDD INTEGRATION PRE-REQUISTE SERVICES
          1. Provide all required system integration.
          2. All fault dependencies and associated set points shall be customized according to the specific project requirements and needs of each application, as well as the project’s intended operation. This process shall be conducted as part of final systems commissioning and documented accordingly.
       2. DATA CONVENTIONS, FDD TOOLS AND APPLICATIONS
          1. The fault detection and diagnostic applications shall employ standardized naming conventions and employ “semantic tagging”, pattern recognition, functional rules processing and other techniques to enable advanced diagnostics and analytics for extended databases. Tags are added to data items as needed to convey definitions and associations. For example, an air handler might have tags that define its location (site, building, floor), fact that it is an electric load, manufacturer, capacity, schedule, associated control parameters, etc. Records can have as many tags as needed and new tags can be added. Solution should follow the **(Project Haystack, Niagara, Custom)** guidelines. **Project Haystack is an open-source initiative to streamline working with data from the Internet of Things.** The initiative standardizes semantic data models and web services with the goal of making it easier to unlock value from the vast quantity of data being generated by the smart devices that permeate our homes, buildings, factories, and cities. Applications include automation, control, energy, HVAC, lighting, and other environmental systems.ad hoc whenever needed. Tags provide the hooks that the analytics engine uses to correlate and analyze the data.
          2. The Fault Detection and Diagnostic (FDD) solution shall employ closed loop control. The closed loop control shall apply the outputs from the FDD back to the IAS as an input to supervised building sub-systems to alter the control of the devices based upon certain conditions found by the FDD analysis. An example may be that if a power meter is found to be offline, then the FDD shall notify the work order managements system to open a work order to have staff check the status of that meter and correct the issue. Another may be if a certain condition is found which may be critical, the FDD may issue a command to shut down that system to eliminate a more serious result.
          3. Alarms and Faults shall be defined in multiple classes for categorization. These classes may be used for many purposes to sort faults for action. Faults shall be monetized (costs associated with each fault) as a way to categorize and compare fault priorities. This will assist the operations team on prioritizing, categorizing and organizing the faults for assignment,
          4. The FDD system shall have the ability to notify and message specific types of users based upon the fault classification. Messaging shall be by text, email, phone or GUI alarm.
          5. The FDD software and application shall have templates and library models to enable the user to populate standard databases using pre-configured templates and libraries for standard system and equipment.
       3. IA BUILDING SUBSYSTEMS FUNCTIONAL SPECIFICATION REQUIREMENTS.

The following matrix outlines the extent of the fault detection diagnostics and demand response participation associated with each building subsystems as well as providing an indication of each system’s demand response classification. See Article 3.5 through 3.13 for complete descriptions of fault rules as well as associated systems demand response functionality.

Outline the systems which shall be monitored by the IAS fault detection and diagnostics. Systems may be windows, elevators, door access, plumbing, HVAC, Lighting, electrical, fire alarm, communications and others.

|  |  |
| --- | --- |
| Sub-System | Fault Detection and Diagnostics (FDD) |
| **[Automated Blind/Shade Sun Control]** | **Yes** |
| **[Automated Window Tinting Control]** | **Yes** |
| **[Vertical Transportation System]** | **Yes** |
| **[Plumbing System]** | **Yes** |
| **[Fire Alarm and Detection System]** | **Yes** |
| **[HVAC System]** | **Yes** |
| **[Lighting & Plug Control]** | **Yes** |
| **[Electrical Power Monitoring (Metering)]** | **Yes** |
| **[Emergency Generator Monitoring]** | **Yes** |
| **[Video Surveillance]** | **Yes** |
| **[Access Control System]** | **Yes** |
| **[Other BAS Systems]** | **Yes** |

* + - 1. GENERAL FAULT DETECTION AND DIAGNOSTICS.
         1. All generated fault notifications shall be issued via email, text or through the work order management system
         2. Faults shall be prioritized per the associated system, location and the level of cost avoidance.
         3. The following matrix outlines the specific rules associated with the fault detection diagnostics of the IAS.

The following fault rules are examples of typical fault detection and diagnostics descriptions. The list of these faults will grow in the future but should be written generically to handle multiple systems. Remember faults should apply to multiple systems and equipment in multiple buildings to be beneficial.

* + 1. Automated Blind/Shade (Sun) Control System

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Blind/Shade Closure Failure | Generates a fault when the blinds and/or shades are open and the outside light level is above a threshold as measured by the sun sensor. |
| Blind/Shade Opening Failure | Generates a fault when the blinds and/or shades are closed and the outside light level is within a threshold as measured by the sun sensor. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

* + 1. Vertical Transportation System Control

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Bad Energy Data | Finds periods when data contains values outside of low and high limits or the data is Null for at least a duration of time. |
| Cab Recall Failure | Generates a fault if an elevator cab fails to recall to a requested floor |
| Cab Maintenance  Failure | Generates a fault when the elevator cabs have been operating without a required maintenance shutdown as measured by an hourly timer. |
| Double Dipping Data | Finds periods when a point’s history contains two or more data points within a leeway of an interval for at least a duration. |
| Missing Data | Finds periods when a record’s history contains zero data points within a leeway of an interval for at least a duration. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

* + 1. Plumbing System Control

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Hot Water Heater Cycling | Generates a fault when the Hot Water Heater stays on or off for less than a duration. |
| Hot Water Temperature Setpoint Unreachable | Finds periods when any water heater is on and the HW temperature is unable to reach a pre-specified threshold of the HW supply setpoint for over a duration. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

* + 1. Fire Alarm and Detection System Control

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Fire Pump Operation | Generates a fault when the Fire Pump Operates, indicates a leak in the system or a loss of pressure. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

* + 1. HVAC Control System Fault Definitions

|  |  |
| --- | --- |
| **Fault Rule Name** | **Fault Rule Short Description** |
| AHU Cooling & Heating Cycling | Finds periods when the heating and cooling are cycling between each other within a threshold. This indicates that the unit is fighting back and forth between its mechanical components. |
| AHU Cooling & Heating Simultaneously | Finds periods when discharge fan is on, heating is on and cooling is on for over a duration. |
| AHU Cooling Failure | Finds periods when discharge fan is on, cooling is on, and discharge temperature sensor is not under mixed air sensor minus a threshold for over a duration. |
| AHU Cooling Valve Leaking | Generates a fault when discharge fan is on, cooling valve is closed, and discharge temperature sensor is under mixed air sensor by a threshold. |
| AHU Discharge Fan Failure | Generates a fault when discharge fan is on and duct static pressure is below a threshold. |
| AHU Discharge Pressure Setpoint Unreachable | Finds periods over a duration when discharge fan is on and discharge pressure is below or above the discharge pressure set point by a threshold. |
| AHU Discharge Pressure Unstable | Generates a fault when the discharge fan is on and the discharge pressure bounces above and below the discharge pressure set point by a dead band |
| AHU Economizing & Cooling Simultaneously | Finds periods when discharge fan is on, outdoor damper is open more than a threshold and cooling is on for over a duration. |
| AHU Economizing & Heating Simultaneously | Finds periods when discharge fan is on, outdoor damper is open more than a threshold and heating is on for over a duration. |
| AHU Heating Failure | Finds periods when discharge fan is on and discharge temperature sensor is not greater than mixed air sensor plus a threshold for over a duration. |
| AHU Heating Valve Leaking | Generates a fault when discharge fan is on, heating valve is closed, and discharge temperature sensor is greater than the mixed air sensor by a threshold. |
| AHU Outside Damper Stuck Closed | Generates a fault when discharge fan is on, outdoor damper is greater than a threshold and the calculated outdoor air percentage is lower by more than a percentage. |
| AHU Outside Damper Stuck Open | Generates a fault when discharge fan is on, outdoor damper is less than a threshold and the calculated outdoor air percentage is higher by more than a percentage. |
| AHU Low Outside Airflow | Generates a fault when the discharge fan is on and the outside airflow is below the outside airflow set point during occupancy. |
| AHU Unstable Outside Airflow | Generates a fault when the discharge fan is on and the outside airflow bounces above and below the outside airflow set point by a dead band. |
| AHU Unit On Discharge Fan Off | Generates a fault when discharge fan is off and anything is on; hot water valve is more than a threshold, any heating stage is on, chilled water valve is more than a threshold, or any cooling stage is on. |
| AHU Discharge Temperature Set point Unreachable | Finds periods when discharge fan is on and any discharge temperature cannot get within a threshold of discharge temperature set point for over a duration. |
| AHU Discharge Temperature Unstable | Finds periods when discharge fan is on and any discharge temperature bounces above and below the discharge temperature set point by a dead band. |
| AHU Low/High Pressure | Finds periods when the AHU supply pressure is outside of the set point (+/- 0.25”) over a duration (~15 minutes). |
| AHU Low/High Temperature | Finds periods when the AHU supply temperature is outside of the set point (+/- 2o F) over a duration (~15 minutes). |
| AHU Unit On Discharge Fan Off | Finds periods when discharge fan is off and anything is on; hot water valve is more than a threshold, any heating stage is on, chilled water valve is more than a threshold, or any cooling stage is on for over a duration. |
| Bad Energy Data | Finds periods when data contains values outside of low and high limits or the data is NaN for at least a duration |
| Heat Running During Warm Weather | Finds periods when heat is are running and the outside air temperature is above a threshold. |
| Building Running Too Late | Finds periods when the demand of the building does not drop off by at least a percentage or threshold for a duration after occupancy is over. |
| Building Starting Too Early | Finds periods when the demand increases by a percentage or threshold for a duration before building occupancy. |
| Boiler Cycling | Generates a fault when the boiler stays on or off for less than a duration. |
| Boilers Running During Warm Weather | Generates a fault when boilers are running and the outside air temperature is above a threshold. |
| Cabinet/Door Heater Zone Temperature Out of Range | Finds periods for longer than a duration when the space temperature is less than or greater than, the heating temperature setpoint by a threshold. |
| Chiller Cycling | Generates a fault when the chiller stays on or off for less than a pre-specified duration. |
| Chilled Water Plant Demand Peak | Finds chilled water demand peaks throughout the day, as measured against a facility benchmark. |
| Chilled Water Pressure set point Unreachable | Finds periods when any pump is on and the differential pressure cannot get within a threshold of differential pressure set point for over a duration(~15 minutes). |
| Chilled Water Pressure Unstable | Finds periods when any pump is on and the differential pressure cannot stay within a threshold of differential pressure set point for over a duration (~15 minutes). |
| Chilled Water Plant Temperature Setpoint Unreachable | Finds periods when any chiller is on and the leaving CHW temperature is unable to reach a pre-specified threshold of the CHW supply setpoint for over a duration. |
| Chilled Water Plant Leaving Temperature Unstable | Generates a fault when the leaving CHW temperature bounces above and below the supply temperature set point by a dead band. |
| Chilled Water Low/High Temperature | Finds periods when the chiller provides water outside of the set point (+/- 2o F) over a duration (~15 minutes). |
| Chilled Water Mixing | Finds periods when the chilled water return temperature is not more than 4o F above the chilled water supply temperature over a duration (~15 minutes). |
| Chilled Water System Failure | Finds periods when any chiller is on within the chiller plant and the chilled water leaving temperature is not within a specified range for over a duration (~15 minutes). |
| Chiller Running During Unoccupied Periods | Generates a Fault if the chiller plant is operating outside the normal occupancy schedule. |
| Cooling Set point Out of Range | Finds periods when the cooling set point is below a threshold for over a duration. |
| Cooling Tower Temperature Set point Unreachable | Finds periods when cooling tower leaving water temperature cannot get within a threshold of the leaving water temperature set point for over a duration. |
| Cooling Tower Temperature Unstable | Finds periods when cooling tower leaving water temperature bounces above and below the water temperature set point by a dead band. |
| Double Dipping Data | This searches the database and finds data which is duplicated (point readings being stored in separate areas) and notifies administrator to reduce duplicated points, trends or data. Finds periods when a point's history contains two or more data points within a leeway of an interval for at least a duration. |
| EF Not Running When Emergency Generator is Engaged | Generates a fault when any exhaust fan serving an emergency generator is not operating when the generator has been engaged |
| EF Not Running Under Thermostatic Control | Finds periods when any exhaust fan controlled via thermostat is not operating when space temperature. |
| EF Running During Unoccupied Periods | Finds periods when any exhaust fan is operating outside the normal schedule. |
| Floor VAV Unstable Airflow | Generates a fault when the floor VAV is active and the supply airflow bounces above and below the supply airflow set point by a dead band. |
| Heat Exchanger Temp Set Point Unreachable | Finds periods when the secondary leaving water temperature cannot get within a threshold of secondary leaving water temperature set point, while either a heat exchanger pump is on or a hot water system pump is on, for over a duration. |
| Heat Exchanger Temp Unstable | Finds periods when the secondary leaving water temperature bounces above and below the secondary leaving water temperature set point by a dead band. |
| Heating Set Point Out of Range | Finds periods when the heating set point is above a threshold for over a duration. |
| Hot Water Circ Pump Running | Generates a fault when hot water heating coil pumps are running and no secondary hot water pumps are running in the system. |
| Hot Water Plant Demand Peak | Finds hot water demand peaks throughout the day, as measured against a facility benchmark. |
| Hot Water Pressure Setpoint Unreachable | Finds periods when any pump is on and the differential pressure cannot get within a threshold of differential pressure set point for over a duration. |
| Hot Water Pressure Unstable | Finds periods when any pump is on and the differential pressure cannot stay within a threshold of differential pressure set point for over a duration. |
| Hot Water Plant Temperature Setpoint Unreachable | Finds periods when any boiler is on and the leaving HW temperature is unable to reach a pre-specified threshold of the HW supply setpoint for over a duration. |
| Hot Water Plant Leaving Temperature Unstable | Generates a fault when the leaving HW temperature bounces above and below the supply temperature set point by a dead band. |
| Missing Data | Finds periods when a record's history contains zero data points within a leeway of an interval for at least a duration. |
| Occupied Cooling Setpoint Out of Range | Finds periods over a duration when the occupied cooling set point is below a threshold. |
| Occupied Heating Setpoint Out of Range | Finds periods over a duration when the occupied heating set point is above a threshold. |
| Power Peak | Finds when power is 5% higher or 5% lower than the previous period or year (similar for day, week, month, year). |
| Pump Cycling | Generates a fault when the pump stays on or off for less than a specified duration. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |
| Short Demand Peak | Finds short demand peaks throughout the day. |
| Split System A/C Unit Cooling Setpoint Out of Range | Finds periods over a duration when the room or zone temperature is unable to maintain a threshold above or below the cooling setpoint. |
| Terminal Unit Airflow Setpoint Unreachable | Finds periods over a duration when the discharge airflow cannot get within a threshold of discharge airflow set point (while the FCU fan is on). |
| Terminal Unit Airflow Unstable | Generates a fault when the discharge airflow bounces above and below the discharge airflow set point by a dead band. |
| Terminal Unit Heating Failure | Generates a fault when the FCU fan is on (if applicable), heating is on, and discharge temperature sensor is not greater than the discharge air sensor plus a threshold. |
| Terminal Unit Heating Valve Leaking | Generates a fault when FCU fan is on (if applicable), heating valve is closed, airflow is above a threshold, and the discharge temperature sensor is above discharge temperature by a threshold. |
| Terminal Unit Zone Temperature Out of Range | Finds periods when the zone air temperature is less than or greater than the zone set point(s) by a threshold for longer than a duration. |
| Underfloor Heating Space Temperature Out of Range | Finds periods when the underfloor heating space temperature is less than or greater than the setpoint(s) by a threshold for longer than a duration. |
| Unoccupied Cooling Setpoint Out of Range | Finds periods over a duration when the unoccupied cooling set point is below a threshold. |
| Unoccupied Heating Setpoint Out of Range | Finds periods over a duration when the unoccupied heating set point is above a threshold. |
| Zone Cooling Damper Malfunction | Finds periods when the cooling damper is open above a threshold and the zone damper discharge air temperature is not within a threshold of the cold deck discharge air temperature for over a duration. |
| Zone Heating Damper Malfunction | Finds periods when the heating damper is open above a threshold and the zone damper discharge air temperature is not within a threshold of the hot deck discharge air temperature for over a duration. |
| Zone Temperature Out of Range (Cooling) | Finds periods when the zone air temperature is less than the zone set point(s) by a threshold for longer than a duration. |
| Zone Temperature Out of Range (Heating) | Finds periods when the zone air temperature is greater than the zone set point(s) by a threshold for longer than a duration. |
| Underfloor Heating Space Temperature Out of Range | Finds periods when the underfloor heating space temperature is less than or greater than the setpoint(s) by a threshold for longer than a duration. |

* + 1. Lighting Control System

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Bad Energy Data | Finds periods when data contains values outside of low and high limits or the data is NaN for at least a duration |
| Double Dipping Data | Finds periods when a point's history contains two or more data points within a leeway of an interval for at least a duration. |
| Lights Operating During Unoccupied Hours | Generates a fault when lights are running during unoccupied hours, and an associated occupancy sensor has not detected motion therein. |
| Lights Not Operating During Occupied Hours | Generates a fault when lights are not running during occupied hours, and an associated occupancy sensor has detected motion therein. |
| Lights Not Dimming During Daylight Harvesting | Finds periods when the lighting level exceeds the zone setpoint(s) by a threshold for a longer than a duration |
| Missing Data | Finds periods when a record's history contains zero data points within a leeway of an interval for at least a duration. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

* + 1. Electrical Power Monitoring (Metering) System Control

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Bad Energy Data | Finds periods when data contains values outside of low and high limits or the data is null for at least a duration |
| Building Running Too Late | Finds periods when the demand of the building does not drop off by at least a percentage or threshold for a duration after occupancy is over. |
| Building Starting Too Early | Finds periods when the demand increases by a percentage or threshold for a duration before building occupancy. |
| Double Dipping Data | Finds periods when a point's history contains two or more data points within a leeway of an interval for at least a duration. |
| Excessive Energy Usage During Unoccupied Period | Generates a fault when the daily unoccupied energy usage is greater than the daily occupied energy usage by a threshold |
| Maximum Demand During Un-occupancy | Finds periods when the maximum demand peak for the day occurs during an unoccupied period. |
| Missing Data | Finds periods when a record's history contains zero data points within a leeway of an interval for at least a duration. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |
| Short Demand Peak | Finds short demand peaks throughout the day. |

* + 1. Emergency Generator Monitoring System Control

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Fuel level Fault | Generates a fault when the fuel level falls by a good measure with no generator operation. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

* + 1. Video Surveillance System Control

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Unauthorized Access | Generates a fault when someone who does not have the proper credentials tries to access the CCTV system. |
| Camera Failure | Finds periods when a camera image does not change by a threshold for a 24-hour period. |

* + 1. Access Control System

| **Fault Rule Name** | **Fault Rule Short Description** |
| --- | --- |
| Door Blocked Open | Generates a fault when a door is open for more than 2 minutes. |
| Unauthorized Access | Generates a fault when someone who does not have the proper credentials tries to access the Access Control system. |
| Sensor Failure | Finds periods when a sensor does not change by a threshold for a 24-hour period. |

The following fault details are examples of typical fault detection and diagnostics details with customized rules. The list of these faults will grow in the future but should be written generically to handle multiple systems. Remember faults should apply to multiple systems and equipment in multiple buildings to be beneficial. Customized rules can be developed for each project but should be standardized as much as possible to provide global rule faults over multiple systems. Remember keeping these rules generic as a global application across multiple systems will allow the facility operators to determine trends and diagnose bigger trends in the data.

* + - 1. FAULT DETECTION AND DIAGNOSTICS DETAILS.
         1. The following provides a summarization of the specific descriptions and requirements associated with the fault detection diagnostics of each building sub-system.

Extended Rule Descriptions and Requirements:

* + 1. Sun Control System.

Blind/Shade Closure Failure

Description:

Generates a fault when the blinds and/or shades are open and the outside light level is above a threshold as measured by the sun sensor. This indicates that either the associated blind/shade motor or controller is not closing the blind/shades when the outside lighting level exceeds a set point. Fault dependencies and associated scenarios include the following;

The fault rule will make sure the exterior lighting level, as measured by the associated sun sensor, is currently utilized and above the set point.

The fault rule will make sure the interior lighting level, as measured by the associated daylight or multi sensor, is currently utilized and above the set point.

Requirements:

Blind Position Command or Shade Position Command: Blind/Shade position command is required, but status can be used as a primary reference.

Exterior Lighting Level: Measured in either lumens of foot candles from the sun sensor.

Interior Lighting Level: Measured in either lumens of foot candles from the ceiling mounted daylight or multi sensor.

Blind/Shade Opening Failure

Description:

Generates a fault when the blinds and/or shades are closed and the outside light level is within a threshold as measured by the sun sensor. This indicates that either the associated blind/shade motor or controller is not opening the blind/shades when the outside lighting level is within the setpoint. Fault dependencies and associated scenarios include the following;

The fault rule will make sure the exterior lighting level, as measured by the associated sun sensor, is currently utilized and within the setpoint.

The fault rule will make sure the interior lighting level, as measured by the associated daylight or multi sensor, is currently utilized and within the set point.

Requirements:

Blind Position Command or Shade Position Command: Blind/Shade position command is required, but status can be used as a primary reference.

Exterior Lighting Level: Measured in either lumens of foot candles from the sun sensor.

Interior Lighting Level: Measured in either lumens of foot candles from the ceiling mounted daylight or multi sensor.

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point, including statuses and operating mode(s).

* + 1. Vertical Transportation System

Bad Energy Data

Description:

Find periods for at least a duration when data contains values outside of low and high limits or the data is shown as “not a number” (NaN). Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Cab Recall Failure

Description:

Generates a fault if an elevator cab fails to recall to a requested floor. This is an indication of an internal cab fault or an error associated with the cab recall switch. Fault dependencies and associated scenarios include the following;

The fault rule will ensure the specific elevator cab is not currently utilized or under a maintenance shutdown.

The fault rule will ensure the recall switch, as managed by the elevator management system (EMS) is currently registering values therein.

Requirements:

Floor Recall Command: Floor recall command is required, but status can be used as a primary reference.

Elevator Cab Status: Current operating position of the elevator cab.

Cab Maintenance Failure

Description:

Generates a fault when the elevator cabs have been operating without a required maintenance shutdown as measured by an hourly timer. This indicates that the elevator cab has not received required maintenance and inspection and is more susceptible to operational interruptions. Fault dependencies and associated scenarios include the following;

The fault rule will ensure the specific elevator cab is not currently under a maintenance shutdown.

The elevator manufacturer’s recommended maintenance procedures intervals are programmed as the hourly setpoint timer.

Requirements:

Elevator Cab Status: Current operating position of the elevator cab

Maintenance Hourly Timer Setpoint: Measured in hours according to manufacturer’s recommendations.

Elevator Cab Operation: Amount of time, as measured in hours, that the elevator has been in operation since a required maintenance shutdown.

Double Dipping Data

Description

Finds periods for at least a duration when a point’s history contains two or more data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Missing Data

Description

Finds periods for at least a duration when a record’s history contains zero data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point, including statuses and operating mode(s).

* + 1. PLUMBING AND LIFE SAFETY SystemS

Bad Energy Data

Description:

Find periods for at least a duration when data contains values outside of low and high limits or the data is shown as “not a number” (NaN). Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Double Dipping Data

Description

Finds periods for at least a duration when a point’s history contains two or more data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Missing Data

Description

Finds periods for at least a duration when a record’s history contains zero data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point, including statuses and operating mode(s).

* + 1. HVAC Control System

AHU Cooling and Heating Cycling

Description:

Finds periods when the heating and cooling are cycling between each other within a threshold. This indicates that the unit is fighting back and forth between its mechanical components. Fault dependencies and associated scenarios include the following;

The fault rule will make sure any chilled water pump, from the chiller plant, is on if a cooling valve is utilized.

Will also make sure any hot water pump, from the boiler plant, is on if a heating valve is utilized.

If served by a steam plant, the rule will make sure steam pressure is over a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Cooling Valve or Cooling Stage: This can either be a numeric cooling valve position or a Boolean cooling stage

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Chilled Water Pump (optional): Any chilled water pump command or status from the chiller plant. If Cooling stage is used, chilled water pump is not necessary.

Hot Water Pump (optional): Any hot water pump command or status from the hot water plant. If heating stage is used, hot water pump is not necessary.

Steam Pressure (optional): Steam pressure if served from a steam plant

AHU Cooling and Heating Simultaneously

Description:

Finds periods over a duration when discharge fan is on, heating is on and cooling is on. Fault dependencies and associated scenarios include the following;

Heating is on when the hot water valve is greater than a threshold or any heating stage is on.

Cooling is on when the chilled water valve is greater than a threshold or any cooling stage is on.

Fault rule will check to see if the unit is in dehumidification mode and will not check for cooling failure periods during this time.

Fault rule will ensure any chilled water pump, from the chiller plant, is on if a cooling valve is utilized.

Will also make sure any hot water pump, from the boiler plant, is on if a heating valve is utilized.

If served by a steam plant will make sure steam pressure is over a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Cooling Valve or Cooling Stage: This can either be a numeric cooling valve position or a Boolean cooling stage

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Dehumidification Mode (optional): Dehumidification mode point to know when the unit is in a dehumidification sequencing mode

Chilled Water Pump (optional): Any chilled water pump command or status from the chiller plant. If Cooling stage is used, chilled water pump is not necessary.

Hot Water Pump (optional): Any hot water pump command or status from the hot water plant. If heating stage is used, hot water pump is not necessary.

Steam Pressure (optional): Steam pressure if served from a steam plant

AHU Cooling Failure

Description:

Finds periods over a certain duration when the discharge fan is on, cooling is on, and discharge temperature sensor is not registering below the mixed air sensor level minus a threshold. Fault dependencies and associated scenarios include the following;

Cooling is on when the chilled water valve is greater than a threshold or any cooling stage is on.

If mixed air sensor does not exist, return air temperature can be used.

If return air temperature does not exist zone temperature sensor can be used. Will also make sure any chilled water pump, from the chiller plant, is on during this period if a cooling valve is utilized.

Will also check to see if the unit is in dehumidification mode and not check for cooling failure periods during this time.

On a face bypass unit, when the cooling valve is in the face, the face bypass damper must be open to the face more than a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Cooling Valve or Cooling Stage: This can either be a numeric cooling valve position or a Boolean cooling stage

Discharge Temperature: Discharge air temperature

Mixed Air Temperature: Mixed air temperature. If not found will fall back to return air temperature. If not found and the unit is a 100% outside air unit will use outside air temperature. If not a 100% outside air unit will fall back to zone air temperature.

Chilled Water Pump: Any chilled water pump command or status from the chiller plant. If Cooling stage is used, chilled water pump is not necessary.

Dehumidification Mode (optional): Dehumidification mode point to know when the unit is in a dehumidification sequencing mode

Face Bypass Damper (optional): The face bypass damper position of the unit. Will be interpreted as percent open to the face. (Only if the cooling valve is in the face)

AHU Cooling Valve Leaking

Description:

Generates a fault when discharge fan is on, cooling valve is closed, and discharge temperature sensor is under mixed air sensor by a threshold.

Will use multiple valves/stages if present and ensure all are closed/off.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Cooling Valve or Pre Cooling Valve: Numeric cooling valve position

Discharge Temperature: Discharge air temperature

AHU Discharge Fan Failure

Description:

Generates a fault when discharge fan is on and duct static pressure is below a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Discharge Pressure: Duct static pressure

AHU Discharge Pressure Set point Unreachable

Description:

Finds periods over a duration when discharge fan is on and discharge pressure is below or above the discharge pressure set point by a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Discharge Pressure: Discharge pressure of the AHU

Discharge Pressure set point: Discharge pressure set point of the AHU

AHU Discharge Pressure Unstable

Description:

Generates a fault when the discharge fan is on and the discharge pressure bounces above and below the discharge pressure set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the pressure crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Requirements

AHU: This rule is applied to only RTU or AHU equipment

AHU Economizing and Cooling Simultaneously

Description:

Finds periods over a duration when discharge fan is on, outdoor damper is open more than a threshold and cooling is on. Fault dependencies and associated scenarios include the following;

Cooling is on when the chilled water valve is greater than a threshold or any cooling stage is on.

This rule is not applicable in some sequences where the unit takes advantage of both free cooling and mechanical cooling at the same time.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Damper Status or Outside Damper Command: Outside damper position

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Cooling Valve or Cooling Stage: This can either be a numeric cooling valve position or a Boolean cooling stage

AHU Economizing and Heating Simultaneously

Description:

Finds periods over a duration when discharge fan is on, outdoor damper is open more than a threshold and heating is on. Fault dependencies and associated scenarios include the following;

Heating is on when the hot water valve is greater than a threshold or any heating stage is on.

On a face bypass unit, the face bypass damper must be open to the face more than a threshold.

If the unit has outside airflow, the outside airflow must be above the set point by a threshold.

If the unit only has minimum outside airflow, the minimum outside airflow must be above the set point by a threshold.

If the unit has return co2 and return co2 set point, the return co2 must be below the return co2 set point by more than a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Damper Status or Outside Damper Command: Outside damper position

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Hot Water Pump: Any hot water pump command or status from the hot water plant. If heating stage is used, hot water pump is not necessary.

Steam Pressure (optional): Steam pressure if served from a steam plant

Face Bypass Damper (optional): The face bypass damper position of the unit. Will be interpreted as percent open to the face.

Outside Airflow (optional): The outside airflow of the unit

Outside Airflow Set point (optional): The outside airflow set point of the unit

Minimum Outside Airflow (optional): The minimum outside airflow of the unit

AHU Excessive Outside Air During Unoccupied Periods

Description:

Generates a fault when the discharge fan is on and the outside damper or minimum outside damper is open during unoccupied periods. Fault dependencies and associated scenarios include the following;

If the outside temperature is below a threshold, then the unit must be heating to create a fault (economizing for free cooling during un-occupancy would be acceptable).

Requirements:

AHU: This rule is applied to only RTU or AHU equipment that are not; 100% outside air, cold deck / hot deck units, or heat wheel units

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Damper Status or Outside Damper Command: Outside damper position

Minimum Outside Damper Status or Command (optional): Minimum outside damper position

Occupancy: Occupancy of the piece of equipment

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Outside Air Temperature: Outside air temperature of the AHU. If nonexistent the building outside air temperature will be used.

AHU Heating Failure

Description:

Finds periods over a duration when the discharge fan is on, heating is on, and the discharge temperature sensor value is not greater than the mixed air sensor level (plus a threshold). Fault dependencies and associated scenarios include the following;

Heating is on when the hot water valve is greater than a threshold or any heating stage is on.

If mixed air sensor does not exist, return air temperature can be used.

If return air temperature does not exist zone temperature sensor can be used.

Fault will make sure any hot water pump, from the hot water plant, is on during this period if a heating valve is utilized.

If served by a steam plant will make sure steam pressure is over a threshold.

Fault will also check to see if the unit is in dehumidification mode and not check for cooling failure periods during this time.

On a face bypass unit, the face bypass damper must be open to the face more than a threshold.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Discharge Temperature: Discharge air temperature

Mixed Air Temperature: Mixed air temperature. If not found will fall back to return air temperature. If not found and the unit is a 100% outside air unit will use outside air temperature. If not a 100% outside air unit will fall back to zone air temperature.

Hot Water Pump: Any hot water pump command or status from the hot water plant. If heating stage is used, hot water pump is not necessary.

Steam Pressure (optional): Steam pressure if served from a steam plant

Heat Exchanger Valves (optional): Valves that control heat exchanger temperatures if needed to check when it should be operational

Dehumidification Mode (optional): Dehumidification mode point to know when the unit is in a dehumidification sequencing mode

Face Bypass Damper (optional): The face bypass damper position of the unit. Will be interpreted as percent open to the face.

AHU Heating Valve Leaking

Description:

Generates a fault when discharge fan is on, heating valve is closed, and discharge temperature sensor is above mixed air sensor by a threshold. Fault dependencies and associated scenarios include the following;

Will use multiple valves/stages if they exist and make sure they are all closed/off.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Heating Valve, Pre Heating Valve, or Re Heating Valve: Numeric heating valve position

Discharge Temperature: Discharge air temperature

Mixed Air Temperature: Mixed air temperature. If not found and the unit is a 100% outside air unit will use outside air temperature. If unit is a 100% return air unit will use return air and if return air is not found will fall back to zone air temperature.

AHU Outdoor Damper Stuck Closed

Description:

Generates a fault when discharge fan is on, outside damper is greater than a threshold and the calculated outside air percentage is lower by more than a percentage. Fault dependencies and associated scenarios include the following;

The outside air percentage will be calculated using the return air temperature, mixed air temperature, and outside air temperature sensor.

If the mixed air temperature sensor is not available, then the discharge air temperature sensor will be used when cooling and heating are both off.

If the return air temperature sensor is not available, then the zone air temperature sensor will be used.

Will not find these periods when the outside air temperature sensor is within a threshold of the return air temperature sensor.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Damper Status or Outside Damper Command: Outside damper position

Return Air Temperature or Zone Air Temperature: Zone temperature will only be used if return air temperature is not available.

Mixed Air Temperature or Discharge Air Temperature: Discharge temperature will only be used if mixed air temperature is not available.

Outside Air Temperature: Outside air temperature of the AHU. If nonexistent the building outside air temperature will be used.

AHU Outdoor Damper Stuck Open

Description:

Generates a fault when discharge fan is on, outside damper is lower than a threshold and the calculated outside air percentage is higher by more than a percentage. Fault dependencies and associated scenarios include the following;

The outside air percentage will be calculated using the return air temperature, mixed air temperature, and outside air temperature sensor.

If the mixed air temperature sensor is not available, then the discharge air temperature sensor will be used when cooling and heating are both off.

If the return air temperature sensor is not available, then the zone air temperature sensor will be used.

Will not find these periods when the outside air temperature sensor is within a threshold of the return air temperature sensor.

If a minimum outdoor damper exists, this will be added to the outside damper position, as a percentage of total outside air intake.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Damper Status or Outside Damper Command: Outside damper position

Return Air Temperature or Zone Air Temperature: Zone temperature will only be used if return air temperature is not available.

Mixed Air Temperature or Discharge Air Temperature: Discharge temperature will only be used if mixed air temperature is not available.

AHU Low Outside Airflow

Description

Generates a fault when the discharge fan is on and the outside airflow is below the outside airflow set point during occupancy.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Airflow: The outside airflow of the unit

Outside Airflow Set point: The outside airflow set point of the unit

Occupancy: Occupancy of the piece of equipment

AHU Unstable Outside Airflow

Description:

Generates a fault when the discharge fan is on and the outside airflow bounces above and below the outside airflow set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the airflow crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Outside Airflow: The outside airflow of the unit

Outside Airflow Set point: The outside airflow set point of the unit

AHU Unit on Discharge Fan is Off

Description:

Generates a fault when discharge fan is off and anything is on; hot water valve is more than a threshold, any heating stage is on, chilled water valve is more than a threshold, or any cooling stage is on. Fault dependencies and associated scenarios include the following;

Both cooling and heating are not required, but one or the other is required for this rule to run successfully.

Requirements:

AHU: This rule is applied to only RTU or AHU equipment

Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Cooling Valve or Cooling Stage (optional): This can either be a numeric cooling valve position or a Boolean cooling stage

Heating Valve or Heating Stage (optional): This can either be a numeric heating valve position or a Boolean heating stage

Bad Energy Data

Description:

Find periods for at least a duration when data contains values outside of low and high limits or the data is NaN. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Building Floor Running Too Late

Description:

Finds periods over a duration after occupancy is over, when the demand of a particular floor does not drop off by at least a percentage or threshold. Fault dependencies and associated scenarios include the following;

A shutdown window can be specified for an allotted time to wait until after occupancy to check for the decrease in demand. This makes sure that a particular floor is shutting down when occupancy is over and equipment is not manually operating or overridden.

Requirements:

Floor Lighting Submeter: Any floor lighting submeter meter of the site

Floor Power Submeter: Any floor power submeter meter of the site

Floor Lighting Demand: The demand of the floor lighting submeter

Floor Power Demand: The demand of the floor power submeter

Occupancy: Occupancy or schedule for the building

Building Floor Starting Too Early

Description:

Finds periods over a duration before building occupancy when the demand of a particular floor increases by a percentage or threshold. Fault dependencies and associated scenarios include the following;

A startup window can be specified for an allotted time before occupancy that demand is allowed to increase. This indicates that a particular floor is starting ahead of occupancy or too many pieces of equipment are coming on outside of normal occupancy on the associated floor.

Requirements:

Floor Lighting Submeter: Any floor lighting submeter meter of the site

Floor Power Submeter: Any floor power submeter meter of the site

Floor Lighting Demand: The demand of the floor lighting submeter

Floor Power Demand: The demand of the floor power submeter

Occupancy: Occupancy or schedule for the building

Boiler Cycling

Description:

Generates a fault when the boiler stays on or off for less than a duration.

Requirements:

Boiler: This rule is applied to only boiler equipment

Boiler Status or Boiler Command: Boiler on/off status

Boilers Running During Warm Weather

Description:

Finds periods when boilers are running and the outside air temperature is above a threshold.

Requirements:

Boiler Plant: This rule is applied to only boiler plant equipment

Boiler(s) Status or Boiler(s) Command: Boiler(s) on/off status

Outside Air Temperature: Outside air temperature of the Boiler Plant. If nonexistent the building outside air temperature will be used.

Cabinet/Door Heater Zone Temperature Out of Range

Description:

Finds periods for longer than a duration when the space temperature is less than or greater than, the heating temperature setpoint by a threshold. Fault dependencies and associated scenarios include the following;

If occupancy exists temperature will only be checked when occupancy is true.

Requirements:

Space Temperature: Space temperature adjacent to the cabinet/door heater

Heating Setpoint: Setpoint associated with the zone air temperature.

Occupancy (optional): Occupancy of the piece of equipment

Fan Status (is applicable): Fan status of the piece of equipment.

Chiller Cycling

Description:

Generates a fault when the chiller stays on or off for less than a pre-specified duration.

Requirements:

Chiller: This rule is applied to only chiller equipment

Chiller Status or Chiller Command: Chiller on/off status

Chilled Water Plant Demand Peak

Description:

Finds chilled water demand peaks throughout the day, as measured against a facility benchmark. Fault dependencies and associated scenarios include the following;

Looks for an increase in demand by a percentage or threshold and then an immediate decrease by a percentage or threshold. This increase and decrease in demand is looked at in consecutive historic data intervals to identify a short demand peak.

Requirements:

Chilled Water BTU Meter: Any meter, including main plant, data centers, E-rooms.

Electrical Submeter: Any meter

Demand: The demand of the meter (electrical only)

Chilled Water Plant Benchmark: BTUs and Electrical

Chilled Water Plant Pressure Setpoint Unreachable

Description:

Finds periods over a duration when the differential pressure is unable to maintain within a threshold of differential pressure set point, while any chilled water pump is on. Fault dependencies and associated scenarios include the following;

This will account for the pressure being too high or too low from set point.

If a freeze protection sequence is in place then will only Spark when any pump is over a speed threshold, but will still Spark anytime the outside air temperature is above a threshold.

If chilled water flows and flow min/max set points exist, then the flows must be above/below set points.

Requirements:

Chiller Plant: This rule is applied to only chiller plant systems

Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing and trying to maintain set point.

Chilled Water Differential Pressure: The differential pressure of the chiller plant system

Chilled Water Differential Pressure Set point: The differential pressure set point of the chiller plant system

Outside Air Temperature (optional): Outside air temperature of the Chiller Plant. If nonexistent the building outside air temperature will be used.

Chilled Water Leaving Flow (optional): The secondary water leaving flow

Chilled Water Leaving Flow Min Set point (optional): The secondary water leaving flow minimum set point.

Chilled Water Leaving Flow Max Set point (optional): The secondary water leaving flow maximum set point.

Chiller Evaporator Leaving Flow (optional): The chiller(s) evaporator leaving flow

Chiller Evaporator Leaving Flow Min Set point (optional): The chiller(s) evaporator leaving flow minimum set point

Chiller Status (optional): The chiller(s) status or command. This is necessary if both chiller flow and chiller flow min set point is to be taken into consideration.

Chilled Water Plant Pressure Unstable

Description:

Finds periods when the secondary differential pressure bounces above and below the secondary differential pressure set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the differential pressure crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Must occur while any pump is on.

Requirements:

Chiller Plant: This rule is applied to only chiller plant systems

Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing and trying to maintain set point.

Chilled Water Differential Pressure: The differential pressure of the chiller plant system

Chilled Water Differential Pressure Set point: The differential pressure set point of the chiller plant system

Chilled Water Plant Temperature Setpoint Unreachable

Description:

Finds periods when any chiller is on and the leaving CHW temperature is unable to reach a pre-specified threshold of the CHW supply setpoint for over a duration.

Requirements:

Chiller Plant: This rule is applied to only chiller plant systems

Chiller Status or Chiller Command: Chiller on/off status. At least one chiller is required to be able to check when chilled water is being chilled.

Chilled Water Plant Leaving Temperature: This is the chiller plant leaving water temperature that is being supplied to the building

Chilled Water Plant Leaving Temperature Unstable

Description:

Finds periods when the leaving CHW temperature bounces above and below the CHW supply temperature setpoint by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the leaving CHW temperature crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Must occur while any chiller is on.

Requirements:

Chiller Plant: This rule is applied to only chiller plant systems

Chiller Status or Chiller Command: Chiller on/off status.

Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing and trying to maintain set point.

Leaving (Supply) Chilled Water Temperature

Chilled Water Temperature Set point: The chilled water setpoint of the chilled water plant

Chiller Running During Unoccupied Periods

Description:

Finds periods when any chiller is operating outside the normal occupancy schedule. Fault dependencies and associated scenarios include the following;

Will only violate if no AHU’s are running or if all AHU’s running has Return Air Temperatures under a certain threshold (cool temperatures) or if only X AHU’s are running with Return Air Temperatures above a threshold (warm temperatures).

The synopsis will also include any available records to indicate authorized overtime usage.

Requirements:

Chiller Plant: This rule is applied to only chiller plant systems

Chiller Status or Chiller Command: Chiller on/off status. At least one chiller is required to be able see if it is running.

Occupancy or Schedule: The chiller plant or site must have a schedule point record or an occupancy point record.

AHU’s: Air Handling Units attached to the chiller plant

AHU Return Air Temperature: Return Air Temperature for each of the attached AHU’s. If return air temperature is not available will fall back to zone temperature. This rule will not fail if not every AHU has a return air temperature.

CRAC Unit Cooling Setpoint Out of Range

Description:

Finds periods over a duration when the computer room temperature is unable to maintain a threshold above or below the cooling setpoint. Fault dependencies and associated scenarios include the following;

This is used to determine if the cooling set point can be maintained or whether it has been set too low and high.

Requirements:

Cooling Set point: A set point specifically for cooling associated with a CRAC unit.

Computer Room Temperature

CRAC Unit Relative Humidity Setpoint Out of Range

Description:

Finds periods over a duration when the computer room relative humidity is unable to maintain a threshold above or below the relative humidity setpoint. Fault dependencies and associated scenarios include the following;

This is used to determine if the relative humidity set point can be maintained.

Requirements:

Relative Humidity Set point: A set point specifically for cooling associated with a CRAC unit.

Computer Room Relative Humidity

Double Dipping Data

Description

Finds periods for at least a duration when a point’s history contains two or more data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

EF Not Running When Emergency Generator is Engaged

Description:

Generates a fault when any exhaust fan serving an emergency generator is not operating when the generator has been engaged. Fault dependencies and associated scenarios include the following;

Periods are only found when an emergency generator is operation.

Requirements:

Exhaust Fans serving Emergency Generators: This rule is applied to only EFs serving an emergency generator.

EF Status or EF Command: EF on/off status.

Emergency Generator Status or Command: On/off status

EF Not Running Under Thermostatic Control

Description:

Finds periods when any exhaust fan controlled via thermostat is not operating when space temperature. Fault dependencies and associated scenarios include the following;

Periods are only found when the EF operates per thermostatic command.

Requirements:

Exhaust Fans w/ Space Thermostats: This rule is applied to only EFs are thermostatically controlled.

EF Status or EF Command: EF on/off status.

Space Temperature.

EF Running During Unoccupied Periods

Description:

Finds periods when any exhaust fan is operating outside the normal schedule. Fault dependencies and associated scenarios include the following;

Periods are only found when the EF is not scheduled to operate or during unoccupied hours.

Requirements:

Scheduled Exhaust Fan: This rule is applied to only EFs which operate per schedule command and excludes EFs that are thermostatically controlled.

EF Status or EF Command: EF on/off status.

Occupancy or Schedule: The EF must have a schedule point record or an occupancy point record.

Floor VAV Unstable Airflow

Description:

Generates a fault when the floor VAV is active and the supply airflow bounces above and below the airflow set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the airflow crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Requirements:

Floor VAV Distribution Terminals: This rule is applied to only floor VAV distribution terminals

Floor VAV Status or Command: Command will suffice, but status is used as primary

Supply Airflow: The supply airflow of the unit

Supply Airflow Setpoint: The supply airflow setpoint of the unit

Heat Exchanger Temp Setpoint Unreachable

Description:

Finds periods over a duration when the secondary leaving water temperature cannot get within a threshold of secondary leaving water temperature set point, while either a heat exchanger pump is on or a water system pump is on. Fault dependencies and associated scenarios include the following;

This will account for temperature being too high or too low from set point.

Requirements:

Heat Exchanger: This rule is only applied to heat exchanger equipment

Pump Status: Must have at least one heat exchanger pump or hot water system pump Boolean status point in order to determine when set point should be maintained

Water Temperature: Secondary leaving water temperature

Water Temperature Set point: Secondary leaving water temperature set point

Summer Winter Mode (optional): Point to determine when the HX is active based on season

Heat Exchanger Valves (optional): Valves that control heat exchanger temperatures if needed to check when it should be operational

Heat Exchanger Temp Unstable

Description:

Generates a fault when the secondary leaving water temperature bounces above and below the secondary leaving water temperature set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the water temperature crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Must occur while either a heat exchanger pump is on or a water system pump is on.

Requirements:

Heat Exchanger: This rule is only applied to heat exchanger equipment

Pump Status: Must have at least one heat exchanger pump or hot water system pump Boolean status point in order to determine when set point should be maintained

Water Temperature: Secondary leaving water temperature

Water Temperature Set point: Secondary leaving water temperature set point

Hot Water Circ Pump Running

Description:

Generates a fault when hot water heating coil pumps are running and no secondary hot water pumps are running in the system.

Requirements:

Hot Water Circ Pump: This rule is applied to only heating coil circulation pumps

Hot Water Circ Pump Status or Command: Pump on/off status

Secondary Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing.

Hot Water Plant Demand Peak

Description:

Finds hot water demand peaks throughout the day, as measured against a facility benchmark. Fault dependencies and associated scenarios include the following;

Looks for an increase in demand by a percentage or threshold and then an immediate decrease by a percentage or threshold. This increase and decrease in demand is looked at in consecutive historic data intervals to identify a short demand peak.

Requirements:

Meter: Any natural gas submeter

Hot Water Plant Benchmark: Natural gas

Hot Water Pressure Set Point Unreachable

Description:

Finds periods over a duration where the secondary differential pressure cannot get within a threshold of secondary differential pressure set point, while any hot water pump is on. Fault dependencies and associated scenarios include the following;

This will account for pressures being too high or too low from set point.

Requirements:

Boiler Plant: This rule is applied to only boiler plant systems

Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing and trying to maintain set point.

Hot Water Differential Pressure: The differential pressure of the boiler plant system

Hot Water Differential Pressure Set point: The differential pressure set point of the boiler plant system

Hot Water Pressure Unstable

Description:

Finds periods when the secondary differential pressure bounces above and below the secondary differential pressure set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the differential pressure crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Must occur while any pump is on.

Requirements:

Boiler Plant: This rule is applied to only boiler plant systems

Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing and trying to maintain set point.

Hot Water Differential Pressure: The differential pressure of the boiler plant system

Hot Water Differential Pressure Set point: The differential pressure set point of the boiler plant system

Hot Water Plant Temperature Setpoint Unreachable

Description:

Finds periods when any boiler is on and the leaving HW temperature is unable to reach a pre-specified threshold of the HW supply setpoint for over a duration.

Requirements:

Boiler Plant: This rule is applied to only boiler plant systems

Boiler Status or Boiler Command: Boiler on/off status. At least one boiler is required to be able to check when hot water is being conditioned.

Hot Water Plant Leaving Temperature: This is the boiler plant leaving water temperature that is being supplied to the building

Hot Water Plant Leaving Temperature Unstable

Description:

Finds periods when the leaving HW temperature bounces above and below the HW supply temperature setpoint by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the leaving HW temperature crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Must occur while any boiler is on.

Requirements:

Boiler Plant: This rule is applied to only boiler plant systems

Boiler Status or Boiler Command: Boiler on/off status.

Pump Status or Pump Command: Pump on/off status. At least one pump is required to be able to check when water is flowing and trying to maintain set point.

Leaving (Supply) Hot Water Temperature

Hot Water Temperature Set point: The hot water setpoint of the boiler plant

Missing Data

Description

Finds periods for at least a duration when a record’s history contains zero data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Occupied Cooling Setpoint Out of Range

Description:

Finds periods over a duration when the occupied cooling set point is below a threshold. Fault dependencies and associated scenarios include the following;

This is used to determine if the zone occupied cooling set point has been set too low.

Requirements:

Zone Occupied Cooling Set point: A set point specifically for occupied cooling associated with a zone air temperature

Occupied Heating Setpoint Out of Range

Description:

Finds periods over a duration when the occupied heating set point is above a threshold. Fault dependencies and associated scenarios include the following;

This is used to determine if the zone occupied heating set point has been set too high.

Requirements:

Zone Occupied Heating Set point: A set point specifically for occupied heating associated with a zone air temperature

Pump Cycling

Description:

Finds periods when the pump stays on or off for less than a specified duration.

Requirements:

Pump: This rule is applied to only pump equipment

Pump Status or Pump Command: Pump on/off status

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point

Short Demand Peak

Description:

Finds short demand peaks throughout the day, including natural gas and electricity. Fault dependencies and associated scenarios include the following;

Looks for an increase in demand by a percentage or threshold and then an immediate decrease by a percentage or threshold. This increase and decrease in demand is looked at in consecutive historic data intervals to identify a short demand peak.

Requirements:

Meter: Any meter

Demand: The demand of the meter (electrical only)

Utility Benchmark: Electrical and natural gas

Split System A/C Unit Cooling Setpoint Out of Range

Description:

Finds periods over a duration when the room or zone temperature is unable to maintain a threshold above or below the cooling setpoint. Fault dependencies and associated scenarios include the following;

This is used to determine if the cooling set point can be maintained or whether it has been set too low and high.

Requirements:

Cooling Setpoint: A set point specifically for cooling associated with a split system A/C unit.

Space Temperature

Terminal Unit Airflow Setpoint Unreachable

Description:

Finds periods over a duration when the discharge airflow cannot get within a threshold of discharge airflow set point (while the FCU fan is on).

Requirements:

Terminal Unit: This rule is applied to only VAV or DDT equipment

AHU Discharge Fan Status or Discharge Fan Command: AHU fan command will suffice, but status is used as primary

Discharge Airflow: Terminal unit discharge airflow

Discharge Airflow Set point: Terminal unit discharge airflow set point

Discharge Airflow Maximum Set point (optional): Terminal unit discharge airflow maximum set point. If available will be used to calculate an appropriate threshold.

Terminal Unit Airflow Unstable

Description:

Generates a fault when the discharge airflow bounces above and below the discharge airflow set point by a dead band. Fault dependencies and associated scenarios include the following;

Periods are only found when the discharge airflow crosses (above and below) the set point by the dead band more than the given amount of crosses in any window period.

Must occur while the AHUs discharge fan is on.

Requirements:

Terminal Unit: This rule is applied to only VAV or DDT equipment

AHU Discharge Fan Status or Discharge Fan Command: AHU fan command will suffice, but status is used as primary

Discharge Airflow: Terminal unit discharge airflow

Discharge Airflow Set point: Terminal unit discharge airflow set point

Discharge Airflow Maximum Set point (optional): Terminal unit discharge airflow maximum set point. If available will be used to calculate an appropriate dead band.

Terminal Unit Heating Failure

Description:

Generates a fault when the FCU fan is on (if applicable), heating is on, and discharge temperature sensor is not greater than the discharge air sensor plus a threshold. Fault dependencies and associated scenarios include the following;

Heating is on when the hot water valve is greater than a threshold or any heating stage is on.

Will also make sure any hot water pump, from the hot water plant, is on during this period if a heating valve is utilized.

If no pumps are available, the rule will not fail.

Requirements:

Terminal Unit: This rule is applied to only VAV, DDT, or PIU equipment

AHU Discharge Fan Status or Discharge Fan Command: AHU fan command will suffice, but status is used as primary

AHU Discharge Temperature: AHU discharge air temperature

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Discharge Temperature: Discharge air temperature

Hot Water Pump (optional): Any hot water pump command or status from the hot water plant. If none are found it will not be incorporated into the rule

Steam Pressure (optional): Steam pressure if served from a steam plant

Terminal Unit Heating Valve Leaking

Description:

Generates a fault when FCU fan is on (if applicable), heating valve is closed, airflow is above a threshold, and the discharge temperature sensor is above discharge temperature by a threshold. Fault dependencies and associated scenarios include the following;

Will use multiple valves if they exist and make sure they are all closed.

Requirements:

Terminal Unit: This rule is applied to only VAV, DDT, or PIU equipment

AHU Discharge Fan Status or Discharge Fan Command: AHU fan command will suffice, but status is used as primary

AHU Discharge Temperature: AHU discharge air temperature

Heating Valve or Heating Stage: This can either be a numeric heating valve position or a Boolean heating stage

Terminal Unit Zone Temperature Out of Range

Description:

Finds periods for longer than a duration when the zone air temperature is less than or greater than, the zone set point(s) by a threshold. Fault dependencies and associated scenarios include the following;

If occupancy exists temperature will only be checked when occupancy is true.

Requirements:

Zone Air Temperature: Zone temperature of a piece of equipment

Zone Effective Set point or Zone Cooling Set point or Zone Heating Set point: Set point associated with the zone air temperature. This can either be one set point or a heating or cooling set point.

Occupancy (optional): Occupancy of the piece of equipment

Fan Status (optional): Fan status of the piece of equipment or the fan status of the AHU supply air to the piece of equipment.

Underfloor Heating Space Temperature Out of Range

Description:

Finds periods when the underfloor heating space temperature is less than or greater than the setpoint(s) by a threshold for longer than a duration. Fault dependencies and associated scenarios include the following;

If occupancy exists temperature will only be checked when occupancy is true.

Requirements:

Underfloor Space Temperature: Space temperature sensor serving underfloor heating system.

Underfloor Heating Space Temperature Setpoint: Setpoint associated with the underfloor heating system space temperatures.

Manifold Status or Command: Underfloor heating manifold is engaged.

Occupancy (optional): Occupancy of the piece of equipment

Unoccupied Cooling Set Point Out of Range

Description:

Finds periods over a duration when the unoccupied cooling set point is below a threshold. Fault dependencies and associated scenarios include the following;

This is used to determine if the zone unoccupied cooling set point has been set too low.

Requirements:

Zone Unoccupied Cooling Set point: A set point specifically for unoccupied cooling associated with a zone air temperature

Unoccupied Heating Set Point Out of Range

Description:

Finds periods over a duration when the unoccupied heating set point is above a threshold. Fault dependencies and associated scenarios include the following;

This is used to determine if the zone unoccupied heating set point has been set too high.

Requirements:

Zone Unoccupied Heating Set point: A set point specifically for unoccupied heating associated with a zone air temperature

Zone Cooling Damper Malfunction

Description:

Finds periods over a duration when the cooling damper is open above a threshold and the zone damper discharge air temperature is not within a threshold of the cold deck discharge air temperature. Fault dependencies and associated scenarios include the following;

The AHU discharge fan must be on during this period too.

Requirements:

Zone Damper: This rule is applied to only zone damper equipment

Zone Damper Discharge Temperature: Discharge temperature of the zone damper

Zone Damper Position: Position of the damper in the cold deck

AHU Cold Deck Discharge Temperature: Cold deck discharge temperature of the AHU serving the zone damper

AHU Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Zone Heating Damper Malfunction

Description:

Finds periods over a duration when the heating damper is open above a threshold and the zone damper discharge air temperature is not within a threshold of the hot deck discharge air temperature. Fault dependencies and associated scenarios include the following;

The AHU discharge fan must be on during this period too.

Requirements:

Zone Damper: This rule is applied to only zone damper equipment

Zone Damper Discharge Temperature: Discharge temperature of the zone damper

Zone Damper Position: Position of the damper in the hot deck

AHU Hot Deck Discharge Temperature: Hot deck discharge temperature of the AHU serving the zone damper

AHU Discharge Fan Status or Discharge Fan Command: Fan command will suffice, but status is used as primary

Zone Temperature Out of Range (Cooling)

Description:

Finds periods when the zone air temperature is less than the zone heating set point by a threshold, and discharge air temperature is less than the zone heating set point by a threshold for more than a duration.

Requirements:

AHU or Terminal Unit: This rule is applied to only AHU, VAV, ATU, DDT, or FPB equipment

Zone Air Temperature: Zone temperature of a piece of equipment

Discharge Air Temperature: Discharge temperature of a piece of equipment

Zone Effective Set point or Zone Heating Set point: Set point associated with the zone air temperature. This can either be the effective set point or the heating set point.

Occupancy (optional): Occupancy of the piece of equipment

Fan Status (optional): Fan status of the piece of equipment or the fan status of the AHU supply air to the piece of equipment.

Zone Temperature Out of Range (Heating)

Description:

Finds periods when the zone air temperature is more than the zone cooling set point by a threshold, and discharge air temperature is more than the zone cooling set point by a threshold for more than a duration.

Requirements:

AHU or Terminal Unit: This rule is applied to only AHU, VAV, ATU, DDT, or FPB equipment

Zone Air Temperature: Zone temperature of a piece of equipment

Discharge Air Temperature: Discharge temperature of a piece of equipment

Zone Effective Set point or Zone Cooling Set point: Set point associated with the zone air temperature. This can either be the effective set point or the cooling set point.

Occupancy (optional): Occupancy of the piece of equipment

Fan Status (optional): Fan status of the piece of equipment or the fan status of the AHU supply air to the piece of equipment.

* + 1. LIGHTING Control System

Bad Energy Data

Description:

Find periods for at least a duration when data contains values outside of low and high limits or the data is shown as “not a number” (NaN). Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Double Dipping Data

Description

Finds periods for at least a duration when a point’s history contains two or more data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Lights Running During Unoccupied Hours

Description:

Generates a fault when lights are running during unoccupied hours and an associated occupancy sensor has not detected motion therein. Fault dependencies and associated scenarios include the following;

Periods are only found when the local occupancy sensor has not detected motion for a defined length of time.

The lighting is scheduled to remain off.

Requirements:

Interior Lighting: This rule is applied to only interior lighting

Lighting Schedule: Occupied/Unoccupied

Light(s) Status or Light(s) Command: Light(s) on/off status

Lighting Level: Measured via Multi-Sensor

Occupancy Sensor Status: Motion Detected/Not Detected.

Occupancy Sensor Timer: 30 Mins (Adj.)

Lights Not Running During Occupied Hours

Description:

Generates a fault when lights are not running during occupied hours and an associated occupancy sensor has detected motion therein. Fault dependencies and associated scenarios include the following;

Periods are only found when the local occupancy sensor has detected motion for a defined length of time.

The lighting is scheduled to remain on.

Requirements:

Interior Lighting: This rule is applied to only interior lighting

Lighting Schedule: Occupied/Unoccupied

Light(s) Status or Light(s) Command: Light(s) on/off status

Lighting Level: Measured via Multi-Sensor

Occupancy Sensor Status: Motion Detected/Not Detected.

Lights Not Dimming During Daylight Harvesting

Description:

Finds periods when the lighting level exceeds the zone setpoint(s) by a threshold for a longer than a duration. Fault dependencies and associated scenarios include the following;

Periods are only found when the daylight multi sensor initiates light harvesting.

The lighting is scheduled to remain on.

Requirements:

Interior Lighting: This rule is applied to only interior lighting

Light(s) Status or Light(s) Command: Light(s) on/off status

Lighting Level: Measured via Multi-Sensor

Lighting Level Dimming Status: Dimming status (%)

Lighting Schedule: Occupied/Unoccupied

Missing Data

Description

Finds periods for at least a duration when a record’s history contains zero data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point from occupancy sensors, daylight sensors and fixture ballasts.

* + 1. ELECTRICAL POWER MONITORING (METERING) AND GENERATOR Control System

Bad Energy Data

Description:

Find periods for at least a duration when data contains values outside of low and high limits or the data is shown as “not a number” (NaN). Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Building Running Too Late

Description:

Finds periods over a duration after occupancy is over, when the demand of the building does not drop off by at least a percentage or threshold. Fault dependencies and associated scenarios include the following;

A shutdown window can be specified for an allotted time to wait until after occupancy to check for the decrease in demand. This makes sure that most equipment is shutting down when occupancy is over and equipment is not manually operating or overridden.

Requirements:

Site Meter: Any main meter of the site

Electrical Submeter(s): Any meter

Demand: The demand of the main meter

Occupancy: Occupancy or schedule for the building

Building Starting Too Early

Description:

Finds periods over a duration before building occupancy when the demand increases by a percentage or threshold. Fault dependencies and associated scenarios include the following;

A startup window can be specified for an allotted time before occupancy that demand is allowed to increase. This indicates that the building is starting ahead of occupancy or too many pieces of equipment are coming on outside of normal occupancy.

Requirements:

Site Meter: Any main meter of the site

Electrical Submeter(s): Any meter

Demand: The demand of the main meter

Occupancy: Occupancy or schedule for the building

Double Dipping Data

Description

Finds periods for at least a duration when a point’s history contains two or more data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Excessive Energy Usage During Unoccupied Periods

Description:

Generates a fault when the daily unoccupied energy usage is greater than the daily occupied energy usage by a threshold. Fault dependencies and associated scenarios include the following;

This fault will not generate on holidays.

Requirements:

Electric Utility Meter: Any main electric meter

Electrical Submeter(s): Any meter

Consumption: The consumption of the electric meter

Occupancy: Occupancy or schedule for the building

Maximum Peak During Un-occupancy

Description:

Finds periods when the maximum demand peak for the day occurs during an unoccupied period. A startup and shutdown duration can be specified so peaks slightly before or after occupancy are not included.

Requirements:

Site Meter: Any main meter of the site

Electrical Submeter(s): Any meter

Demand: The demand of the main meter

Occupancy: Occupancy or schedule for the building

Missing Data

Description

Finds periods for at least a duration when a record’s history contains zero data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point, including statuses and operating mode(s).

Short Demand Peak

Description:

Finds short demand peaks throughout the day. Fault dependencies and associated scenarios include the following;

Looks for an increase in demand by a percentage or threshold and then an immediate decrease by a percentage or threshold. This increase and decrease in demand is looked at in consecutive historic data intervals to identify a short demand peak.

Requirements:

Meter: Any meter

Demand: The demand of the meter

* + 1. SECURITY Control System

Bad Energy Data

Description:

Find periods for at least a duration when data contains values outside of low and high limits or the data is shown as “not a number” (NaN). Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Double Dipping Data

Description

Finds periods for at least a duration when a point’s history contains two or more data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Missing Data

Description

Finds periods for at least a duration when a record’s history contains zero data points within a leeway of an interval. Fault dependencies and associated scenarios include the following;

All data will be imported into the SCMS ‘as is’ from its existing system.

Requirements

Consumption or Demand Point: Any point that has consumption or demand type units

Sensor Failure

Description:

Finds periods over a duration when a sensor does not change by a threshold for a 24-hour period and equipment is running.

Requirements:

Sensor: Any numerical data point, including statuses and operating mode(s).

* + - 1. DIVISION 22 FUNCTIONAL SPECIFICATIONS
         1. Domestic Water Booster Pump Control System:

The domestic water booster pump control system shall be provided with communication capabilities to be integrated into the IAS through the FACLAN building network. Communication systems shall be non-proprietary open systems such as BACnet or Modbus. System shall share the following:

Status: on/off

Operating Hours.

Lead/Lag assignment.

System pressure (PSI).

Heat detector status, temperature

Status: available, not available, activated, failure, trouble, alarm, etc.

In occupancy mode, the domestic water booster pump control system shall be engaged.

In un-occupancy mode, the domestic water booster pump control system shall be disengaged.

In emergency mode, the domestic water booster pump control system shall be disengaged.

* + - 1. DIVISION 23 FUNCTIONAL SPECIFICATIONS
         1. The use of products and components shall be in accordance with the details specified in division 23.
         2. HVAC System:

The HVAC system shall be provided with communication capabilities to be integrated into the IAS through the FACLAN building network. Communication systems shall be non-proprietary open systems such as BACnet or Modbus.

In occupancy mode, the HVAC system shall be engaged. In addition to the aforementioned, the following will be conducted in occupancy mode;

Upon the identified presence of a tenant via the occupancy sensors, the HVAC control system shall initiate a demand control ventilation (calculated OA CFM) program based on number of occupants present in a large occupied HVAC zones (non-office or large open office).

Optimum start times for HVAC equipment shall be utilized during occupancy mode.

The HVAC control system shall totalize room occupancy per OA Zone to enable demand based outside air delivery.

During Demand Response – Level 2, the Chiller units shall increase its leaving chilled water temperature by 2 deg F.

During Demand Response – Level 2, the AHU units shall increase its discharge air temperature by 2 deg F

In un-occupancy mode, the HVAC system shall be disengaged and placed in standby (unless optimum start programming is active or engaged). The following will be conducted in un-occupancy mode;

The HVAC shall be engaged during temporary occupancy and shall remain on for a pre-determined duration of time

In emergency mode, the HVAC system shall be partially engaged. The following will be conducted in emergency mode;

The AHUs and Smoke Exhaust Fans shall be sequenced per approved Smoke Control Sequence.

* + - 1. DIVISION 25 FUNCTIONAL SPECIFICATIONS
         1. The use of products and components shall be in accordance with the details specified in division 25.
      2. DIVISION 26 FUNCTIONAL SPECIFICATIONS
         1. The use of products and components shall be in accordance with the details specified in division 26.
         2. Electrical Power Meter Monitoring System:

The electrical power monitoring system shall be provided with communication capabilities to be integrated into the IAS through the FACLAN building network. Communication systems shall be non-proprietary open systems such as BACnet or Modbus.

In occupancy mode, the electrical power monitoring system shall be engaged.

In un-occupancy mode, the electrical power monitoring system shall be engaged.

In emergency mode, the electrical power monitoring system shall be engaged, unless the facility experiences a power outage.

* + - * 1. Lighting Control System:

The lighting control system shall be provided with communication capabilities to be integrated into the IAS through the FACLAN building network. Communication systems shall be non-proprietary open systems such as BACnet or Modbus. System shall share the following data:

Read device (DALI device) status

Read Lamp status

Read Light level

Read what override is active

Send override to a device

Set override type (high priority, normal)

Set light level

Set duration

Calling Preset DALI scene

Set scene ID

Set duration for a scene

Set scene level

Read lights on/off status for a group of fixtures

Send override to a group of fixtures

Set light level for a group of fixtures

Read ballast status for a group of fixtures

Read lamp status for a group of fixtures

Read power consumption for a group of fixtures

Set Light level for a group of fixtures via scenes

Set the priority of the override command sent to a group of fixtures

Read occupancy sensor status

Read daylight sensor reading

In occupancy mode, the lighting control system shall be engaged. In addition to the aforementioned, the following will be conducted in occupancy mode;

Upon the identified vacancy of a tenant, the HVAC control system shall initiate a demand control ventilation (calculated OA CFM) program based on number of occupants present in an large occupied HVAC zones (non-office or large open office).

During Demand Response – Level 1, the public area, back of house and corridor lighting shall be dimmed by 15%.

During Demand Response – Level 2, the public area, back of house and corridor lighting shall be dimmed by 15%.

During Demand Response – Level 3, the office lighting shall be dimmed by 15%.

In un-occupancy mode, the lighting control system shall be disengaged and placed in standby, as only essential security offices and areas shall remain illuminated. The following will be conducted in un-occupancy mode;

The lighting control shall be engaged during temporary occupancy and shall remain on for a pre-determined duration of time.

In emergency mode, the lighting control system shall be engaged. The following will be conducted in emergency mode;

All lighting levels and set points will be over-ridden and turned on at100%.

* + - * 1. Plug Load Control System:

The plug load control system shall be provided with communication capabilities to be integrated into the IAS through the FACLAN building network. Communication systems shall be non-proprietary open systems such as BACnet or Modbus. System shall share the following data:

Read device (DALI device) status

Read plug status

Read what override is active

Send override to a device

Set override type (high priority, normal)

Set status (on or off)

Set duration

Read plug on/off status for a group of plugs

Send override to a group of plugs

Read status for a group of plugs

Read power consumption for a group of plugs

Set the priority of the override command sent to a group of plugs

In occupancy mode, the plug load control system shall be engaged. In addition to the aforementioned, the following will be conducted in occupancy mode;

During Demand Response – Level 1, the public area plugs shall be shut off.

During Demand Response – Level 2, the back of house plugs shall be shut off.

During Demand Response – Level 3, the office non-critical plugs shall be shut off.

In un-occupancy mode, the plug load control system shall be disengaged and placed in standby, as only essential areas and critical plug loads shall be powered.

In emergency mode, the plug load control system shall be engaged and enabled.

* + - * 1. Emergency Generator and UPS systems:

The emergency generator shall be provided with communication capabilities to be integrated into the IAS through the FACLAN building network. Communication systems shall be non-proprietary open systems such as BACnet or Modbus. The system shall share the following information/data with the IAS;

Kwh and kW from generators time stamped in 15 minute instances.

Starts and runtime.

Battery voltage.

Fuel tank level.

Radiator and oil temperatures.

Percent of full load power production.

Volts, amps, hertz, power factor.

Alarm or fault occurrences (failure, fuel loss, power loss, communication loss).

In occupancy mode, the emergency generator shall be disengaged unless the unit is manually operated.

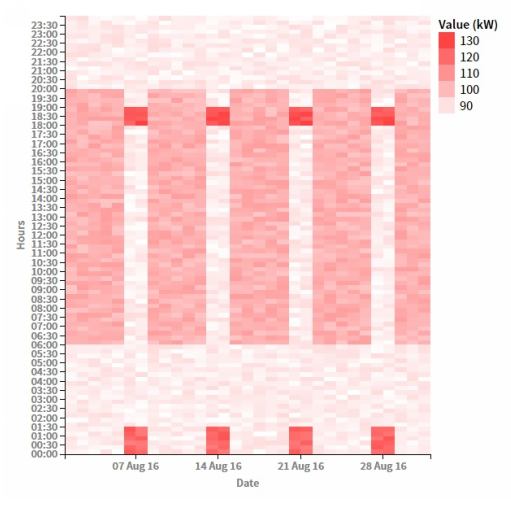
In un-occupancy mode, the emergency generator shall be disengaged unless the unit is manually operated.

In emergency mode, the emergency generator shall be engaged in the event the facility experiences a power outage.

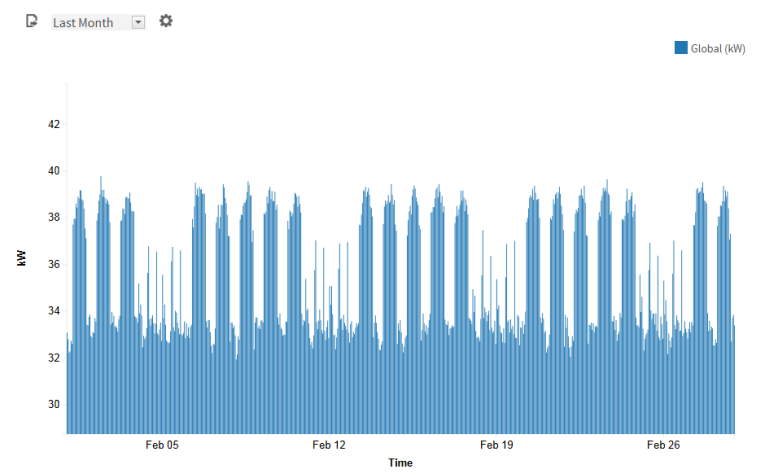
* + - 1. DIVISION 27 and 28 FUNCTIONAL SPECIFICATIONS
         1. The use of products and components shall be in accordance with the details specified in division 27 and 28.
      2. GRAPHICAL EXAMPLES

This section can be included as is or as an attachment. The graphics should be reviewed and updated as examples of what the engineer would expect as a deliverable.

* + - * 1. Provide graphical diagrams which assist with analytics such as a weekly diagram with color coded times of day to show values:



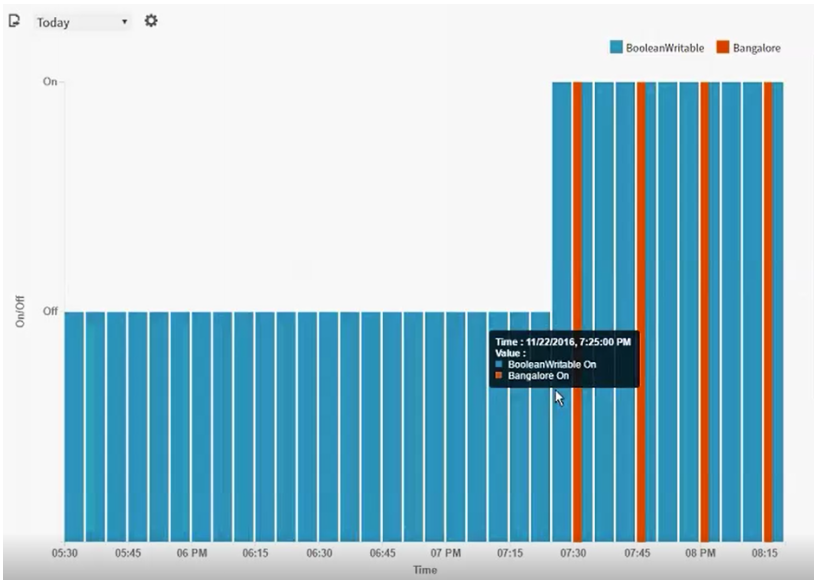
* + - * 1. Software shall show power use profiles in multiple formats.



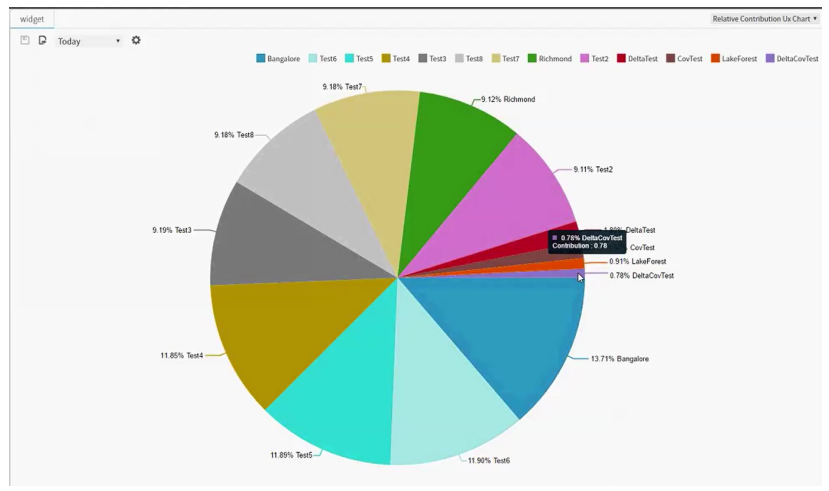
* + - * 1. Multiple values can be overlaid on a graph for comparison.



* + - * 1. The software shall show equipment operation in chart form.

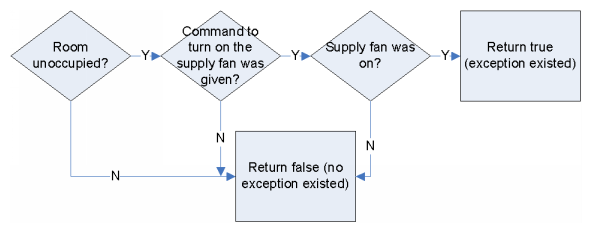


* + - * 1. Software should be able to provide relative contribution charts.

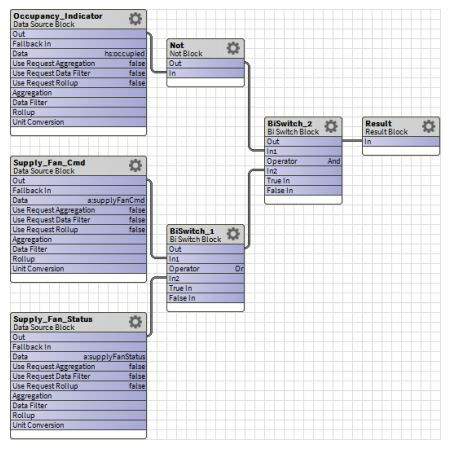


* + - * 1. Software shall provide flowcharts and linked programming algorithms.

The following are examples of flow charts which illustrate the programming format (these charts may or may not be provided by the software.



* + - * 1. This is an example of the graphical programming algorithms.



* + - 1. IAS POINTS LIST

The points list below are standard ones which can be added to and edited. Edit the following points list in consultation with the client and the project team, as the associated project requirements may dictate a change in number and type of building systems and equipment installed therein. Use this section if the analytics shall be provided by the system integrations contractor or an IAS provider. Use section 230900 if the analytics shall be provided by the building automation contractor under the mechanical contractor division. Edit references to division 25 and check if those sections are provided.

* + - * 1. The following table contains building subsystem points which will be exposed in the IAS along with the corresponding point classification and whether the point will participate in fault detection diagnostics or demand response events. The points list shown below represents the minimum threshold point requirements for each building subsystem and is segmented by each respective CSI Divisions as well as associated equipment/systems. **Please see Section 250500 – Common Work Results for Integrated Automation for the specific naming convention associated with the IAS.**

| **Point Name** | **Description** | **Actual IAS Point Name (typ.) - SiteName\_Building#.\_BuildingWing\_Floor\_Equipment** | **BACnet Object Type (typ.)** | | **IAS Graphic** | | **FDD** | **DR** | **Trend** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Access Control System** |  |  |  | |  | |  |  |  |
| STS | System Status | XXXX\_XXXX\_XXXX\_ACS#\_STS | Multi-state Input (13) | | x | |  |  | x |
| MODE | System Mode (Multi-state Signal) | XXXX\_XXXX\_XXXX\_ACS#\_MODE | Multi-state Input (13) | | x | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_ACS#\_ALM | Multi-state Input (13) | | x | |  |  | x |
| OVR\_SP | System Override | XXXX\_XXXX\_XXXX\_ACS#\_OVR\_SP | Multi-state Output (14) | | x | |  |  | x |
| OPEN | Open Individual Access | XXXX\_XXXX\_XXXX\_ACS#\_OPEN | Analog Input (0) | | x | |  |  | x |
| CLOSE | Close Individual Access | XXXX\_XXXX\_XXXX\_ACS#\_CLOSE | Analog Input (0) | | x | |  |  | x |
| DETECT\_OCC | Pedestrian Detection at Turnstile duing Occupancy | XXXX\_XXXX\_XXXX\_PAC#\_DETECT\_OCC | | Multi-state Input (13) | x |  | |  | x |
| DETECT\_UNOCC | Pedestrian Detection at Turnstile duing Unoccupancy | XXXX\_XXXX\_XXXX\_PAC#\_DETECT\_UNOCC | | Multi-state Input (13) | x |  | |  | x |
|  |  |  | |  |  |  | |  |  |
| ***Existing*** |  |  |  | |  | |  |  |  |
| **Elevator/Escalator** |  |  |  | |  | |  |  |  |
| STS | System Status | XXXX\_XXXX\_XXXX\_ELV#\_STS | Multi-state Input (13) | | x | |  |  | x |
| MODE | System Mode (Multi-state Signal) | XXXX\_XXXX\_XXXX\_ELV#\_MODE | Multi-state Input (13) | | x | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_ELV#\_ALM | Multi-state Input (13) | | x | |  |  | x |
| OVR\_SP | System Override | XXXX\_XXXX\_XXXX\_ELV#\_OVR\_SP | Multi-state Output (14) | | x | |  |  | x |
| MODE | Mode | XXXX\_XXXX\_XXXX\_ELV#\_MODE | Analog Input (0) | | x | |  |  | x |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_ELV#\_AMP | Analog Input (0) | | x | | x |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_ELV#\_KW | Analog Input (0) | | x | | x |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_ELV#\_KWH | Analog Input (0) | | x | |  | x | x |
| LOCATION | Floor Location | XXXX\_XXXX\_XXXX\_ELV#\_FLR | Analog Input (0) | | x | |  |  | x |
| RUNTIME | Runtime Hours | XXXX\_XXXX\_XXXX\_ELV#\_HOURS | Analog Input (0) | | x | |  |  | x |
| **Division 22** |  |  |  | |  | |  |  |  |
|  | Booster Pump status | Same as HVAC Pump |  | |  | |  |  |  |
| **Division 23** |  |  |  | |  | |  |  |  |
| AHUs: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_AHU#\_AMP | Analog Input (0) | |  | |  |  | x |
| CDT | Cold Deck Temperature | XXXX\_XXXX\_XXXX\_AHU#\_CDT | Analog Input (0) | | x | |  |  | x |
| CLT | Cooling (Coil) Leaving Temperature | XXXX\_XXXX\_XXXX\_AHU#\_CLT | Analog Input (0) | | x | | x |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_AHU#\_CO2 | Analog Input (0) | | x | | x |  | x |
| DASP | Discharge Air Static Pressure | XXXX\_XXXX\_XXXX\_AHU#\_DASP | Analog Input (0) | | x | | x |  | x |
| DAT | Discharge Air Temperature | XXXX\_XXXX\_XXXX\_AHU#\_DAT | Analog Input (0) | | x | |  | x | x |
| EAT | Exhaust Air Temperature | XXXX\_XXXX\_XXXX\_AHU#\_EAT | Analog Input (0) | | x | | x |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_AHU#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_AHU#\_KWH | Analog Input (0) | |  | |  |  | x |
| MAT | Mixed Air Temperature | XXXX\_XXXX\_XXXX\_AHU#\_MAT | Analog Input (0) | | x | | x |  | x |
| OAF | Outside Airflow | XXXX\_XXXX\_XXXX\_AHU#\_OAF | Analog Input (0) | | x | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_AHU#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_AHU#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_AHU#\_OAT | Analog Input (0) | | x | | x |  | x |
| PHT | Pre-Heat Temperature | XXXX\_XXXX\_XXXX\_AHU#\_PHT | Analog Input (0) | | x | |  |  | x |
| PCWDP | Process Chilled Water Differential Pressure | XXXX\_XXXX\_XXXX\_AHU#\_PCWDP | Analog Input (0) | | x | |  |  | x |
| PCWR | Process Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_AHU#\_PCWR | Analog Input (0) | | x | | x |  | x |
| PCWS | Process Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_AHU#\_PCWS | Analog Input (0) | | x | | x |  | x |
| RARH | Return Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_AHU#\_RARH | Analog Input (0) | | x | | x |  | x |
| RACO2 | Return Air Carbon-Dioxide | XXXX\_XXXX\_XXXX\_AHU#\_RACO2 | Analog Input (0) | | x | | x |  | x |
| RAF | Return Airflow | XXXX\_XXXX\_XXXX\_AHU#\_RAF | Analog Input (0) | | x | |  |  | x |
| RAT | Return air Temperature | XXXX\_XXXX\_XXXX\_AHU#\_RAT | Analog Input (0) | | x | | x |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_AHU#\_RH | Analog Input (0) | | x | |  |  | x |
| RSP | Remote Static Pressure | XXXX\_XXXX\_XXXX\_AHU#\_RSP | Analog Input (0) | | x | |  |  | x |
| SAF | Supply Airflow | XXXX\_XXXX\_XXXX\_AHU#\_SAF | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_AHU#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_AHU#\_ZNT | Analog Input (0) | | x | | x | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_AHU#\_ALM | Binary Input (3) | | x | | x |  | x |
| FLTR | Dirty Filter Alarm (via Differential Pressure Switch) | XXXX\_XXXX\_XXXX\_AHU#\_FLTR | Binary Input (3) | |  | | x |  | x |
| FZ | Freezestat | XXXX\_XXXX\_XXXX\_AHU#\_FZ | Binary Input (3) | |  | | x |  | x |
| RFST | Return Fan Status | XXXX\_XXXX\_XXXX\_AHU#\_RFST | Binary Input (3) | | x | |  |  | x |
| SFST | Supply Fan Status | XXXX\_XXXX\_XXXX\_AHU#\_SFST | Binary Input (3) | | x | |  |  | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_AHU#\_VIB | Binary Input (3) | |  | | x |  | x |
| CLG | Cooling Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AHU#\_CLG | Analog Output (1) | | x | |  |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AHU#\_HTG | Analog Output (1) | | x | |  |  | x |
| HUM | Humidifier Control Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AHU#\_HUM | Analog Output (1) | | x | |  |  | x |
| MAD | Mixed Air Dampers (0-100 percent open control signal relative to OAD) | XXXX\_XXXX\_XXXX\_AHU#\_MAD | Analog Output (1) | | x | |  |  | x |
| OAD | Outside Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AHU#\_OAD | Analog Output (1) | | x | |  |  | x |
| RAD | Return Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AHU#\_RAD | Analog Output (1) | | x | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_AHU#\_SPD | Analog Output (1) | | x | |  |  | x |
| VLV | Modulating Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AHU#\_VLV | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_AHU#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_AHU#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| DAT\_STPT | Discharge Air Temperature Set point | XXXX\_XXXX\_XXXX\_AHU#\_DAT\_STPT | Analog Value (2) | | x | |  | x | x |
| EFF\_CLG | Effective Cooling Set point | XXXX\_XXXX\_XXXX\_AHU#\_EFF\_CLG | Analog Value (2) | | x | |  | x | x |
| EFF\_HTG | Effective Heating Set point | XXXX\_XXXX\_XXXX\_AHU#\_EFF\_HTG | Analog Value (2) | | x | |  | x | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_AHU#\_HLALM | Analog Value (2) | |  | | x |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_AHU#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| HUM\_STPT | Humidity Set point | XXXX\_XXXX\_XXXX\_AHU#\_HUM\_STPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_AHU#\_LLALM | Analog Value (2) | |  | | x |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_AHU#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_AHU#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| RAH\_STPT | Return Air (Relative) Humidity Set point | XXXX\_XXXX\_XXXX\_AHU#\_RAH\_STPT | Analog Value (2) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_AHU#\_STPT | Analog Value (2) | | x | | x | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_AHU#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| ACs: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_RTU#\_AMP | Analog Input (0) | |  | |  |  | x |
| CDT | Cold Deck Temperature | XXXX\_XXXX\_XXXX\_RTU#\_CDT | Analog Input (0) | | x | |  |  | x |
| CLT | Cooling (Coil) Leaving Temperature | XXXX\_XXXX\_XXXX\_RTU#\_CLT | Analog Input (0) | | x | | x |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_RTU#\_CO2 | Analog Input (0) | | x | | x |  | x |
| DASP | Discharge Air Static Pressure | XXXX\_XXXX\_XXXX\_RTU#\_DASP | Analog Input (0) | | x | | x |  | x |
| DAT | Discharge Air Temperature | XXXX\_XXXX\_XXXX\_RTU#\_DAT | Analog Input (0) | | x | |  | x | x |
| EAT | Exhaust Air Temperature | XXXX\_XXXX\_XXXX\_RTU#\_EAT | Analog Input (0) | | x | | x |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_RTU#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_RTU#\_KWH | Analog Input (0) | |  | |  |  | x |
| MAT | Mixed Air Temperature | XXXX\_XXXX\_XXXX\_RTU#\_MAT | Analog Input (0) | | x | | x |  | x |
| OAF | Outside Airflow | XXXX\_XXXX\_XXXX\_RTU#\_OAF | Analog Input (0) | | x | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_RTU#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_RTU#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_RTU#\_OAT | Analog Input (0) | | x | | x |  | x |
| PHT | Pre-Heat Temperature | XXXX\_XXXX\_XXXX\_RTU#\_PHT | Analog Input (0) | | x | |  |  | x |
| RARH | Return Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_RTU#\_RARH | Analog Input (0) | | x | |  |  | x |
| RACO2 | Return Air Carbon-Dioxide | XXXX\_XXXX\_XXXX\_RTU#\_RACO2 | Analog Input (0) | | x | | x |  | x |
| RAF | Return Airflow | XXXX\_XXXX\_XXXX\_RTU#\_RAF | Analog Input (0) | | x | | x |  | x |
| RAT | Return air Temperature | XXXX\_XXXX\_XXXX\_RTU#\_RAT | Analog Input (0) | | x | | x |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_RTU#\_RH | Analog Input (0) | | x | | x |  | x |
| RSP | Remote Static Pressure | XXXX\_XXXX\_XXXX\_RTU#\_RSP | Analog Input (0) | | x | |  |  | x |
| SAF | Supply Airflow | XXXX\_XXXX\_XXXX\_RTU#\_SAF | Analog Input (0) | | x | | x |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_RTU#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_RTU#\_ZNT | Analog Input (0) | | x | |  | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_RTU#\_ALM | Binary Input (3) | | x | |  |  | x |
| FLTR | Dirty Filter Alarm (via Differential Pressure Switch) | XXXX\_XXXX\_XXXX\_RTU#\_FLTR | Binary Input (3) | |  | |  |  | x |
| FZ | Freezestat | XXXX\_XXXX\_XXXX\_RTU#\_FZ | Binary Input (3) | |  | | X |  | x |
| RFST | Return Fan Status | XXXX\_XXXX\_XXXX\_RTU#\_RFST | Binary Input (3) | | x | | X |  | x |
| SFST | Supply Fan Status | XXXX\_XXXX\_XXXX\_RTU#\_SFST | Binary Input (3) | | x | | X |  | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_RTU#\_VIB | Binary Input (3) | |  | | X |  | x |
| CLG | Cooling Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_RTU#\_CLG | Analog Output (1) | | x | |  |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_RTU#\_HTG | Analog Output (1) | | x | |  |  | x |
| MAD | Mixed Air Dampers (0-100 percent open control signal relative to OAD) | XXXX\_XXXX\_XXXX\_RTU#\_MAD | Analog Output (1) | | x | | x |  | x |
| OAD | Outside Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_RTU#\_OAD | Analog Output (1) | | x | |  |  | x |
| RAD | Return Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_RTU#\_RAD | Analog Output (1) | | x | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_RTU#\_SPD | Analog Output (1) | | x | |  |  | x |
| VLV | Modulating Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_RTU#\_VLV | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_RTU#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_RTU#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| DAT\_STPT | Discharge Air Temperature Set point | XXXX\_XXXX\_XXXX\_RTU#\_DAT\_STPT | Analog Value (2) | | x | |  | x | x |
| EFF\_CLG | Effective Cooling Set point | XXXX\_XXXX\_XXXX\_RTU#\_EFF\_CLG | Analog Value (2) | | x | |  | x | x |
| EFF\_HTG | Effective Heating Set point | XXXX\_XXXX\_XXXX\_RTU#\_EFF\_HTG | Analog Value (2) | | x | |  | x | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_RTU#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_RTU#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| HUM\_STPT | Humidity Set point | XXXX\_XXXX\_XXXX\_RTU#\_HUM\_STPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_RTU#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_RTU#\_LLSTPT | Analog Value (2) | | x | | x |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_RTU#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| RAH\_STPT | Return Air (Relative) Humidity Set point | XXXX\_XXXX\_XXXX\_RTU#\_RAH\_STPT | Analog Value (2) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_RTU#\_STPT | Analog Value (2) | | x | | X | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_RTU#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| FCUs: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_FCU#\_AMP | Analog Input (0) | |  | |  |  | x |
| CLT | Cooling (Coil) Leaving Temperature | XXXX\_XXXX\_XXXX\_FCU#\_CLT | Analog Input (0) | | x | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_FCU#\_CO2 | Analog Input (0) | | x | |  |  | x |
| DAT | Discharge Air Temperature | XXXX\_XXXX\_XXXX\_FCU#\_DAT | Analog Input (0) | | x | |  | x | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_FCU#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_FCU#\_KWH | Analog Input (0) | |  | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_FCU#\_RH | Analog Input (0) | | x | | X |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_FCU#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_FCU#\_ZNT | Analog Input (0) | | x | | X | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_FCU#\_ALM | Binary Input (3) | | x | | X |  | x |
| FLTR | Dirty Filter Alarm (via Differential Pressure Switch) | XXXX\_XXXX\_XXXX\_FCU#\_FLTR | Binary Input (3) | |  | | X |  | x |
| SFST | Supply Fan Status | XXXX\_XXXX\_XXXX\_FCU#\_SFST | Binary Input (3) | | x | |  |  | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_FCU#\_VIB | Binary Input (3) | |  | | X |  | x |
| CLG | Cooling Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_FCU#\_CLG | Analog Output (1) | | x | |  |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_FCU#\_HTG | Analog Output (1) | | x | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_FCU#\_SPD | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_FCU#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_FCU#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| DAT\_STPT | Discharge Air Temperature Set point | XXXX\_XXXX\_XXXX\_FCU#\_DAT\_STPT | Analog Value (2) | | x | |  | x | x |
| EFF\_CLG | Effective Cooling Set point | XXXX\_XXXX\_XXXX\_FCU#\_EFF\_CLG | Analog Value (2) | | x | |  | x | x |
| EFF\_HTG | Effective Heating Set point | XXXX\_XXXX\_XXXX\_FCU#\_EFF\_HTG | Analog Value (2) | | x | |  | x | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_FCU#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_FCU#\_STPT | Analog Value (2) | | x | |  | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_FCU#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| VAVs: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_VAV#\_AMP | Analog Input (0) | |  | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_VAV#\_CO2 | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_VAV#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_VAV#\_KWH | Analog Input (0) | |  | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_VAV#\_RH | Analog Input (0) | | x | |  |  | x |
| RSP | Remote Static Pressure | XXXX\_XXXX\_XXXX\_VAV#\_RSP | Analog Input (0) | | x | |  |  | x |
| SAF | Supply Airflow | XXXX\_XXXX\_XXXX\_VAV#\_SAF | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_VAV#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_VAV#\_ZNT | Analog Input (0) | | x | | X | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_VAV#\_ALM | Binary Input (3) | | x | | X |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_VAV#\_HTG | Analog Output (1) | | x | | X |  | x |
| MAD | Mixed Air Dampers (0-100 percent open control signal relative to OAD) | XXXX\_XXXX\_XXXX\_VAV#\_MAD | Analog Output (1) | | x | |  |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_VAV#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_VAV#\_STPT | Analog Value (2) | | x | | X | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_VAV#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| FPVAVs: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_FPVAV#\_AMP | Analog Input (0) | |  | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_FPVAV#\_CO2 | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_FPVAV#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_FPVAV#\_KWH | Analog Input (0) | |  | |  |  | x |
| RARH | Return Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_FPVAV#\_RARH | Analog Input (0) | | x | |  |  | x |
| RACO2 | Return Air Carbon-Dioxide | XXXX\_XXXX\_XXXX\_FPVAV#\_RACO2 | Analog Input (0) | | x | |  |  | x |
| RAF | Return Airflow | XXXX\_XXXX\_XXXX\_FPVAV#\_RAF | Analog Input (0) | | x | |  |  | x |
| RAT | Return air Temperature | XXXX\_XXXX\_XXXX\_FPVAV#\_RAT | Analog Input (0) | | x | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_FPVAV#\_RH | Analog Input (0) | | x | |  |  | x |
| RSP | Remote Static Pressure | XXXX\_XXXX\_XXXX\_FPVAV#\_RSP | Analog Input (0) | | x | |  |  | x |
| SAF | Supply Airflow | XXXX\_XXXX\_XXXX\_FPVAV#\_SAF | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_FPVAV#\_VLT | Analog Input (0) | | x | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_FPVAV#\_ZNT | Analog Input (0) | | x | | X | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_FPVAV#\_ALM | Binary Input (3) | |  | | X |  | x |
| ST | Status for Pump or Fan (when only fan for system) | XXXX\_XXXX\_XXXX\_FPVAV#\_ST | Binary Input (3) | | x | |  |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_FPVAV#\_HTG | Analog Output (1) | | x | |  |  | x |
| MAD | Mixed Air Dampers (0-100 percent open control signal relative to OAD) | XXXX\_XXXX\_XXXX\_FPVAV#\_MAD | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_FPVAV#\_CMD | Binary Output (4) | | x | |  |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_FPVAV#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_FPVAV#\_STPT | Analog Value (2) | | x | | X | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_FPVAV#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| DX Unit: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_AC#\_AMP | Analog Input (0) | |  | |  |  | x |
| CLT | Cooling (Coil) Leaving Temperature | XXXX\_XXXX\_XXXX\_AC#\_CLT | Analog Input (0) | | x | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_AC#\_CO2 | Analog Input (0) | | x | |  |  | x |
| DAT | Discharge Air Temperature | XXXX\_XXXX\_XXXX\_AC#\_DAT | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_AC#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_AC#\_KWH | Analog Input (0) | |  | |  |  | x |
| MAT | Mixed Air Temperature | XXXX\_XXXX\_XXXX\_AC#\_MAT | Analog Input (0) | | x | |  |  | x |
| OAF | Outside Airflow | XXXX\_XXXX\_XXXX\_AC#\_OAF | Analog Input (0) | |  | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_AC#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_AC#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_AC#\_OAT | Analog Input (0) | | x | |  |  | x |
| RARH | Return Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_AC#\_RARH | Analog Input (0) | | x | |  |  | x |
| RACO2 | Return Air Carbon-Dioxide | XXXX\_XXXX\_XXXX\_AC#\_RACO2 | Analog Input (0) | | x | |  |  | x |
| RAF | Return Airflow | XXXX\_XXXX\_XXXX\_AC#\_RAF | Analog Input (0) | | x | |  |  | x |
| RAT | Return air Temperature | XXXX\_XXXX\_XXXX\_AC#\_RAT | Analog Input (0) | | x | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_AC#\_RH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_AC#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_AC#\_ZNT | Analog Input (0) | | x | | X | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_AC#\_ALM | Binary Input (3) | | x | |  |  | x |
| FLTR | Dirty Filter Alarm (via Differential Pressure Switch) | XXXX\_XXXX\_XXXX\_AC#\_FLTR | Binary Input (3) | |  | |  |  | x |
| ST | Status for Pump or Fan (when only fan for system) | XXXX\_XXXX\_XXXX\_AC#\_ST | Binary Input (3) | |  | |  |  | x |
| CLG | Cooling Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AC#\_CLG | Analog Output (1) | | x | |  |  | x |
| OAD | Outside Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AC#\_OAD | Analog Output (1) | | x | |  |  | x |
| RAD | Return Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_AC#\_RAD | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_AC#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_AC#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| EFF\_CLG | Effective Cooling Set point | XXXX\_XXXX\_XXXX\_AC#\_EFF\_CLG | Analog Value (2) | | x | |  | x | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_AC#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_AC#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| HUM\_STPT | Humidity Set point | XXXX\_XXXX\_XXXX\_AC#\_HUM\_STPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_AC#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_AC#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_AC#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| RAH\_STPT | Return Air (Relative) Humidity Set point | XXXX\_XXXX\_XXXX\_AC#\_RAH\_STPT | Analog Value (2) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_AC#\_STPT | Analog Value (2) | | x | |  | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_AC#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| Heat Pump: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_HP#\_AMP | Analog Input (0) | |  | |  |  | x |
| CLT | Cooling (Coil) Leaving Temperature | XXXX\_XXXX\_XXXX\_HP#\_CLT | Analog Input (0) | | x | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_HP#\_CO2 | Analog Input (0) | | x | |  |  | x |
| DAT | Discharge Air Temperature | XXXX\_XXXX\_XXXX\_HP#\_DAT | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_HP#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_HP#\_KWH | Analog Input (0) | |  | |  |  | x |
| MAT | Mixed Air Temperature | XXXX\_XXXX\_XXXX\_HP#\_MAT | Analog Input (0) | | x | |  |  | x |
| OAF | Outside Airflow | XXXX\_XXXX\_XXXX\_HP#\_OAF | Analog Input (0) | |  | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_HP#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_HP#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_HP#\_OAT | Analog Input (0) | | x | |  |  | x |
| RARH | Return Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_HP#\_RARH | Analog Input (0) | | x | |  |  | x |
| RACO2 | Return Air Carbon-Dioxide | XXXX\_XXXX\_XXXX\_HP#\_RACO2 | Analog Input (0) | | x | |  |  | x |
| RAF | Return Airflow | XXXX\_XXXX\_XXXX\_HP#\_RAF | Analog Input (0) | | x | |  |  | x |
| RAT | Return air Temperature | XXXX\_XXXX\_XXXX\_HP#\_RAT | Analog Input (0) | | x | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_HP#\_RH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_HP#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_HP#\_ZNT | Analog Input (0) | | x | | X | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_HP#\_ALM | Binary Input (3) | | x | |  |  | x |
| FLTR | Dirty Filter Alarm (via Differential Pressure Switch) | XXXX\_XXXX\_XXXX\_HP#\_FLTR | Binary Input (3) | | x | |  |  | x |
| ST | Status for Pump or Fan (when only fan for system) | XXXX\_XXXX\_XXXX\_HP#\_ST | Binary Input (3) | | x | |  |  | x |
| CLG | Cooling Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_HP#\_CLG | Analog Output (1) | | x | |  |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_HP#\_HTG | Analog Output (1) | | x | |  |  | x |
| OAD | Outside Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_HP#\_OAD | Analog Output (1) | | x | |  |  | x |
| RAD | Return Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_HP#\_RAD | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_HP#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_HP#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| EFF\_CLG | Effective Cooling Set point | XXXX\_XXXX\_XXXX\_HP#\_EFF\_CLG | Analog Value (2) | | x | |  |  | x |
| EFF\_HTG | Effective Heating Set point | XXXX\_XXXX\_XXXX\_HP#\_EFF\_HTG | Analog Value (2) | | x | |  | x | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_HP#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_HP#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| HUM\_STPT | Humidity Set point | XXXX\_XXXX\_XXXX\_HP#\_HUM\_STPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_HP#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_HP#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_HP#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| RAH\_STPT | Return Air (Relative) Humidity Set point | XXXX\_XXXX\_XXXX\_HP#\_RAH\_STPT | Analog Value (2) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_HP#\_STPT | Analog Value (2) | | x | |  | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_HP#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| Unit Heaters: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_UH#\_AMP | Analog Input (0) | |  | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_UH#\_CO2 | Analog Input (0) | | x | |  |  | x |
| DAT | Discharge Air Temperature | XXXX\_XXXX\_XXXX\_UH#\_DAT | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_UH#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_UH#\_KWH | Analog Input (0) | |  | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_UH#\_RH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_UH#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_UH#\_ZNT | Analog Input (0) | | x | | X | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_UH#\_ALM | Binary Input (3) | | x | |  |  | x |
| ST | Status for Pump or Fan (when only fan for system) | XXXX\_XXXX\_XXXX\_UH#\_ST | Binary Input (3) | | x | |  |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_UH#\_HTG | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_UH#\_CMD | Binary Output (4) | | x | |  |  | x |
| EFF\_HTG | Effective Heating Set point | XXXX\_XXXX\_XXXX\_UH#\_EFF\_HTG | Analog Value (2) | | x | |  |  | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_UH#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_UH#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_UH#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_UH#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| OCC | Occupied Mode | XXXX\_XXXX\_XXXX\_UH#\_OCC | Multi-state Value (19) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_UH#\_STPT | Analog Value (2) | | x | | X | x | x |
| UNOCC | Unoccupied Mode | XXXX\_XXXX\_XXXX\_UH#\_UNOCC | Multi-state Value (19) | | x | |  |  | x |
| Exhaust Fans: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_EF#\_AMP | Analog Input (0) | |  | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_EF#\_CO2 | Analog Input (0) | | x | |  |  | x |
| EAT | Exhaust Air Temperature | XXXX\_XXXX\_XXXX\_EF#\_EAT | Analog Input (0) | | x | | X |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_EF#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_EF#\_KWH | Analog Input (0) | |  | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_EF#\_RH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_EF#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_EF#\_ZNT | Analog Input (0) | | x | | X |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_EF#\_ALM | Binary Input (3) | | x | |  |  | x |
| EFST | Exhaust (Relief) Fan Status | XXXX\_XXXX\_XXXX\_EF#\_EFST | Binary Input (3) | | x | |  |  | x |
| EAD | Exhaust (or Relief) Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_EF#\_EAD | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_EF#\_CMD | Binary Output (4) | | x | |  |  | x |
| HSPD | High Speed | XXXX\_XXXX\_XXXX\_EF#\_HSPD | Binary Output (4) | | x | |  |  | x |
| LSPD | Low Speed | XXXX\_XXXX\_XXXX\_EF#\_LSPD | Binary Output (4) | | x | |  |  | x |
| MSPD | Medium Speed | XXXX\_XXXX\_XXXX\_EF#\_MSPD | Binary Output (4) | | x | |  |  | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_EF#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_EF#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_EF#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_EF#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_EF#\_STPT | Analog Value (2) | | x | | X | x | x |
| Kitchen Exhaust Fans: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_KEF#\_AMP | Analog Input (0) | |  | |  |  | x |
| CO2 | (Space) Carbon-Dioxide | XXXX\_XXXX\_XXXX\_KEF#\_CO2 | Analog Input (0) | | x | |  |  | x |
| EAT | Exhaust Air Temperature | XXXX\_XXXX\_XXXX\_KEF#\_EAT | Analog Input (0) | | x | | X |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_KEF#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_KEF#\_KWH | Analog Input (0) | |  | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_KEF#\_RH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_KEF#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_KEF#\_ZNT | Analog Input (0) | | x | | X |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_KEF#\_ALM | Binary Input (3) | | x | |  |  | x |
| EFST | Exhaust (Relief) Fan Status | XXXX\_XXXX\_XXXX\_KEF#\_EFST | Binary Input (3) | | x | |  |  | x |
| EAD | Exhaust (or Relief) Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_KEF#\_EAD | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_KEF#\_CMD | Binary Output (4) | | x | |  |  | x |
| HSPD | High Speed | XXXX\_XXXX\_XXXX\_KEF#\_HSPD | Binary Output (4) | | x | |  |  | x |
| LSPD | Low Speed | XXXX\_XXXX\_XXXX\_KEF#\_LSPD | Binary Output (4) | | x | |  |  | x |
| MSPD | Medium Speed | XXXX\_XXXX\_XXXX\_KEF#\_MSPD | Binary Output (4) | | x | |  |  | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_KEF#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_KEF#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_KEF#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_KEF#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| STPT | Set point (Zone Temperature Set point) | XXXX\_XXXX\_XXXX\_KEF#\_STPT | Analog Value (2) | | x | | X |  | x |
| DMPR\_POS | Hood Damper Position | XXXX\_XXXX\_XXXX\_KEF#\_DMPR\_POS | Analog Input (0) | | x | | X |  | x |
| SUP\_PRESS | Suppression System Pressure | XXXX\_XXXX\_XXXX\_KEF#\_SUP\_PRESS | Analog Input (0) | | x | | X |  | x |
| Make-up Air Units: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_MAU#\_AMP | Analog Input (0) | |  | |  |  | x |
| EAT | Exhaust Air Temperature | XXXX\_XXXX\_XXXX\_MAU#\_EAT | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_MAU#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_MAU#\_KWH | Analog Input (0) | |  | |  |  | x |
| MAT | Mixed Air Temperature | XXXX\_XXXX\_XXXX\_MAU#\_MAT | Analog Input (0) | | x | | X |  | x |
| OAF | Outside Airflow | XXXX\_XXXX\_XXXX\_MAU#\_OAF | Analog Input (0) | |  | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_MAU#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_MAU#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_MAU#\_OAT | Analog Input (0) | | x | |  |  | x |
| PHT | Pre-Heat Temperature | XXXX\_XXXX\_XXXX\_MAU#\_PHT | Analog Input (0) | | x | |  |  | x |
| RARH | Return Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_MAU#\_RARH | Analog Input (0) | | x | |  |  | x |
| RACO2 | Return Air Carbon-Dioxide | XXXX\_XXXX\_XXXX\_MAU#\_RACO2 | Analog Input (0) | | x | |  |  | x |
| RAT | Return air Temperature | XXXX\_XXXX\_XXXX\_MAU#\_RAT | Analog Input (0) | | x | |  |  | x |
| RH | (Space) Relative Humidity | XXXX\_XXXX\_XXXX\_MAU#\_RH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_MAU#\_VLT | Analog Input (0) | |  | |  |  | x |
| ZNT | Zone or Space Temperature | XXXX\_XXXX\_XXXX\_MAU#\_ZNT | Analog Input (0) | | x | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_MAU#\_ALM | Binary Input (3) | | x | | X |  | x |
| FLTR | Dirty Filter Alarm (via Differential Pressure Switch) | XXXX\_XXXX\_XXXX\_MAU#\_FLTR | Binary Input (3) | |  | | X |  | x |
| FZ | Freezestat | XXXX\_XXXX\_XXXX\_MAU#\_FZ | Binary Input (3) | |  | | X |  | x |
| ST | Status for Pump or Fan (when only fan for system) | XXXX\_XXXX\_XXXX\_MAU#\_ST | Binary Input (3) | | x | |  |  | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_MAU#\_VIB | Binary Input (3) | |  | | X |  | x |
| HTG | Heating Coil Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_MAU#\_HTG | Analog Output (1) | | x | |  |  | x |
| MAD | Mixed Air Dampers (0-100 percent open control signal relative to OAD) | XXXX\_XXXX\_XXXX\_MAU#\_MAD | Analog Output (1) | | x | |  |  | x |
| OAD | Outside Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_MAU#\_OAD | Analog Output (1) | | x | |  |  | x |
| RAD | Return Air Damper (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_MAU#\_RAD | Analog Output (1) | | x | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_MAU#\_SPD | Analog Output (1) | | x | |  |  | x |
| VLV | Modulating Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_MAU#\_VLV | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_MAU#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_MAU#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_MAU#\_HLALM | Analog Value (2) | |  | | X |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_MAU#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| HUM\_STPT | Humidity Set point | XXXX\_XXXX\_XXXX\_MAU#\_HUM\_STPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_MAU#\_LLALM | Analog Value (2) | |  | | X |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_MAU#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| RAH\_STPT | Return Air (Relative) Humidity Set point | XXXX\_XXXX\_XXXX\_MAU#\_RAH\_STPT | Analog Value (2) | | x | |  | x | x |
| Chillers: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_CH#\_AMP | Analog Input (0) | |  | |  |  | x |
| CHWDP | Chilled Water Differential Pressure | XXXX\_XXXX\_XXXX\_CH#\_CHWDP | Analog Input (0) | | x | | X |  | x |
| CHWR | Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_CH#\_CHWR | Analog Input (0) | | x | | X |  | x |
| CHWS | Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_CH#\_CHWS | Analog Input (0) | | x | | X |  | x |
| CWR | Condenser Water Return | XXXX\_XXXX\_XXXX\_CH#\_CWR | Analog Input (0) | | x | | X |  | x |
| CWS | Condenser Water Supply | XXXX\_XXXX\_XXXX\_CH#\_CWS | Analog Input (0) | | x | | X |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_CH#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_CH#\_KWH | Analog Input (0) | |  | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_CH#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_CH#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_CH#\_OAT | Analog Input (0) | | x | |  |  | x |
| PRESS | Pressure | XXXX\_XXXX\_XXXX\_CH#\_PRESS | Analog Input (0) | | x | |  |  | x |
| PCWDP | Process Chilled Water Differential Pressure | XXXX\_XXXX\_XXXX\_CH#\_PCWDP | Analog Input (0) | | x | | X |  | x |
| PCWR | Process Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_CH#\_PCWR | Analog Input (0) | | x | | X |  | x |
| PCWS | Process Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_CH#\_PCWS | Analog Input (0) | | x | | X |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_CH#\_VLT | Analog Input (0) | |  | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_CH#\_ALM | Binary Input (3) | | x | |  |  | x |
| CWR | Condenser Water Return | XXXX\_XXXX\_XXXX\_CH#\_CWR | Binary Input (3) | | x | | X |  | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_CH#\_VIB | Binary Input (3) | |  | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_CH#\_SPD | Analog Output (1) | | x | |  |  | x |
| VLV | Modulating Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_CH#\_VLV | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_CH#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_CH#\_ENABLE | Binary Output (4) | | x | | X |  | x |
| ISOL | Isolation Valve(s) for entire system | XXXX\_XXXX\_XXXX\_CH#\_ISOL | Binary Output (4) | | x | | X |  | x |
| HISOL | Humidifier Isolation Valve | XXXX\_XXXX\_XXXX\_CH#\_HISOL | Binary Output (4) | | x | | X |  | x |
| RISOL | Return Isolation Valve | XXXX\_XXXX\_XXXX\_CH#\_RISOL | Binary Output (4) | | x | | X |  | x |
| SISOL | Supply Isolation Valve | XXXX\_XXXX\_XXXX\_CH#\_SISOL | Binary Output (4) | | x | | X |  | x |
| CHWS\_STPT | Chilled Water Supply Temperature Set point | XXXX\_XXXX\_XXXX\_CH#\_CHWS\_STPT | Analog Value (2) | | x | | X | x | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_CH#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_CH#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_CH#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_CH#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| Cooling Towers: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_CT#\_AMP | Analog Input (0) | |  | |  |  | x |
| CWR | Condenser Water Return | XXXX\_XXXX\_XXXX\_CT#\_CWR | Analog Input (0) | | x | | X |  | x |
| CWS | Condenser Water Supply | XXXX\_XXXX\_XXXX\_CT#\_CWS | Analog Input (0) | | x | | X |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_CT#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_CT#\_KWH | Analog Input (0) | |  | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_CT#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_CT#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_CT#\_OAT | Analog Input (0) | | x | |  |  | x |
| PRESS | Pressure | XXXX\_XXXX\_XXXX\_CT#\_PRESS | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_CT#\_VLT | Analog Input (0) | |  | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_CT#\_ALM | Binary Input (3) | | x | |  |  | x |
| CWS\_SP | Condenser Water Supply Set point | XXXX\_XXXX\_XXXX\_CT#\_CWS\_SP | Analog Output (1) | | x | | X | x | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_CT#\_VIB | Binary Input (3) | |  | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_CT#\_SPD | Analog Output (1) | | x | | X |  | x |
| VLV | Modulating Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_CT#\_VLV | Analog Output (1) | | x | |  |  | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_CT#\_CMD | Binary Output (4) | | x | | X |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_CT#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| ISOL | Isolation Valve(s) for entire system | XXXX\_XXXX\_XXXX\_CT#\_ISOL | Binary Output (4) | | x | |  |  | x |
| HISOL | Humidifier Isolation Valve | XXXX\_XXXX\_XXXX\_CT#\_HISOL | Binary Output (4) | | x | |  |  | x |
| RISOL | Return Isolation Valve | XXXX\_XXXX\_XXXX\_CT#\_RISOL | Binary Output (4) | | x | | X |  | x |
| SISOL | Supply Isolation Valve | XXXX\_XXXX\_XXXX\_CT#\_SISOL | Binary Output (4) | | x | | x |  | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_CT#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_CT#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_CT#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_CT#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| Heat Exchangers: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_HX#\_AMP | Analog Input (0) | |  | |  |  | x |
| CHWR | Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_HX#\_CHWR | Analog Input (0) | | x | | X |  | x |
| CHWS | Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_HX#\_CHWS | Analog Input (0) | | x | | X |  | x |
| CWR | Condenser Water Return | XXXX\_XXXX\_XXXX\_HX#\_CWR | Analog Input (0) | | x | | X |  | x |
| CWS | Condenser Water Supply | XXXX\_XXXX\_XXXX\_HX#\_CWS | Analog Input (0) | | x | | X |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_HX#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_HX#\_KWH | Analog Input (0) | |  | |  |  | x |
| OAENTH | Outdoor Air Enthalpy | XXXX\_XXXX\_XXXX\_HX#\_OAENTH | Analog Input (0) | | x | |  |  | x |
| OAH | Outdoor Air (Relative) Humidity | XXXX\_XXXX\_XXXX\_HX#\_OAH | Analog Input (0) | | x | |  |  | x |
| OAT | Outdoor Air Temperature | XXXX\_XXXX\_XXXX\_HX#\_OAT | Analog Input (0) | | x | |  |  | x |
| PRESS | Pressure | XXXX\_XXXX\_XXXX\_HX#\_PRESS | Analog Input (0) | | x | |  |  | x |
| PCWR | Process Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_HX#\_PCWR | Analog Input (0) | | x | | X |  | x |
| PCWS | Process Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_HX#\_PCWS | Analog Input (0) | | x | | X |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_HX#\_VLT | Analog Input (0) | |  | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_HX#\_ALM | Binary Input (3) | | x | |  |  | x |
| VIB | Vibration Switch Alarm | XXXX\_XXXX\_XXXX\_HX#\_VIB | Binary Input (3) | |  | |  |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_HX#\_SPD | Analog Output (1) | | x | | X |  | x |
| VLV | Modulating Valve (0-100 percent open control signal) | XXXX\_XXXX\_XXXX\_HX#\_VLV | Analog Output (1) | | x | | X | x | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_HX#\_CMD | Binary Output (4) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_HX#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| ISOL | Isolation Valve(s) for entire system | XXXX\_XXXX\_XXXX\_HX#\_ISOL | Binary Output (4) | | x | | X |  | x |
| RISOL | Return Isolation Valve | XXXX\_XXXX\_XXXX\_HX#\_RISOL | Binary Output (4) | | x | | X |  | x |
| SISOL | Supply Isolation Valve | XXXX\_XXXX\_XXXX\_HX#\_SISOL | Binary Output (4) | | x | | X |  | x |
| HLALM | High Limit Alarm | XXXX\_XXXX\_XXXX\_HX#\_HLALM | Analog Value (2) | |  | |  |  | x |
| HLSTPT | High Limit Set point | XXXX\_XXXX\_XXXX\_HX#\_HLSTPT | Analog Value (2) | | x | |  |  | x |
| LLALM | Low Limit Alarm | XXXX\_XXXX\_XXXX\_HX#\_LLALM | Analog Value (2) | |  | |  |  | x |
| LLSTPT | Low Limit Set point | XXXX\_XXXX\_XXXX\_HX#\_LLSTPT | Analog Value (2) | | x | |  |  | x |
| Pumps: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_P#\_AMP | Analog Input (0) | |  | |  |  | x |
| CHWDP | Chilled Water Differential Pressure | XXXX\_XXXX\_XXXX\_P#\_CHWDP | Analog Input (0) | | x | | X |  | x |
| CHWR | Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_P#\_CHWR | Analog Input (0) | | x | | X |  | x |
| CHWS | Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_P#\_CHWS | Analog Input (0) | | x | | X |  | x |
| CWR | Condenser Water Return | XXXX\_XXXX\_XXXX\_P#\_CWR | Analog Input (0) | | x | | X |  | x |
| CWS | Condenser Water Supply | XXXX\_XXXX\_XXXX\_P#\_CWS | Analog Input (0) | | x | | X |  | x |
| HWHDP | Hot Water Heating Differential Pressure | XXXX\_XXXX\_XXXX\_P#\_HWHDP | Analog Input (0) | | x | |  |  | x |
| HWHR | Hot Water Heating Return Temperature | XXXX\_XXXX\_XXXX\_P#\_HWHR | Analog Input (0) | | x | |  |  | x |
| HWHS | Hot Water Heating Supply Temperature | XXXX\_XXXX\_XXXX\_P#\_HWHS | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_P#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_P#\_KWH | Analog Input (0) | |  | |  |  | x |
| PRESS | Pressure | XXXX\_XXXX\_XXXX\_P#\_PRESS | Analog Input (0) | | x | |  |  | x |
| PCWDP | Process Chilled Water Differential Pressure | XXXX\_XXXX\_XXXX\_P#\_PCWDP | Analog Input (0) | | x | | X |  | x |
| PCWR | Process Chilled Water Return Temperature | XXXX\_XXXX\_XXXX\_P#\_PCWR | Analog Input (0) | | x | | X |  | x |
| PCWS | Process Chilled Water Supply Temperature | XXXX\_XXXX\_XXXX\_P#\_PCWS | Analog Input (0) | | x | | X |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_P#\_VLT | Analog Input (0) | | x | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_P#\_ALM | Binary Input (3) | | x | |  |  | x |
| ST | Status for Pump or Fan (when only fan for system) | XXXX\_XXXX\_XXXX\_P#\_ST | Binary Input (3) | | x | | X |  | x |
| SPD | Speed for Fan or Pump Variable Frequency Drive (0-100 percent control signal) | XXXX\_XXXX\_XXXX\_P#\_SPD | Analog Output (1) | | x | | X | x | x |
| CMD | Command for Fan or Pump Start/Stop | XXXX\_XXXX\_XXXX\_P#\_CMD | Binary Output (4) | | x | | X | x | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_P#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| ***Division 26***  Meters: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_M#\_AMP | Analog Input (0) | | x | | X |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_M#\_KW | Analog Input (0) | | x | | X |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_M#\_KWH | Analog Input (0) | | x | |  | x | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_M#\_ALM | Binary Input (3) | | x | | X |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_M#\_VLT | Analog Input (0) | | x | | X |  | x |
| HTZ | Hertz (Frequency) | XXXX\_XXXX\_XXXX\_M#\_HTZ | Analog Input (0) | | x | |  |  | x |
| PF | Power Factor | XXXX\_XXXX\_XXXX\_M#\_PF | Analog Input (0) | | x | | x |  | x |
| Lighting Control System: |  |  |  | |  | |  |  |  |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_LCS#\_KW | Analog Input (0) | |  | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_LCS#\_KWH | Analog Input (0) | |  | |  |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_LCS#\_ALM | Multi-state Input (13) | | x | | x |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_LCS#\_ENABLE | Binary Output (4) | | x | |  |  | x |
| STS\_LAMP | Lamp Status | XXXX\_XXXX\_XXXX\_LCS#\_STS\_LAMP | Analog Input (0) | | x | | x |  | x |
| STS\_BAL | Ballast Status | XXXX\_XXXX\_XXXX\_LCS#\_STS\_BAL | Analog Input (0) | | x | | x |  | x |
| STS\_LIGHT | Status of Lighting Level | XXXX\_XXXX\_XXXX\_LCS#\_STS\_LIGHT | Analog Input (0) | | x | |  | x | x |
| STS\_GROUP | Status of Lighting Groups | XXXX\_XXXX\_XXXX\_LCS#\_STS\_GROUP | Binary Input (3) | | x | |  | x | x |
| STS\_GROUP\_LAMP | Status of Lighting Groups Lamps | XXXX\_XXXX\_XXXX\_LCS#\_STS\_GROUP\_LAMP | Analog Input (0) | | x | | x |  |  |
| STS\_GROUP\_BAL | Status of Lighting Groups Ballasts | XXXX\_XXXX\_XXXX\_LCS#\_STS\_GROUP\_BAL | Analog Input (0) | | x | | x |  |  |
| STS\_OCC\_SEN | Status of Occupancy Sensor | XXXX\_XXXX\_XXXX\_LCS#\_STS\_OCC\_SEN | Binary Input (3) | | x | |  |  | x |
| STS\_DAY\_SEN | Status of Daylight Sensor | XXXX\_XXXX\_XXXX\_LCS#\_STS\_DAY\_SEN | Analog Input (0) | | x | |  |  | x |
| SP\_LIGHT | Light Level Set point | XXXX\_XXXX\_XXXX\_LCS#\_SP\_LIGHT | Analog Output (1) | | x | |  | x | x |
| SP\_GROUP\_LIGHT | Group Light Level Set point | XXXX\_XXXX\_XXXX\_LCS#\_SP\_GROUP\_LIGHT | Analog Output (1) | | x | |  | x | x |
| SP\_LIGHT\_TIME | Lighting Level Duration Set point | XXXX\_XXXX\_XXXX\_LCS#\_SP\_LIGHT\_TIME | Analog Output (1) | | x | |  | x | x |
| SP\_SCENE | Lighting Scene Set point | XXXX\_XXXX\_XXXX\_LCS#\_SP\_SCENE | Multi-state Output (14) | | x | |  | x | x |
| STS\_SCENE | Lighting Scene Status | XXXX\_XXXX\_XXXX\_LCS#\_STS\_SCENE | Multi-state Input (13) | | x | |  |  | x |
| SP\_SCENE\_LIGHT | Lighting Level Scene Set point | XXXX\_XXXX\_XXXX\_LCS#\_SP\_SCENE\_LIGHT | Analog Output (1) | | x | |  | x | x |
| SP\_SCENE\_LIGHT\_TIME | Lighting Level Scene Duration Set point | XXXX\_XXXX\_XXXX\_LCS#\_SP\_SCENE\_LIGHT\_TIME | Analog Output (1) | | x | |  | x | x |
| OVR\_SP\_GROUP\_LIGHT | Override Group Light Level Set point | XXXX\_XXXX\_XXXX\_LCS#\_OVR\_SP\_GROUP\_LIGHT | Analog Output (1) | | x | |  |  | x |
| OVR\_LIGHT | Override Light Level Set point | XXXX\_XXXX\_XXXX\_LCS#\_OVR\_LIGHT | Analog Output (1) | | x | |  |  | x |
| PRIOR\_OVR\_GROUP | Set point of Priority Override Command for Group of Lights | XXXX\_XXXX\_XXXX\_LCS#\_PRIOR\_OVR\_GROUP | Analog Output (1) | | x | |  |  | x |
| Emergency Generator: |  |  |  | |  | |  |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_GEN#\_AMP | Analog Input (0) | | x | |  |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_GEN#\_KW | Analog Input (0) | | x | |  |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_GEN#\_KWH | Analog Input (0) | | x | |  |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_GEN#\_VLT | Analog Input (0) | | x | |  |  | x |
| HTZ | Hertz (Frequency) | XXXX\_XXXX\_XXXX\_GEN#\_HTZ | Analog Input (0) | | x | |  |  | x |
| PF | Power Factor | XXXX\_XXXX\_XXXX\_GEN#\_PF | Analog Input (0) | | x | |  |  | x |
| LVL | Fuel Tank Level | XXXX\_XXXX\_XXXX\_GEN#\_LVL | Analog Input (0) | | x | | x |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_GEN#\_ALM | Binary Input (3) | | x | |  |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_GEN#\_ENABLE | Binary Output (4) | | x | |  | x | x |
| STARTS | Number of Operational Starts | XXXX\_XXXX\_XXXX\_GEN#\_STARTS | Analog Input (0) | | x | |  |  | x |
| RUNTIME | Number of Total Operating Hours | XXXX\_XXXX\_XXXX\_GEN#\_RUNTIME | Analog Input (0) | | x | | x |  | x |
| TEMP\_OIL | Temperature of Oil | XXXX\_XXXX\_XXXX\_GEN#\_TEMP\_OIL | Analog Input (0) | | x | |  |  | x |
| TEMP\_RAD | Temperature of Radiator | XXXX\_XXXX\_XXXX\_GEN#\_TEMP\_RAD | Analog Input (0) | | x | |  |  | x |
| STS\_LOAD | Percent of Full Load Power Production | XXXX\_XXXX\_XXXX\_GEN#\_STS\_LOAD | Analog Input (0) | | x | | x |  | x |
| Electric Panels/Plug Load Control | |  | |  |  |  | |  |  |
| AMP | Amperage | XXXX\_XXXX\_XXXX\_EP#\_AMP | | Analog Input (0) | x |  | |  | x |
| KW | Kilowatts | XXXX\_XXXX\_XXXX\_EP#\_KW | | Analog Input (0) | x |  | |  | x |
| KWH | Kilowatt Hour | XXXX\_XXXX\_XXXX\_EP#\_KWH | | Analog Input (0) | x |  | |  | x |
| ALM | Alarm - General Alarm or Fault | XXXX\_XXXX\_XXXX\_EP#\_ALM | | Binary Input (3) | x |  | |  | x |
| ENABLE | Enable/Disable Command for System or Equipment Stage | XXXX\_XXXX\_XXXX\_EP#\_ENABLE | | Binary Output (4) | x |  | |  | x |
| VLT | Voltage | XXXX\_XXXX\_XXXX\_EP#\_VLT | | Analog Input (0) | x |  | |  | x |
| STS\_OUTLET | Status of Recepticle Outlet | XXXX\_XXXX\_XXXX\_EP#\_STS\_OUTLET | | Analog Input (0) | x |  | | x | x |
| SP\_OUTLET | Set point of Recepticle Outlet | XXXX\_XXXX\_XXXX\_EP#\_SP\_OUTLET | | Analog Output (1) | x |  | | x | x |
| Fire Alarm Systems: |  |  | |  |  |  | |  |  |
| STS | System Status | XXXX\_XXXX\_XXXX\_FAS\_STS | | Multi-state Input (13) | x |  | |  | x |
| ZONE\_STS | Adressable Zone Status | XXXX\_XXXX\_XXXX\_ FAS \_ZONE\_STS | | Multi-state Input (13) | x |  | |  | x |
| ALM | Alarm – General Alarm or Fault | XXXX\_XXXX\_XXXX\_ FAS \_ALM | | Multi-state Input (13) | x | x | |  | x |
| PRESS | System Pressure | XXXX\_XXXX\_XXXX\_ FAS \_PRESS | | Analog Input (0) | x | x | |  | x |

END OF SECTION 258000