BUILDING MANAGEMENT SYSTEMS
&
AUTOMATIC
TEMPERATURE CONTROL
STANDARDS

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SECTION 1 - Controls Requirements

Design & Performance Criteria:

1. Controls Contractor: The Controls Contractor shall be a local representative of corporate manufacture of Honeywell or Johnson Controls. Rebranded Honeywell or Johnson Controls vender products will not be accepted. All controls shall only be supplied by an authorized local branch of either Johnson controls or Honeywell.
2. **Devices and logic not covered by this document must be approved by PPD Controls before it is implemented.**
3. Honeywell Projects:
    1. When a Honeywell system's I/O Point Count for a Project exceeds 2,000 points, the cost of licensing these points will need to be added to the project's cost at $1.68 per point.
    2. If a Client Station is needed for a new project, the cost of $5,000 to add a license shall be added to the project.
    3. Any new controls that are added to a building that does not have an existing connection to the Honeywell Lon or Cbus will need to be connect to their dedicated point server for their particular area of the campus located at 284 East Ave.
    4. When the IO Point Count for a Honeywell project exceeds 5,000 points, a Honeywell EBI Distributed Server will need to be added to the automation systems topography.
4. Mechanical Integration:

1. Package Equipment shall not be equipped with facility controls other than Johnson or Honeywell. The only exception is if the manufacturer installs their own controls package manufactured by the supplier of the mechanical equipment. To accept this exclusion, the control package will need to be trademarked under the supplier of the mechanical equipment's manufacturer. The manufacturer will have to supply full integration to JCI Metasys or Honeywell EBI facility system via BACnet MSTP or IP, Lon, Modbus, and all hardware and engineering to achieve this integration.
2. An example of what would be acceptable is a Trane chiller with Trane Tracer controls. What would not be accepted is a Trane chiller with Automated Logic controls
3. Acceptable mechanical package equipment are Boilers, Chillers, Variable Speed Drives, and Lab Hoods controls.

5. H.W.XL Plus: Any project that includes mechanical upgrades to systems that have Honeywell XL Plus controls will need to upgrade the controls to a modern controls system.
6. Intrusion Alarms: Any area or project that has or will have intrusion alarms needs to have adequate points connected to the DDC control panel for connectivity to UVM Police Services.

2. **<u>Project Allowances</u>**:

1. Definition; an allowance is a fixed number of control points that can be used on a project for any reason. This includes any missed items during design and or any new points needed due to scope change.
2. The number of project allowances shall be selected and determined by an agreement with UVM PPD Controls and the Mechanical Consultant at the beginning of the project and the cost of these allowances to be included in the overall project cost.
3. Each allowance shall include the cost for 50 feet of conduit and needed wire for each instance. (contractor shall provide value cost at bid time)
4. Each allowance shall include the cost for engineering, documentation, system startup and checkout and system graphics. (contractor shall provide value cost at bid time)
5. Labor rates shall not exceed what is agreed upon in the UVM service contract for any of the above items.
6. Field devices can be UVM supplied or by others. In the case where the controls contractor supplies the end device there shall not be a markup greater than 15%.
7. These budgeted allowances do not include for the 10% spare I/O listed in (4. F.)

3. **<u>Submittals to be reviewed by University</u>**:

1. Shop Drawings:
    1. All submittal drawings and data sheets shall be submitted to and approved by UVM Physical Plant before any controls work is started.

2. All control drawings shall be done in Visio.
3. One hard copy and one electronic copy of the as-built drawings shall be submitted to the UVM Physical Plant controls group
4. When the project is completed, the Visio file for the project shall be given to UVM Physical Plant Department.

2. Graphics:
    1. Provide a floor plan graphic showing all rooms with temperature, humidity, setpoint value, controller status/location, equipment locations and a link to the associated mechanical system graphic. Also show controlling sensors (DP Sensors or Static Pressure Sensors) on the floor plan.
    2. Provide a mechanical system graphic showing all hardware point values and with set points values.
    3. All equipment pages need to have equipment number; location of equipment & Area serves located on screen
        a. If Typical Graphics are being used, this can be done by using network variables
        b. If equipment number is not given at time of project, then Space needs to be saved on screen for it and if typical graphics are used then a Network variable needs to be added for future for quick edit.
    4. As Built drawings need to be viewable from the graphics.
    5. All graphics shall be drawn to best represent the mechanical system by properly locating the point value in the duct work, piping schematic and location valves and coils.
    6. All graphics shall be consistent with each other and updated at the completion of the project.
    7. All overrides need to be shown in yellow
    8. Setpoints need to be having a blue color background to differentiate from points
    9. Typical Graphics
        a. Typical graphics should be done by building only and not shared across buildings
        b. VAV Typical graphics should be by air handler
    10. If a piece of equipment has multiple pieces of equipment associated with it there should be a master page of the equipment
        a. Example: An Air handler that has multiple VAV's should have a master VAV page that you can click on all the VAV's with a basic values for each vav.

4. **<u>Products, Materials & Equipment</u>**:
    1. Controls Field Bus:
        1. Building control field bus shall only be Honeywell Cbus, JCI N2 or Bacnet MSTP or Lonbus.
        2. No Field bus shall have no more than one repeater.

3. All field bus shall be in conduit
4. All wire used to interconnect networked devices shall be designed and labelled for that particular bus usage type.

2. Network:
    1. All network interface protocol shall only be TCP/IP protocol.
    2. Network shall have home run connections to UVM network services switches. Only one unmanaged network switches shall between two network interfaces.
    3. In the case where IP base controllers are used no more than three controllers can be daisy chained back to the network switch.
    4. All IP network cable shall be black in color
    5. Each network interface panel shall a minimum of a four port switch installed for access to UVM controls network.
    6. Each network interface will be placed on the UVM controls network vLan.
    7. If there needs to be interconnectivity between network interfaces during construction before UVM's telecom network can be completed a temporary network will need to setup by the controls contractor. This may be needed for system balancing or system commissioning before the permanent network can be completed. Once this work is done, each interface will need to be installed with only one unmanaged switch between each network interface.
3. Servers: All needed servers for a project will be placed on the physical plants virtual server system at 284 East Ave.
4. Client Workstations: All client work stations shall be provided by the controls contractor and shall be manufactured by Dell.
5. Open Protocols:
    1. All Open Protocols shall be TCP/IP compatible.
    2. BACnet, Lon, Modbus, are acceptable protocols.
    3. When a new Protocol is needed for a project, the cost of licensing the driver shall be included in the project cost.
6. I/O Points: All plant controllers shall have a minimum of 10% spare I/O for future points.

1. Building System Monitoring Points:
    1. Fire Alarm Panels:
        a. Fire Alarm Status
        b. Panel Trouble Status
        c. **Note: Fire Alarm Interface to be done by the Controls Group with Adams Devices.**
    2. Generators:
        a. Run Status
        b. Fault Status
    3. ATS: ATS Status
    4. Sump Pumps: High Alarm Status

5. Building Water Flow: Gallon Per. Min.
6. Building Power: KWH, Shark Meter
7. Building. Pneumatic Air: Low Pressure Alarm
8. Building Entrance Utilities monitoring.
9. Steam station (high, medium and low pressure.
10. Steam flow Lbs/Hr Spirax Sarco or Onicon
11. Chilled water (supply pressure and return pressure.
12. Chilled water flow GPM. Spirax Sarco or Onicon

5. **<u>Installation, Fabrication, and Construction</u>**:
    1. Terminations: All splices from devices to control wires are to be in a junction box.
    2. If there needs to be interconnectivity between network interfaces during construction before UVM's telecom network can be completed a temporary network will need to setup by the controls contractor. This may be needed for system balancing or system commissioning before the permanent network can be completed. Once this work is done, each interface will need to be installed with only one unmanaged switch between each network interface.
    3. Attic Stock:
        1. If any controller or thermostat is used in the project up to ten times the contractor shall supply a spare for stock to be given to UVM physical plant.
        2. If any device is used more than fifty times in the project, three spares shall be provided as spares for stock to be given to UVM Physical Plant.
    4. Commissioning:
        1. Provide functional performance testing of the dynamic function and operation of mechanical equipment and control systems using manual or monitoring methods.
        2. The commissioning process shall encompass and coordinate the traditional system of documentation, equipment startup, control system calibration, performance testing and training.
    5. Control System Labeling:
        1. <u>Note: Printed labels only will be accepted. No hand written labels allowed</u>.
        2. Hardware:
            a. Control Panel Door shall be labeled with the breaker feeding the panel and what controller/controllers are inside
            b. Wires shall be labeled at both ends, including to what field device, controller, and I/O.
            c. Controller shall be labeled with the name it is brought to the front end as and the associated network address (field network/IP address)
            d. IO Modules shall be labeled with their field network address
            e. All Field Devices (sensors, transmitters, actuators) are to be labeled with the name they are brought into the front end as and to what controller, and I/O they are going to.

f. Wall mounted Thermostats, Humidity Sensors, and CO2 sensors are to be labeled with which system they serve (ex: VAV2, or Single Zone Ahu 1). These sensors are to be labeled in a way that doesn't weigh on how the device operates. Label back plate that mounts to the wall.

3.Front End User Interface:

a. Network Interfaces shall be labeled as follows: Building Abbreviation_ Device Number.
    a. EX: STEML_NAE_01
b. Controllers will be labeled with the Building Abbreviation System

c. Points will be labeled with Building Abbreviation_System_Device.
    a. EX: STEML_RmW106_ClgVlv
d. All points and controllers need to have descriptions describing what the point is and where the controller is located.

6. **Warranties**:
    1. Warrantee shall cover parts and labor for no less than one year from building turnover effective starting the date the Contract work is accepted as complete by the Owner and in accordance with the General Provisions/Conditions.
    2. Warrantee otherwise if stated greater in bid documents frontends shall supersede.

7. **Details and Sketches** – See Section 7

SECTION 2 – General, Materials, and Execution

PART 1 - GENERAL

1.1 AUTOMATIC TEMPERATURE CONTROLS

A. General

1. The Automatic Temperature Control Contractor (ATCC) shall furnish and install a complete building automatic temperature control systems in accordance with the specifications and all applicable drawings as herein described. The controls shall be DDC with electric actuation. The systems will consist of electric controls, direct digital controls (DDC) and buildings management system (BMS) controls or any mixture for a fully functional system to meet the intent of specifications.
2. The control system shall be an extension of the existing manufacturers systems and be compatible in all aspects to the central Honeywell Inc. ® or Johnson Controls Inc. ® hardware. The systems shall be installed in a manner that allows future access to devices for maintenance, repair, and replacement.

B. Qualified (ATCC) list

1. The ATCC shall be a local corporate manufactures representative who are regularly employed in the business of selling control products, designing control systems, installing control systems and servicing control systems according to manufacturer's guidelines, codes and specifications in a neat workmanship like manner.
2. The installation can be performed by qualified employees or can be subcontracted to qualified wiring & piping subcontractors.
3. The ATCC shall have a service staff capable of servicing and programming the new controls supplied as part of this specification and all the existing Pneumatic, Electric, Digital and BMS controls and software's currently under their service contract.

1.2 DISPOSAL OF OLD CONTROLS

A. All old controls shall be turned over to the University controls department.

1.3 INCIDENTAL WORK BY OTHERS

A. The designated Contractor under the supervision of the ATCC shall furnish the following incidental work. The HVAC or Mechanical Contractor (HVACC or MC) shall coordinate required work with the ATCC.

1. HVAC Contractor shall:
   a) Install automatic valves, sensor wells, and other similar equipment that are specified to be supplied by the ATCC.
   b) Provide, on magnetic starters furnished, all necessary auxiliary contacts, with buttons and hand-off-auto (H-O-A) switches in required configurations.

c) Provide necessary blank-off plates required to install dampers that are smaller than duct size.

d) Install and assemble single dampers or multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper actuators.

e) Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified.

f) Provide access doors or other approved means of access through ceiling and walls for service to control equipment.

g) Install smoke detectors supplied by the electrical contractor (EC).

2. Electrical Contractor shall:

a) Provide power wiring to controls as mentioned herein.

b) Provide Automatic Temperature Controls Interface Junction box (ATCIJB's) as herein specified.

(1) Paint the ATCIJB's junction box and cover blue or owner selected color to indicate that this junction box is designated for ATC use only.

(2) All ATCIJB's shall have the circuit breaker and electrical panel identification affixed on the box in Dymo-tape type labeling or a laminated type tagging secured to the box.

(3) Affix all labeling for wires and panels to include safety arc flash distances as well as adhering to all code clearance guidelines.

c) Provide a circuit breaker for each group of ATC equipment requiring power. The circuit shall not be configured for more than 80% of the breaker full load capacity. The circuit shall be no greater than 20 amperes at 120 volts. Coordinate with the ATCC the power requirements, the quantity of circuits and layout. Circuit shall be labeled for equipment supplied.

d) Furnish smoke detectors and wire to the building fire alarm system. Provide at least one addition set of dry form "C" contacts with the detector to be used by the ATCC. All smoke detectors to be fed from emergency power source.

e) Provide line voltage receptacle and power to the main control panel locations from a dedicated circuit breaker.

f) Provide all power wiring for the mechanical equipment interface boards or gateways being integrated.

3. ATC Contractor shall:

a) Provide all devices, wiring and labor required to interface to the building ATC/BMS systems.

b) Provide power wiring from the breaker to the local ATC panels. The ATCC shall coordinate the number and locations of these power drops with the Electrical Contractor.

c) Work with the Testing and Balancing (TAB) person to setup or assist in the setup of all controls as needed for proper equipment and control operation including but not limited to transmitter ranges, meter ranges, and sensor calibration.

d) Provide ATC equipment startup and loop checkout sheets initialed, signed and dated by the ATCC commissioning person. Copies of the checkout sheets shall be sent to the Commissioning Agent (CA) to be included with the agent's final report.

e) Work with the CA to perform the functional performance tests (FPT) on each piece of equipment to demonstrate the operation of the controls for specification compliance and proper operation. The commissioning agent shall send copies of the FPT sheets in the agent's final report. Including any punch list items and anticipated completion date for any and all corrections with associated sign-off sheet for completion.

f) Provide a laptop or other handheld device or devices and any equipment training to the TAB and CA so these people may manipulate the controls for testing, balancing and commissioning purposes.

g) The ATCC shall provide the network trunk wiring and connections from the DDC panels to the nearest existing network trunk.

4. General Contractor shall:

a) Provide all the coring, cutting, patching and painting.

5. Commissioning Agent shall:

a) Work with the MC and the ATCC to perform the FPTs as outlined in the commissioning specification.

b) Work with the mechanical engineer (ME) and the owner to resolve any system operational differences or problems for proper functional system performances. Punch list items with completion date and sign-off sheet.

1.4 CONTROL DRAWINGS

A. Drawings and product data sheets (Submittals) shall be submitted for approval before work is started or materials purchased. Product data and schedules may be submitted separately to help expedite matters on fast track projects.

B. One set of As-Built drawings shall be given to the owner. A panel layout drawing shall be left inside each ATC panel for the respective systems within the panel.

C. One set of electronic As-Built drawings, using VISIO® software, shall be given to the owner on suitable media.

D. The first page shall contain a table of contents and any legends.

E. All pages must have the same outline or border with title blocks.

F. Multi pages for a system shall be grouped together and numbered sequentially for that system's prefix or series number. Example: AHU-1-1, AHU-1-2 and AHU-1-3 etc.

G. The drawings are to include, but not limited to, the following:

1. System schematic flow diagram of such items as: Air Handling Unit and duct, Heat Exchanger and piping, control piping risers or layouts and communication trunk layout.
2. Wiring schematic details for starters showing safeties, interlocks, all terminal blocks and any other control connections in one picture depicting the complete system or process or sequence of events. This will eliminate needless flipping of pages because of fragmented wiring schematics.
3. Bill of Material showing device Tag Name, Quantity, Part Number, Item Description and manufacture name.
4. The final As-Built drawings shall include the results of all completed punch list items.

H. Sequence of Operation shall be in the voice of the ATCC author not a copy of the specifications.

1.5 GLOSSARY OF TERMS

A. **Actuator:** A device that converts a pneumatic or electric signal to force which produces movement.

B. **Adjustment:** The procedure required to produce the exact setting, response or effect desired.

C. **Ambient Temperature:** The temperature of the surrounding environment.

D. **Commissioning**: See Commissioning in PART 3.

E. **Control-Agent:** The energy regulated by the **controlled device.** The most common sources of energy are: water (hot or cold), air (hot or cold), steam, electrical current and refrigerant.

F. **Control Point:** The actual value of the **controlled variable, which** the **controller** is maintaining at any, given time. I.E. The actual temperature as measured.
Control Range:

1. **Controller:** The **range** between the upper and lower output limits of a **controller.** (A controller's output may control several **controlled devices** in sequence).
2. **Controlled Device:** The actual operating range, between the upper and lower output limits of a **controlled device** when by the **output** of a **controller**.

G. **Controlled Device:** The instrument that receives the controller's **output signal** and regulates the flow of the **control-agent.** It is functionally divided into two parts:
Actuator: receives the output signal and converts it into force.

1. **Regulator:** valve body or damper, which regulates the flow of the **control-agent**.

Closed Loop System: The arrangement of components to allow system **feedback**. E.g., a heating unit, valve and thermostat arranged so that each component affects the other and can react to it.

H. **Controlled Medium:** Substance such as air in a room which is temperature, humidity or pressure controlled, and which is affected by the **control-agent** and **heat gains** or losses to surrounding areas.

I. **Controlled Variable**: In a **closed loop system**, the temperature, and humidity or pressure which, when varying, causes the **controller** to respond and control the amount of change.

J. **Controller** (HVAC): An instrument that measures the **controlled variable** and responds by producing an **output signal** which is proportional to the difference between the **setpoint** and the **control point**

K. **Controller Feedback:** The change in the controller's **output** in response to a measured change in the **controlled variable** transmitted back to the **controller input** for evaluation.

L. **Cycling:** Continuous oscillation occurring without periodic stimuli. A situation in a **closed loop system** where the **controller's** response **(sensitivity) to an input** change causes this instability.

M. **Derivative:** Third term in the equation, which implies the anticipatory action of the controller resulting in faster response. **Traditionally not used in HVAC loops. See also Rate Time**

N. **Differential**: Number of units the **controlled variable** must change before the **output signal** from a two-position device changes from maximum to minimum or vice versa (see **control range**).

O. **Direct Acting:** The **output signal** changing in the same direction the **controlled or measured variable** changes. E.g. an increase in the controlled or measured variable results in an increased output signal.
Enthalpy Switchover: Automatic switching or regulation of outside air and return air dampers. Total heat content of inside and outside air is compared before selecting either

inside or outside air or a mixture of the two for ventilating, which will require the least amount of refrigeration, humidification or dehumidification.

P. **Face and Bypass:** Duct and damper system, which directs air through (face) or around (bypass) heating or cooling coils.

Q. **Fail-safe position:** The final position the controlled device will be in when it's power source, air or electricity, is removed or turned off, which will allow or disallow the controlled agent to perform its normal function. Fail heating controlled device to full heat and cooling controlled device to no cooling and humidifier to no humidification.

R. **Gain:** Receiver-controller change in **output** pressure per change of **Input** pressure to the receiver-controller (A pressure output vs. pressure input).

S. **Input Signal**: A variable signal received by an **instrument,** which directs that instrument to **change its output signal.** If an instrument has more than one **input signal,** they interact to provide an output change.
Integral: Second term in the equation, which implies the summation of the error over time thus changing the output to help eliminate the error. **See also Reset R a t e**

T. **Load**: The demand on the operating resources of a system.

U. **Load Change:** The change in the usually uncontrollable **heat gain** or **loss** caused by lights, machinery, people, outside air temperature variations or solar effect.

V. **Master:** An instrument whose variable **output** is used to change the **setpoint** of a **submaster controller.** The master may be a humidity controller, pressure controller, manual switch, transmitter, thermostat, etc.

AA. **Measured Variable**: The uncontrolled variable such as temperature, relative humidity or pressure measured by a **sensing element**.

BB. **Normally Closed:** Applies to a **controlled device** that closes when the power applied to it is removed.

CC. **Normally Open:** Applies to a **controlled device** that opens when the power applied to it is removed.

DD. **Offset:** The difference between the **setpoint of** the **controller and** the **control point,** caused by **load changes** affecting the system. Offset is also referred to as "drift", "deviation" or "droop

EE. **Open Loop System**: The arrangement of components, which will not allow system feedback.

FF. **Output Signal**: A signal produced in response to a given **input**.

GG. **Overshoot:** The greatest amount a **controlled variable** deviates from its desired value before stabilizing, after a change of **Input.**

HH. **Proportional Action (P):** An **output signal** changing in proportion to the amount of change in the **controlled or measured variable** (contrast with two-position).

II. **Proportional Band:** The change in the **controlled variable** required to move the **controlled device** from one of its extreme limits of travel to the other. It is normally used in conjunction with recording and indicating controllers and is expressed in percent of the chart or scale range.

JJ. **Proportional Plus Automatic Reset Action (PI):** A combination of proportional action and a response, which continually resets the **control point** back toward the **setpoint** to reduce the **offset** (see **reset rate**).

KK. **Proportional Plus Rate Action (PD):** A combination of **proportional action** and a response that precedes the normal proportional response The combined response is proportional to the rate of change or speed with which the **controlled variable** deviates from the **setpoint**. (See rate time). **Traditionally not used in HVAC loops.**.

LL. **Range:** The values of a variable from one point value to another point value (the two "end points", see **span**).

MM. **Range of Remote Readjustment or Reset:** The amount of **setpoint** change of the **submaster** produced by a full change in output signal from the **master**.

NN. **Rate Time (D):** The time in minutes that rate action response precedes normal proportional action response. **Traditionally not used in HVAC loops.**

OO. **Ratio** (HVAC): The input signal change of one of the receiver-controller's inputs to the input change of the other input which causes the **output signal** to return to its original intermediate position.

PP. **Reset Rate (I):** The number of times per minute that the change made by the **proportional action** is duplicated by the reset action. It is usually expressed in "repeats per minute".

QQ. **Reverse Acting:** The **output signal** changing in the opposite direction the **controlled or measured variable** changes. Example: an increase in the controlled or measured variable results in a decreased output signal.

RR. **Start Point:** The starting pressure or voltage at which an actuator or pilot positioner or staging relay or sequencer starts to operate.

SS. **Sensing Element:** Part of the pneumatic or electronic **controller,** which senses the change in temperature, humidity or pressure and converts this change into either movement or resistance to current flow.

TT. **Sensitivity:** The change (Δ) of pressure the **controller** output produces per unit change in the **controlled variable.** (Δ pressure/degree temperature; Δ pressure/percent relative humidity; Δ pressure/psig pressure; Δ voltage/degree temperature; Δ resistance/degree temperature).

UU. **Setpoint:** The point at which the **controller is** set. The desired **controlled variable** value, which can be obtained by either an integral or remote adjustment of the controller.

X. **Span:** The algebraic difference between the upper and lower values of a range.

WW. **Spring Range: The range through** which the signal applied must change to produce total movement **of the controlled device** from one extreme position to the other.

1. **Nominal Spring Range:** The change in applied signal that causes total movement when there is no external force opposing the **actuator.**

Actual Spring Range: The change in applied signal that operates the controlled device under actual conditions when it must overcome forces due to fluid flow, friction, etc., in addition to the nominal spring force.

XX. **Supply Pressure:** The energy source (compressed air) supplied to a **controller** and/or auxiliary device.

YY. **Supply Voltage:** The energy source supplied to the **controller** and/or auxiliary device (usually 120 VAC or 24 VAC).

ZZ. **Throttling Range (Proportional controllers):** The required change in **controlled variable** to move the **controlled device(s)** from one extreme limit of travel to the other.

AAA. **Transducer:** An instrument that converts an **input signal** into an **output signal,** usually of another form. E.g. electrical input to pneumatic output.

BBB. **Two-Position Action:** The type action in which the **output signal** is changed to either a maximum or minimum value with no intermediate steps (contrast with **proportional**).

CCC. **Working Range: The desired controlled or measured variable** values over which a system operates.

1.6 SAFETIES

A. All safeties shall shutdown equipment regardless of the position of a starter H-O-A switch position. Special circumstances may prevail and shall be describe elsewhere by the mechanical engineer with regard to life safety systems such as life safety smoke purge or smoke ventilation, etc. Life safety systems shall prevail over equipment safety systems.

B. All life safeties should be powered from emergency sources.

C. All safeties such as low temperature, high temperature, smoke detectors and others shall be hardwired into their respective starters or shutdown devices by one of the three methods mentioned below.

D. Listed below are three acceptable safety wiring methods for this campus:

1. Hardwire a pair of line voltage wires from each safety device to the respective unit starter. Separate wiring carrier systems shall be installed so line voltage does not interfere with low voltage or the DDC signals. DDC alarming signals shall be in their own wiring carrier system to the DDC panel. Wiring carrier system shall comply with division 16000.

2. Hardwire a pair of low voltage wires or cable from each safety device its respective DPDT low voltage relay with LED. The relay maybe TPDT or 4PDT with LED as required for the application. The first contact of each relay shall be wired in series with each other relay to shut down the respective unit starter. The second contact of each relay shall be wire as a digital (DI) or binary (BI) input to the DDC system for individual alarm reporting. The third and fourth contacts if supplied can be used for other interlocking as required by the applications. These relays can be mounted together in the ATC/DDC panel or mounted together in a small enclosure at the starter. If the relays are mounted at the ATC/DDC panel then a secondary SPDT

   relay with LED, RIB® type relay, shall be mounted at the starter. This is done to keep all wiring low voltage except within the starter.

3. Hardwire a pair of low voltage wires or cable from each safety device directly to individual digital (DI) or binary (BI) inputs. Specific DDC software control logic, such as PLC type, shall be arranged in such a manner to perform the proper shutdown as stated in the sequence of operations and issue an output to a dedicated digital (DO) or binary (BO) output and relay. There shall be a dedicated shutdown,

   RIB® type, relay other than the traditional start-stop, RIB® type, relay. When the DDC is off line for whatever reason the unit or units served by this DDC

shall not function with the H-O-A switch in any position unless life safety systems as described by the mechanical are commanded to do so.

E. Software may be used as a replacement for value-added hardwiring reduction provided the specific computer receiving the input signals is specifically designed for these types of processes:

1. Such as a computerized or addressable fire alarm system.
2. Such as DDC systems with special separate shutdown loops and relays, which are not to be included or incorporated as part of the normal start-stop circuits to H-O-A's.
3. All interlocks used in conjunction with safeties shall have separate shutdown relays to

PART 2 - MATERIALS

2.1 CARBON DIOXIDE CO2

A. Duct or Room mountable

B. Unit powered with 12 to 30 VDC or 20 to 30 VAC at 50/60 Hz.

C. User-selectable output of 0 to 10 VDC or 0 to 5 VDC.

D. Sensor range 0 – 2000 PPM, repeatable to ±20 PPM.

E. Compliant to ASHRAE 62-1998 standards for air quality.

F. Preferred manufactures for carbon dioxide sensors shall be: Honeywell, Johnson Controls.

2.2 CONTROL POWER WIRING

A. The Electrical Contractor shall provide all control power and emergency control power wiring (120 VAC) to all designated ATC Interfacing Junction Boxes (ATCIJB), shown and/or stated, provided under this section of the specifications. The junction box and cover of the ATCIJB shall be painted blue or owner selected color to signify ATC wiring.

B. The Electrical Contractor shall coordinate the number and locations of these ATCIJB's with the ATCC.

C. All control power wiring and emergency control power wiring from these junction boxes (ATCIJB) to the ATC panels and controllers shall be by the ATCC or ATC Wiring Contractor. All conduit and wiring provided by the ATCC or ATC Wiring Contractor shall be installed in accordance with the requirements of Section 16000 of these Specifications and with the respective equipment manufacturer requirements.

D. All ATC panels shall have individual on off switches and duplex receptacle located inside each panel.

E. The Electrical Contractor shall provide a 3/4-inch, minimum size and weather tight conduit from the split-system cooling condenser to a junction box inside the building envelope. The junction box must be kept accessible for future use. The ATCC shall provide the ATC wiring from the condenser and any additional conduit and wire from the junction box to the respective ATC/DDC panel. The junction box and cover shall be painted blue or owner selected color to signify ATC wiring.

F. The Electrical Contractor shall provide a minimum 3/4-inch size weather tight conduit from each remote piece of equipment to a location inside the building envelope. Consult with the ATCC for specific conduit size. The junction box and cover shall be painted blue or owner selected color to signify ATC wiring. For items such as cooling towers or exhaust fans.

G. The Electrical Contractor shall provide an ATCIJB in the power-wiring conduit to provide ATC access for all Fractional horsepower or non-magnetic starter Exhaust Fans, Unit Heaters, Cabinet Unit Heaters, Fan Coil Unit etc. for thermostat and/or pressure electric switch wires and wire carriers.

2.3 CONTROL WIRING

A. Low voltage and Sensor wire and conduit

1. All Analog Inputs, Binary Inputs and Analog Outputs shall be 2, 3 or 4 conductors twisted #18 AWG stranded conductors in sheathed cable. All cables shall be shielded or not shielded, a mix will not be accepted. If shielded cable is used, ground the shield as specified by ATCC.
2. All Binary Outputs shall be 2 or 3 conductors twisted #18 AWG stranded conductors in sheathed cable.
3. All communication trunks shall be 2 in sheathed cable. Line voltage wiring is not allowed in the same conduit with communication wiring. This is not an insulation issue but a communication noise issue. State type and approximate distances on the trunk layout to be submitted.
4. All wiring must be installed in EMT with the following exceptions.
   a) If section 16000 allows low voltage wiring above accessible ceilings to be installed without conduit. Plenum rated sheathing may be required.

B. Line voltage wire type and conduit.

1. All wiring must be installed in EMT or flexible conduit, refer to section 16000.
2. Thermostat wiring to fractional horsepower Exhaust Fans, Unit Heaters, Cabinet Unit Heaters and Fan Coil Units shall conform to Section 16000.

C. IP (CAT V) Cable

1. Cable shall be black in color.

2.4 CONTROL DAMPERS

A. Furnish and install, at locations shown on plans, or in accordance with schedules, modulating opposed blade control dampers and two-position parallel blade control dampers that meet the following minimum construction standards:

B. Linkage shall be concealed out of the air stream, within the damper frame to reduce pressure drop and noise.

C. Submittal must include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500.

D. Leakage: Less than one half percent maximum flow based on approach velocity of 4000 ft. / min. at 6.2 inches water gauge.

E. All multiple damper sections must have jackshafts.

F. Damper Fail-safe positions.

1. Outdoor air, Exhaust air and inlet vane dampers shall fail to the closed position.
2. Combustion air and generator exhaust air shall fail to the open position.
3. Return air and face & bypass shall fail to the open or coil face position.
4. Smoke dampers shall fail to the closed position with end switches to shut off mechanical equipment.

G. Preferred manufacture for dampers shall be: Ruskin or owner approved substitution.

2.5 CONTROL DAMPER SIZING

A. The ATCC shall be responsible for properly sizing all control dampers and be guaranteed to meet the CFM loads, pressures and leakage ratings as specified in the contract documents.

B. The ATCC shall be responsible for proper installation of the control dampers being installed by others.

C. Outdoor air dampers shall be sized for low velocity to minimize snow infiltration.

D. Return air dampers width, at the mixing Plenum, should be the same size as the connection from the outdoor air damper to the mixing Plenum. Frozen coils could be the result of one duct being narrower than the other duct

2.6 CONTROL DAMPER ACTUATORS

A. The ATCC shall be responsible for damper actuator sizing to insure tight close off against the controlled variable.

B. Dampers 8 feet and wider shall have a damper actuator on each end of the damper (Master & Slave) with jackshaft the full width of the damper. All multiple damper sections under 8 feet must have jackshafts.

C. Electric Actuators (Motors)

1. Actuators shall be quiet in operation and shall have ample power to overcome friction of damper linkage and air stream pressure, to position dampers accurately and smoothly. The damper actuator mounting arrangement shall be outside the air stream whenever possible.
2. The actuator shall be designed for direct coupling to the damper.
3. Power voltage shall be 24 VAC.
4. Input control voltage for proportional actuators shall be 0-10 or 2-10
5. Input control voltage for two-position actuators shall be 24 VAC.
6. Noise <45db.
7. Spring return shall be provided in the event of power failure.
8. Reversible rotation and position indicator.
9. Manual override.
10. Run Time - 150 sec. (spring return <60 sec.)
11. Ambient temperature - (–22) to 122 degrees F.
12. Built-in auxiliary switches when required.
13. Zero and span adjustments.
15. ISO 9001.

16. Preferred manufactures for damper actuators shall be Honeywell, Johnson Controls and Belimo.

2.7 CONTROL VALVES

A. All control valves shall be installed on the return piping to a coil or radiation.

B. The valves shall be quiet in operation and fail-safe in either normally open heating or normally closed cooling position upon the loss of voltage. All control valves shall be suitable for the pressure conditions and shall close off against the controlled variable differential pressure. Body pressure rating and connection type (screwed or flanged) shall conform to pipe schedule in this specification.

C. All control valves shall be single seated type with equal percentage flow characteristics. The valve discs shall be composition type with bronze trim.

D. Hot water control valves (air handling units, cabinet unit heaters, unit heaters and radiation) shall be electric. Control shall be "fully" modulating type with spring return. Control valves shall fail-safe in the “normally open" position. Hot water control valves shall be selected with a maximum pressure drop of (10) feet

E. Steam control valves shall be electric. Steam control valves shall be "fully" modulating type capable of controlling low-pressure steam (below 15 psig) and be configured in a 1/3rd 2/3rd arrangement. Valves shall fail closed.

F. Chilled water control valves shall be electric. Chilled water control valves shall be "fully" modulating type and shall fail-safe in "normally closed" position. Chilled water control valves shall be selected with a maximum pressure drop of (10) feet.

G. Preferred manufactures for control valves shall be: Honeywell, Johnson Controls, Belimo, and Bray.

2.8 CONTROL VALVE ACTUATORS

A. Electric Actuators/Operators

B. Electric Actuators (Motors)

1. Actuators shall be quiet in operation and shall have ample power to overcome friction of damper linkage and air stream pressure, to position dampers accurately and smoothly. The damper actuator mounting arrangement shall be outside the air stream whenever possible.
2. The ATCC shall be responsible for valve actuator sizing to insure tight close off against the controlled variable
3. Preferred manufactures for control valve actuators shall be: Honeywell, Johnson Controls, Belimo, and Bray
4. Actuator/Valve assemblies shall be mounted at a 45 Deg angle when installed on a steam system.
5. Power voltage shall be 24VAC.
6. Input control voltage for proportional actuators shall be 0-10, 2-10
7. Input control voltage for two-position actuators shall be 24VAC.
8. Noise <45db.
9. Spring return shall be provided in the event of power failure.
10. Reversible rotation and position indicator.
11. Manual override.
12. Run Time - 150 sec. (spring return <60 sec.)
13. Ambient temperature - (–22) to 122 degrees F.
14. Built-in auxiliary switches when required.
15. Zero and span adjustments.

2.9 FLOW MEASURING STATIONS

A. The ATCC shall furnish the airflow measuring stations (AFMS).

B. The MC shall install the AFMS in accordance to the manufactures guidelines.

C. The AFMS shall be sized so that the minimum volume velocity of the air-handling unit (AHU) shall be 20% greater than the AFMS minimum velocity of 400 ft/min and the AHU maximum volume velocity shall not exceed 80% of the AFMS maximum velocity of 4000 ft/min.

D. The AFMS shall have air-straightening devices and multi-measuring pickup points to insure efficient non-turbulent measurement.

E. The ATCC shall furnish and install the velocity pressure sensors.

F. The AFMS shall be provided with ductwork and flanges to secure the station to new ductwork. The AFMS may be of the insertion type for existing ductwork, which have its own ductwork on one of the four sides.

G. It is expected that the overall equipment installation and air measuring provide a system that shall be within 5% of the TAB reading at minimum and maximum system air volumes.

H. Preferred manufactures for flow-measuring stations shall be: Ebtron

2.10 HUMIDITY SENSOR OR HUMIDITY AND TEMPERATURE SENSOR

A. The humidity and temperature sensing can be done with a single room or duct-mounted unit.

B. The humidity sensor shall be capable of measuring humidity over the entire range of 0 to 100% RH.

C. The unit can be powered with 12 to 30 VDC or 20 to 30 VAC at 50/60 Hz.

D. User-selectable output of either 0 to 10 VDC or 0 to 5 VDC.

E. Humidity Transmitter

1. Accuracy - ±3% RH for 5-95% RH, ±5% RH for 0-5% and 95-100% RH.
2. Temperature Coefficient - 0.12% RH/ °F (0.22% RH/ °C).
3. Response Time - Element Time Constant of 120 sec. between 50-90%.
4. Offset Adjustment - ±5%

F. Ambient Conditions

1. Operating - 32°F to 140°F (0 to 60°C), 0 to 100% RH.

G. Temperature Transmitter

RTD2. Accuracy: ±0.34°F (0.18 °C) @ 70 °F (21 - °C)

H. Preferred manufactures for Humidity and Temperature sensors shall be: Honeywell, Johnson Controls, and Vaisala.

2.11 CONDENSATE PAN SENSOR

A. Shall be Rectorseal SS3. Substitutions must be approved by owner.

2.12 LOW LIMIT TEMPERATURE CONTROLLER (FREEZE)

A. Electric Low Limit Temperature Controller (LLTC) shall have 20'-0" low point sensitive elements installed to cover the entire coil area. The element must be serpentine horizontally across the coil from top to bottom. The body of the LLTC must be fastened at a higher elevation then the element itself... LLTC shall be installed in an accessible location.

B. The LLTC shall be installed with the averaging discharge air temperature sensor in the same plane.

C. Multi or large coils may require more than one LLTC. A LLTC shall be provided for each coil. Multi LLTC's shall be wired in series with each other.

D. **See temperature sensors Fig "Duct-1"** for accessories in section 2.18.

E. LLTC shall be Auto reset with a limit of 3 resets with in a 24 hour period programmed in software. After the 3 times there needs to be an alarm for freeze stat lock out. This alarm needs to be located by the freezestat on the screen and there shall be a reset point to reset the freeze stat lock out sequence.

F. The selected manufactures for low temperature controllers shall be: Johnson Controls A70GA-1C.

2.13 PANELS - ENCLOSURES

A. General

1. All ATC/DDC panels shall be mounted on walls or free standing. They shall not be mounted higher than 78 inches (6' 6" AFF) above finished floor to the top of the panel. The panels shall be mounted off the wall by 1" or the width of a vertical piece of Unistrut to allow any water coming down the wall to pass behind the panel.
2. Panels and supporting brackets are not to be mounted on a fan housing, unless the fan is isolated from it's housing by proper isolation devices and the housing is secured to the floor.
3. The fan housing shall not be used for any type of electrical ground.
4. If ATC/DDC panel locations are not shown on the mechanical drawings then the panel shall be located within 10 feet from the unit it is controlling, free standing or wall mounted.
5. If no space is available for mounting panels then the Architect / Owner will need to approve a location.
6. Avoid mounting air handling unit panels in ceilings. Final approval to mount panels in the ceiling shall have to come from the Architect / Owner with the exception of VAV Boxes.
7. Ceiling access to the panel location, of approximately 18 inches square or 24 inches diagonal, for an average sized service person is required. The HVAC Contractor shall install all access doors.

B. Location

1. The building network digital controller panel (NDC) shall be located in a Mechanical Equipment Room. It shall be in an accessible area near the door to the room for easy operator access, see above for installation guidelines.

2.14 PRESSURE SENSORS

A. Filter

1. Pressure differential shall be sensed by a differential pressure electric switch with SPDT, for non-air-handling units. Range shall be as required to meet project requirements, suggested range of 0 - 1.6 INWC.
2. Pressure differential shall be sensed by an analog 0 - 10 VDC, sensor for air-handling units only. Range shall be as required to meet project requirements, suggested range of 0 - 2.0 INWC.
3. When the pressure across the filter media exceeds the adjustable setpoint, initial value 1 INWC, an alarm shall latch ON and be reported at the OWS, to read for example, "DIRTY PREFILTER ALARM"
4. Preferred manufactures for pressure sensors shall be: Honeywell, Johnson Controls and Dwyer.

B. Room Static Pressure

1. Room static pressure sensor shall be sensed by an analog 0 - 10 VDC, bi-directional device. Range shall be as required to meet project requirements, suggested ranges of ±0.1 or ±.25 INWC..
2. Preferred manufactures for pressure sensors shall be: Honeywell, Johnson Controls and Setra.

C. Duct Pressure

1. Duct static and velocity pressure sensor shall be sensed by an analog 0 - 10 VDC unidirectional or bi-directional device. Range shall be as required to meet project requirements, suggested ranges of +0.1 or ±2.5 or ±5.0 INWC.
2. Duct Static differential pressure controller with manual reset, setpoint adjustable from 0.4 – 12 INWC.
3. Preferred manufactures for pressure sensors shall be: Honeywell, Johnson Controls, Cleveland and Setra.

2.15 RELAYS

A. General-purpose power, UL recognized and CSA certified.

B. SPDT, DPDT, TPDT and 4PDT contact arrangements @ 10 ampere rating.

C. Coil voltages from 5 – 30 VDC and 24 – 120 VAC.

D. Indicator light – LED.

E. Ice cube style with DIN rail or surface mount socket.

F. Track mounting.

G. Direct mounting enclosure with 1/2" male thread.

H. Built-in hand-off-auto switch as required.

I. RIB Relays with LED shall be externally mounted

J. Preferred manufactures for relays shall be: Air Products & Controls, IDEC, Omron and RIB.

2.16 STATUS SENSORS

A. Air & Water Flow

1. Current relay (CT) - Fan and Pump Status (approximately 1/2 HP and less)
   a) If Air or Water flow for each fan or pump are indicated by means of a current relay which opens an electrical contact as the amperage falls below a setpoint, indicating NO-FLOW. The current relay shall be used on small hp units where there is no VFD installed
   b) Preferred manufactures for status sensors shall be Hawkeye
2. Current sensor (CT)- Fan and Pump Status

a) Air or Water flow for each fan or pump shall be sensed by an analog current sensor 0 - 10 VDC. When the amperage falls below a setpoint, indicating NO-FLOW. Used when there is no VFD installed.

b) Preferred manufactures for status sensors shall be Hawkeye,

2.17 SMOKE DETECTION SYSTEM

A dry contact shall be provided for interface and alarming on the BMS system

2.18 TEMPERATURE SENSORS

A. Temperature sensors shall be resistance type (RTD), providing a linear ohm per °F characteristic change and shall be housed as required (space, immersion, duct, etc.) for the particular application. Also see Humidity Sensor above.

B. Averaging sensors shall be a minimum of 8'-0" in length and shall be serpentine in such a manner so as to sense a representative sample of the medium being controlled. The sensing element must be kept from chafing against the metal by isolating it with poly tubing or mounting bracket specially made for this application.

C. Air-handling unit or other like configurations preheat and heating coils discharge air temperature sensors shall be averaging.

D. Air-handling unit or other like configurations supply air temperature sensors and reheat coils discharge air temperature sensors shall be averaging if the cross sectional area of the coil is 10 sqft or greater. If the cross sectional area of the coil is less than 10 sqft a probe type sensor shall be used.

E. The averaging coil discharge air temperature sensor shall be installed with the LLTC in the same plane, See Figures “Avg.-1” below.

F.

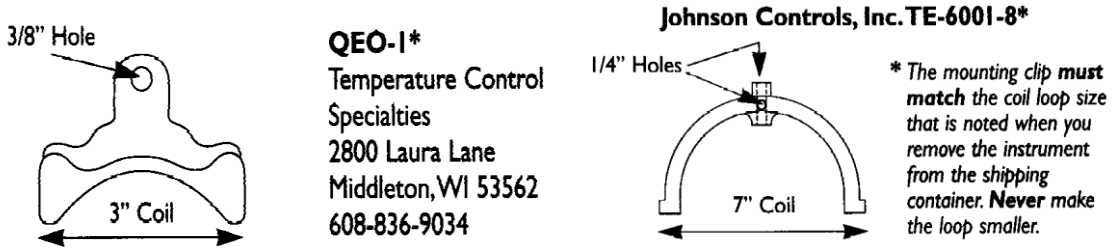

Figure "Avg.-1"

G.

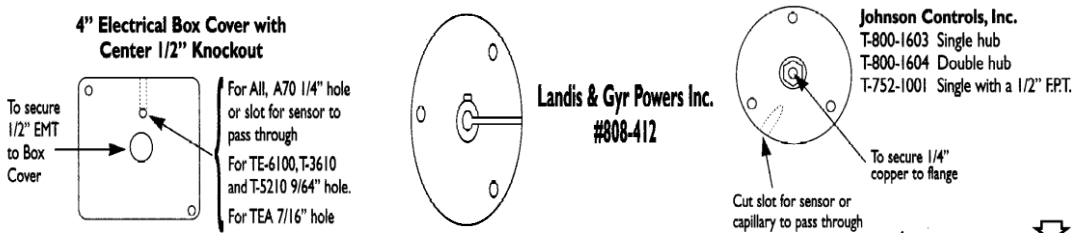

Figure "Duct-1"

H. Preferred manufactures for sequencer shall be: Honeywell and Johnson Controls.

2.19 THE NETWORK

A. The networks exist for Honeywell and Johnson Controls brands of building management systems (BMS) and all new or renovation additions to the system shall communicate to them. If software or hardware upgrades are required to communicate and to operate the latest controls to be installed in this specification, then the ATCC shall provide the upgrades as part of contract at no additional cost to the owner.

B. Network layout to be provided in as-built documents. This applies for field bus and TCP/IP networks.

2.20 OPERATOR WORK STATION

A. If a new operator workstation (OWS) is needed for a new project it shall be compatible with the existing OWS's.

B. The ATCC shall provide a new OWS with all BMS software, graphics software and any other software and hardware to operate seamlessly with all other OWS's.

2.21 OPEN PROTOCOL

A. All open protocols shall be TCP/IP compatible.

B. Both level 1 and level 2 trunks shall be open protocol.

C. BACnet®, Lonworks, Modbus are acceptable protocols.

2.22 INTEGRATION

A. The ATCC shall furnish and install any integrating device to mechanical equipment interface boards or gateways that shall come with such equipment as boilers, chillers, Lab Controls and other vendors as supplied elsewhere.

B. The ATCC shall furnish and install all wiring for the communication of the DDC to the interface board or gateway and from the interface board or gateway to the equipment listed.

C. The ATCC shall furnish and install all control power wiring from the junction box to the integrator.

D. The MC shall furnish and install mechanical equipment interface boards or gateways for the following systems:

1. Boiler systems.
2. Chiller systems.
3. Variable Speed Drives.
4. Lab Control systems.
5. Flow and Energy Meters
6. Lighting Systems
7. Kitchen Exhaust Systems
8. Other Equipment Upon Owner Approval

2.23 GRAPHICS

A. The ATCC shall provide graphics software if it does not already exist or upgrade the current applications software as needed to be compatible with the latest controls requirements.

B. The ATCC shall generate the following list of graphics layouts.

C. List

1. Floor plan showing all room: temperature, humidity and pressure readings with setpoints, controller status/location, equipment locations and a link to the associated mechanical system graphic. No tuning parameters to be shown.
2. Each mechanical system layout showing all hardware point readings with setpoints. No tuning parameters to be shown. Reference the control drawing submittal for all hardware points. Systems to be included but not limited to are: air-handling units, boilers, heat exchangers, chillers, condensers, cooling towers, variable and constant volume boxes, fan coil units, cabinet unit heaters, unit heaters, unit ventilators, exhaust fans, generators and lab hoods.
3. Point names for the sensors may be omitted provided that the sensor is properly located in the duct or piping schematic that best represents the sensor name and location. The duct and piping schematics shall be properly labeled such as: SA for supply air, HWS for hot water supply etc.
4. All OWS graphics shall be consistent with each other and undated by the ATCC at

the completion of the project.

5. ATC As-Built drawings shall be accessible from the graphics.

D. All overrides need to be shown in yellow

E. Setpoints need to be having a blue color background to differentiate from points

F. All equipment pages need to have equipment number, location of equipment & Area serves located on screen

1. If Typical Graphics are being used, this can be done by using network variables
2. If equipment number is not given at time of project then Space needs to be saved on screen for it and if typical graphics are used then an Network variable needs to be added for future for quick edit.

G. Typical Graphics

1. Typical graphics should be done by building only and not shared across buildings
2. VAV Typical graphics should be by air handler
3. If a piece of equipment has multiple pieces of equipment associated with it there should be a master page of the equipment
   a) Example: An Air handler that has multiple VAV's should have a master VAV page that you can click on all the VAV's with a basic value for each vav.

2.24 POINTS

A. Spares

1. Each DDC, non-ASC, controller shall have a minimum of 10% or at a minimum of 2 spare points of each type of I/O.

B. Names

1. If this is a new system, then the list of suggested point names shall be submitted for approval. Samples should be given to the owner for review before drawing and databases are generated. The ATC programmers shall follow the customer's naming conventions.
2. The point names shall be consistent with the owner supplied naming convention list.

C. Input

1. Analog Inputs
   a) The DDC inputs or function modules shall have the capability to accept theses device input types:
      (1) Resistive Temperature Device (RTD).
      (2) Voltage DC (VDC) device. Typically Humidity, Pressure & CO2.
      (3) Milliamp (mA) device. Typically Humidity, Pressure & CO2.

2. Binary Inputs

a) Binary Inputs must be able to accept NO or NC signals. Output

Shall be capable of outputting 24 VAC/VDC, 0-10VDC, and 0-20mA.Analog Output
Shall be capable of outputting 0-10VDC and 0-20mA.

2.23 **POINT LIST** Point list of all I/O and device tags shall be submitted for owner approval. All points shall use UVM's naming convention for applicable system.

2.24 **SEQUENCE OF OPERATIONS** Sequence of operations shall be submitted to owners for prior approval before final programming. A meeting shall be held with owner and mechanical engineer to finalize sequences before the start of programming.

BILL OF MATERIALS

2.25 Bill of Material shall be supplied in as-built drawings. List full part numbers of associated devices. Supply vendor where the parts came from.

PART 3 - EXECUTION

3.1 COMMISSIONING VERIFY SETUP CHECKOUT STARTUP ACCEPTANCE

A. Commissioning is the act of putting the: correctly designed; fully verified; fully setup; fully checked out; fully statically tested; fully dynamically tested and fully functional systems into full service by the ATCC. Each device in the system shall be commissioned. Spot checking is not accepted.

B. Verify is the act of visual inspecting by the ATCC to acknowledge that all controls are install properly as per manufacturer's instructions. All firmware and software revisions shall be the latest available.

C. Setup is the act of adjusting or setting: setpoints; pressure switch settings; circuit board jumps; and whatever other adjustments that are required to make the product function properly per manufacturer's instructions.

D. Checkout is the act of witnessing the controls mechanical or electrical response to signal changes after they have been verified and setup by the ATCC per manufacturer's instructions.

E. Startup is the act of statically and dynamically testing control loops to see if the loop performs correctly as designed by the ATCC per manufacturer's guidelines.

F. Mechanical System startup shall be completed by a qualified, factory trained, technician.

G. VFD startup shall be completed by a qualified, factory trained, technician.

H. Acceptance is the act of the ATCC person performing all of the above affixing their signature on the controls checkout sheets stating that system has been commissioned. Approval is needed by the Commissioning contractor and the University's Retro-Commissioning Engineer.

I. The ATCC shall provide, at appropriate time or as directed by the Architect, the on-site services of a competent factory trained Engineer or authorized representative of the manufacturer to commission the automatic temperature controls provided under

this Contract.

J. The ATCC shall commission and set in operating condition the automatic temperature control systems, in the presence of the Owner and Architect's representatives or Commissioning Agent, who will sign the control drawings and/or FPT sheets per system. ATCC shall provide the time and tools needed to work with the Commissioning contractor and the University's Retro-Commissioning Engineer.

K. The ATC Contractor shall coordinate their commissioning with all other trades needed for a successful systems commissioning process. The system shall be commissioned prior to Operation and Maintenance instructions.

L. The ATCC shall guarantee that the designed ATC systems shall operate so as not to damage any mechanical systems and endanger anyone's life. Areas of concern should be sent to the Architect or owner with possible solutions anytime.

M. During the warranty period, if changes are made, as-built documents need to be updated to reflect the change.

N. All field controller program files and front end databases shall be provided to the University Control Group.

3.2 TRAINING

A. Instruction of Owner's Personnel

1. Provide the services of competent instructors who shall give full instruction to designated personnel in the operation, maintenance, and programming of ATC systems. Mechanical contractor shall also provide a qualified system start up technician for HVAC system training.
2. Operational and maintenance instruction shall be provided by the ATCC factory trained service person to give full instruction to designated personnel in the operation, maintenance of the building ATC Products.
3. All training shall include audio/video filming of the onsite training to be used for future reference as well as future trainings of new personnel.
    a) If the customer is familiar with the products then a short on site review of several hours to several days will be required. Vendor offsite or online training credits shall be provided to UVM personnel instead of onsite training when requested.
    b) If the customer is NOT familiar with the products then an on site structured training course of several days to a week shall be needed. The ATCC shall submit an outline to the owner for approval.
    c) Training shall be scheduled to accommodate multiple shifts.
4. Applications programming and Graphics design instruction shall be provided by the ATCC factory trained systems applications engineering person to give full instruction to designated personnel in the operation, and maintenance of ATC Systems.
    a) If the customer is familiar with the new systems applications then a short on site review of several hours to several days shall be required.

b) If the customer is NOT familiar with the products then an on site structured training course of several days to a week shall be needed. The ATCC shall submit an outline to the owner for approval.

5. Orient the training specifically to the systems installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. Provide a training manual for each student, which describes in detail the data included in each training program. Provide equipment and material required for classroom training.

B. Training on the functional operation of the ATC system shall include:

1. Operation of the equipment.
2. Programming.
3. Diagnostics.
4. Failure recovery procedures.
5. Alarm formats (where applicable).
6. Maintenance and calibration.
7. Troubleshooting, diagnostics, and repair instructions.
8. Video/Audio of all onsite training classes
9. Full list of manufacturers recommended spare parts
10. Contacts for factory/service support
11. All warranty information

3.3 PROGRAMMED MAINTENANCE

A. Upon completion of the installation, the ATC Contractor shall submit to the Owner an agreement, to provide the necessary programmed maintenance, to keep the various control systems in proper working condition beyond the guarantee period. If a service contract already exists the ATCC shall send the owner an agreement for increasing services.

B. This programmed maintenance agreement shall fully describe the maintenance work to be performed and shall advise the cost of this work.

3.4 GUARANTEE

A. The ATC system specified herein and shown on the drawings shall be guaranteed to be free from original defects in both material and workmanship for a period of (1) year of normal use and service (unless the manufacturer warranty is greater), excepting damages from other causes. This guarantee shall become effective starting the date the Contract work is accepted as complete by the Owner and in accordance with the General Provisions/Conditions.

SECTION 3 - Sequences of Operation

General AHU Standards

- Each AHU shall have its own plant controller
- All Controlling sensors, transmitters, and devices must

  be hard wired back to the DDC controller

- Systems should be designed so the MAX operating frequency is 60 Hz
- Air Handlers should automatically reset after being shut down due to an external safety and the alarm condition clears.

AHU – CONSTANT VOLUME, TEMPERATURE CONTROL

OCCUPIED MODE

The supply and return fans, with status feedback, shall be started automatically by the optimal start time of day feature in the BMS computer and operate continually with the outdoor, return and exhaust air dampers modulated open to minimum position whenever the system is indexed to this mode, subject to the safeties and morning warm-up features.

OPTIMAL START TIME

The BMS is used to determine the length of time required to bring each zone from its current temperature to the STANDBY setpoint temperature. Then, the controller waits as long as possible before starting the system, so that the temperature in each zone reaches the occupied setpoint just in time for occupancy. The optimal starting time is determined using the difference between the actual zone temperature and the occupied setpoint temperature. It compares this difference with the historical performance of how quickly the zone has been able to warm up or cool down.

MORNING WARM-UP

The return air morning warm-up controller shall override the primary control signal to the mixed air dampers and place them in their fail-safe re-circulating position when the return air temperature falls below an adjustable setpoint, 65 degrees F. The morning warm-up clock shall keep the mixed air dampers in their fail-safe re-circulating position throughout the warm-up period

Choose one of the two temperature sequences below based on chilled water or direct expansion cooling.

TEMPERATURE (with CHW cooling)

The supply air temperature controller's setpoint, 65-55 degrees F., shall be reset inversely to the change in space or return air temperature over a predetermined schedule, 70-75 degrees F. The supply air temperature controller shall modulate sequentially without overlap, the heating valve, the economized dampers above minimum position or above

the indoor air quality controller command and the cooling valve to control supply air temperature at setpoint. Per VT Energy Code, no simultaneous heating and cooling at the same time except when dehumidifying.

TEMPERATURE (with DX cooling)

. When OAT is above DX enable setpoint and the Return Air Temp is above 73 (adj) enable the first stage of cooling. Enable the second stage if the Return Air Temp is above 75 (adj). The supply air temperature controller shall modulate sequentially without overlap, the heating valve and the economized dampers above minimum position or above the indoor air quality controller command to control supply air temperature at setpoint.

COOLING LOCKOUT

The cooling lockout controller shall override the control signal to the cooling device and deactivate the cooling process when the outdoor air temperature falls below an adjustable setpoint, 50 degrees. F.

TRUE ENTHALPY ECONOMIZER w/Dry-bulb (OAT, OAH, RAT, RAH)

. When the OA Enthalpy is less than RA Enthalpy allow Enthalpy Control of mixed air dampers. Enthalpy control shall be allowed to run when OAT is between 45 and 73 deg .

INDOOR AIR QUALITY (CO2)

The indoor air quality controller shall modulate the economizer dampers above minimum position to an adjustable maximum position to control IAQ at an adjustable setpoint, based on ASHRAE 62.1. A mixed air low limit setpoint of 45 (adj) shall limit the mixed air dampers when in IAQ control.

HUMIDIFICATION (return air reset) (If Applicable)

The supply air humidity controller's setpoint, 75-25 %RH, shall be reset inversely to the change in return air humidity, 25-50 %RH, over a predetermined schedule. The supply air humidity controller shall modulate the humidifier control valve to control supply air humidity at setpoint, subject to the humidity high, airflow and humidity low temperature limit controllers

DEHUMIDIFICATION (with Chilled Water) (If Applicable)

The return air humidity controller shall override the control signal to the cooling valve and modulate the cooling valve to control return air humidity at setpoint, 55 %RH. Reheat shall modulate to maintain discharge air temperature setpoint.

DEHUMIDIFICATION (with DX) (If Applicable)

The return air humidity controller shall override the control signal to the DX cooling and cycle the stages to control return air humidity at setpoint, 55 %RH. DX cooling shall be staged. If return air humidity is 1-5% above setpoint then enable stage 1. Above 5% RH over setpoint, enable stage 2.

UNOCCUPIED MODE

The supply and return fans shall be off with the outdoor, return and exhaust air dampers positioned to their failsafe re-circulating position, the heating valve closed and the cooling valve closed whenever the system is indexed to this mode by the time-of-day scheduling from the BMS.

.When OAT is below 45 deg and the unit is off, modulate the heating valve to maintain a plenum temperature of 70 deg. The unit shall be enabled (in full recirc mode) if the space falls below unoccupied heating setpoint (60 deg adj) or above unoccupied cooling setpoint (80 deg adj).

SAFETIES

LOW LIMIT

Low Limit Controllers shall shutdown the unit when the heating coil leaving temp is below 38 Deg. The AHU will restart automatically after the alarm condition clears. After the third shutdown in a 24 hour period the unit should remain locked out and be manually reset via a point on the BMS graphic.

SMOKE Detection

The supply and return duct smoke detectors shall stop the fans and position the mixing dampers to their failsafe re-circulating position upon sensing products of combustion. The controller shall alarm at the local DDC and BMS operator workstation.

AIR FLOW

The fan status controller shall position the mixing dampers to their failsafe re-circulating position; deactivate the humidification and cooling when airflow ceases. The controller shall alarm at the local DDC and BMS operator workstation.

ALARMS

Alarmed points that are conditional or seasonal shall be silenced when operating conditions make the alarm NULL.

AHU MASP – VARIABLE AIR VOLUME

Sequence is the same as above with the addition of the following sequences.

STATIC PRESSURE

The duct static shall be measured at a point 2/3rds the distance on the longest duct from the supply fan. On larger systems, static pressure sensors should be placed on the main duct at every floor. Options shall be selectable from the front-end as to which device to control to. Static pressure shall be reset based on VAV damper position (Greatest damper VAV damper position shall be 90% open) between min setpoint and max setpoint (values determined during balancing).

The same shall occur to control the return fan speed when an open plenum with return damper strategy is used.

DAT Reset

The AHU discharge air temperature shall be reset based on a response to the building load. If all boxes require heating, the DAT Setpoint shall be increased over a period of time until the DAT Setpoint equals MAX DAT Setpoint. If any VAV is requesting cooling, the AHU DAT setpoint shall be reset back down to the MIN DAT Setpoint.

If the installed system does not support the sequence above, the AHU DAT Setpoint shall be reset based on Outside Air Temperature.

SAFETIES

FAN STATIC PRESSURE (MANUAL RESET)

The supply or return fan static pressure controller shall stop the fans and position the mixing dampers to their failsafe re-circulating position and the capacity controlling devices to zero capacity when the static pressure rises above the controller's setpoint. The controller can be manually reset once the cause for this occurrence has been corrected. The controller shall alarm at the local DDC and BMS operator workstation.

VFD FAULT ALARM

The variable frequency drive fault alarm shall position the mixing dampers to their failsafe re- circulating position and deactivate the cooling when the drive fault alarms. The fault alarm shall alarm at the local DDC and BMS operator workstation.

ALARMS

Alarmed points that are conditional or seasonal shall be silenced when operating conditions make the alarm NULL.

AHU 100% OA -TEMPERATURE & HEAT RECOVERY CONTROL

Sequence is the same as above with the addition of the following sequences.

FACE & BYPASS SWITCHOVER

The supply air temperature controller shall modulate the face & bypass damper with the heating valve positioned to full heating when the outdoor or heating heat-recovery coil air temperature is below the heating switchover controller adjustable setpoint, 40 degrees F,
The supply air temperature controller shall modulate the heating valve with the face & bypass damper positioned to full heating when the outdoor or heating heat-recovery coil air temperature is above the heating switchover controller adjustable setpoint, 40 degrees F.

HEAT RECOVERY & GLYCOL PUMP OR Wheel

The glycol heat recovery valve shall be modulated by the supply air temperature controller in the heating recovery mode and shall be positioned to the full recovery position when the system is in the cooling recovery mode for precooling. The outdoor air temperature controller shall start the heat recovery pump when its ambient temperature falls below the heating recovery adjustable setpoint, 55 degrees F or rises above the cooling recovery adjustable setpoint 75 degrees F and the system is indexed to the occupied mode.

HEAT RECOVERY LOW LIMIT

The low limit controller shall override the primary control signal to the glycol control valve to control the exhaust air temperature or exhaust air coil leaving water temperature from falling below setpoint, 35 degrees F.

ALARMS

Alarmed points that are conditional or seasonal shall be silenced when operating conditions make the alarm NULL.

AHU with Energy Recovery Wheel

OCCUPIED MODE

The supply and return fans, with status feedback, shall be started automatically by the optimal start time of day feature in the BMS computer and operate continually with the outdoor, return and exhaust air dampers modulated open to minimum position whenever the system is indexed to this mode, subject to the safeties and morning warm-up features.

OPTIMAL START TIME

The BMS is used to determine the length of time required to bring each zone from its current temperature to the STANDBY setpoint temperature. Then, the controller waits as long as possible before starting the system, so that the temperature in each zone reaches the occupied setpoint just in time for occupancy. The optimal starting time is determined using the difference between the actual zone temperature and the occupied setpoint temperature. It compares this difference with the historical performance of how quickly the zone has been able to warm up or cool down.

MORNING WARM-UP

The return air morning warm-up controller shall override the primary control signal to the mixed air dampers and place them in their fail-safe re-circulating position when the return air temperature falls below an adjustable setpoint, 65 degrees F. The morning warm-up clock shall keep the mixed air dampers in their fail-safe re-circulating position throughout the warm-up period

UNIT ENABLE

Upon a start command the isolation damper will open. When open status is achieved the supply fan will be started. When the supply fan ampere indicates the fan has started, the control sequence will be enabled. The supply fan will modulate speed to maintain the discharge static pressure at setpoint. Upon loss of airflow, the supply fan will attempt to automatically restart until status is received.

Exhaust Fan Control

After the supply fan has been started the isolation damper will open and the exhaust fan will start when the damper end switch shows open status. The exhaust fan will modulate speed to maintain the exhaust duct static pressure at setpoint.

Temperature Control and System Modes

Free Cooling: Wheel is bypassed and disabled. Active when OA temperature is less than RA temperature, OA enthalpy is less than RA enthalpy, and the system has a cooling request.

Cooling Recovery Mode: Active when OA enthalpy is greater than RA enthalpy by at least 1 BTU/lb. Wheel runs at full speed.

Heat Recovery Mode: Wheel speed modulates to maintain DAT setpoint (faster wheel speed results in higher DAT). Active when OAT is less than DAT setpoint by at least 1 deg F. When wheel is at full speed and DAT is still less than setpoint, the heating coil shall modulate to maintain DAT setpoint.

Frost Control Modes: Active when exhaust air temp is below manufacturer recommended setpoint. Wheel speed maintains EAT setpoint (35 deg adj) (Faster wheel speed results in lower EAT). Modulate heating coil to maintain DAT setpoint when in this mode.

SAFETIES

LOW LIMIT

Low Limit Controllers shall shutdown the unit when the heating coil leaving temp is below 38 Deg. The AHU will restart automatically after the alarm condition clears. After the third shutdown in a 24 hour period the unit should remain locked out and be manually reset via a point on the BMS graphic.

SMOKE Detection

The supply and return duct smoke detectors shall stop the fans and position the mixing dampers to their failsafe re-circulating position upon sensing products of combustion. The controller shall alarm at the local DDC and BMS operator workstation.

AIR FLOW

The fan status controller shall position the mixing dampers to their failsafe re-circulating position; deactivate the humidification and cooling when airflow ceases. The controller shall alarm at the local DDC and BMS operator workstation.

ALARMS

Alarmed points that are conditional or seasonal shall be silenced when operating conditions make the alarm NULL.

CABINET UNIT HEATER & UNIT HEATER

CABINET UNIT HEATER

Hot water systems only. All controls by the project ATC vendor.

Aquastat Standard: Honeywell Electromechanical Single Function

OCCUPIED

The space temperature controller will modulate the control valve and the return hot water aquastat will cycle the fan to control the space temperature at an occupied adjustable setpoint when the system is indexed to this mode by the BMS time-of-day schedule. The aquastat stops the fan when its return water temperature falls below the adjustable setpoint, 100 degrees F. Fan speed is selected manually by the unit-supplied switch.

STANDBY (occupancy sensor)

The space temperature controller will modulate the control valve and the return hot water aquastat will cycle the fan to control the space temperature at a reduced standby adjustable setpoint when the system is indexed to this mode by the occupancy sensor. The aquastat stops the fan when its return water temperature falls below the adjustable setpoint, 100 degrees F. The occupancy sensor will index the system to standby, during the occupied mode only, when the space has been vacant greater than the sensor time delay setpoint. The occupancy sensor adjustable time delay with an initial setting of 15 minutes will prevent the system from short cycling as occupants leave and enter the room.

UNOCCUPIED

The space temperature controller will modulate the control valve and the return hot water aquastat will cycle the fan to control the space temperature at a reduced unoccupied adjustable setpoint when the system is indexed to this mode by the BMS time-of-day schedule. The aquastat stops the fan when its return water temperature falls below the adjustable setpoint, 100 degrees F. Indexing the override button will cause the system to revert to the occupied mode of operation for a predetermined adjustable time period with an initial setting of 2 hours. The occupancy sensor will not be operational during the unoccupied mode.

CABINET UNIT HEATER

Public & Non-Public areas - corridors, entryways, utility rooms and non-mechanical rooms. DDC controls. Thermostat with guard & aquastat.

The space thermostat, in series with the return water aquastat, will cycle the fan to control the space temperature at an adjustable setpoint, 60 degrees F. The aquastat will override the space thermostat and stop the fan when its return water temperature falls below the adjustable setpoint, 100 degrees F.

UNIT HEATER

Hot water systems only. All controls by the project ATC vendor.

Non-Public areas - mechanical and electrical rooms. DDC controls. Thermostat & aquastat.

The space thermostat, in series with the return water aquastat, will cycle the fan to control the space temperature at an adjustable setpoint, 55 degrees F. The aquastat will override the space thermostat and stop the fan when its return water temperature falls below the adjustable setpoint, 100 degrees F.

FAN COIL UNIT

OCCUPIED

The fan is started operates when the space is calling for heating or cooling. The space temperature controller will modulate the heating and/or cooling control valves sequentially without overlap to control the space temperature at an occupied adjustable setpoint when the system is indexed to this mode by the BMS time-of-day schedule. Fan speed is set at balancing. Control to the effective heating/cooling setpoints. Heating/Cooling setpoints have a 2.5 deg differential from the base setpoint. For Example: Thermostat setpoint is set to 70 deg. The effective heating setpoint is 67.5 deg and the effective cooling setpoint is 72.5 deg.

STANDBY (occupancy sensor)

The fan is started and operates when the space is calling for heating or cooling.. The space temperature controller will modulate the heating and/or cooling control valves sequentially without overlap to control the space temperature at a standby setpoint Control to the effective standby heating/cooling setpoints. Heating/Cooling setpoints have a 5 deg differential from the base setpoint. For Example: Thermostat setpoint is set to 70 deg. The effective heating setpoint is 65 deg and the effective cooling setpoint is 75 deg.

The occupancy sensor will index the system to standby, during the occupied mode only, when the space has been vacant longer than the sensor time delay value. The occupancy sensor with an adjustable time delay and an initial setting of 15 minutes will prevent the system from short cycling as occupants leave and enter the room.

UNOCCUPIED

The space temperature controller will modulate the heating and/or cooling control valves sequentially without overlap and cycle the fan to control the space temperature at a setback or adjustable setpoint when the system is indexed to this mode by the BMS time-of-day schedule.

The occupancy sensor will put the unit back in OCC mode when occupancy is detected during scheduled unoccupied hours.

FAN STATUS & ALARM

The unit shall have a fan status which when the respective start-stop condition is not equal to its command state the digital controller shall position the control devices in the failsafe position and alarm at the local controller and the BMS.

GENERATOR

. All controls by the project ATC vendor. Controls may be hardwired stand alone or DDC

All hardwired points and setpoints are to be viewable and adjustable at the BMS graphics.

GENERATOR ROOM VENTILATION and HEATING

The normally open outdoor air damper shall open when the generator is in operation. The space temperature controller shall modulate the normally open exhaust damper and normally closed return air damper to control the space temperature at an adjustable setpoint, 75 degrees F when the generator is in operation.

The space temperature controller shall cycle the unit heater to control the space temperature at an adjustable setpoint, 55 degrees F.

The space temperature, the generator run status and the transfer switch status points shall report their statuses to the BMS local DDC and operator workstations.

Sufficient heating is required to keep other systems (sprinkler for example) from freezing when the OA dampers are open and the generator is running.

HEATING HOT WATER

The heating system can be a boiler or boilers; steam heat exchanger or exchangers with 1/3 & 2/3 steam valves or direct control of the boiler or boilers. All controls by the project ATC vendor.

All real points and setpoints are to be viewable and adjustable at the BMS graphics.

HEATING HOT WATER (dual temperature)

SUPPLY WATER RESET (heat exchanger with 1/3 & 2/3 valves)

The hot water supply temperature controller shall modulate the steam control valves sequentially to control the supply water temperature at setpoint. The hot water controller setpoint shall be automatically reset by outdoor air temperature over a predetermined schedule 120 – 180 degrees F, inversely to the change in the outdoor air temperature, 0 - 60 degrees F.

SUPPLY WATER RESET (simplex boiler)

The outdoor air temperature controller shall automatically enable the boiler controls when its ambient temperature falls below an adjustable setpoint, 60 degrees F. The hot water supply temperature controller shall cycle the boiler low and high fire stages sequentially to control the supply water temperature at setpoint. The hot water controller setpoint shall be automatically reset or adjusted by outdoor air temperature, over a predetermined schedule 100 – 180 degrees F, inversely to the change in the outdoor air temperature, 0 - 60 degrees F. Boiler status & alarm shall be displayed at the operator workstation and local DDC panel. See combustion air damper, boiler high fire and Auto-Local switch.

SUPPLY WATER RESET (duplex boiler)

The outdoor air temperature controller shall automatically enable the lead and lag boiler controls to operate when its ambient temperature falls below an adjustable setpoint, 60 degrees F. The hot water supply temperature controller shall cycle the lead boiler low and high fire stages and then cycle the lag boiler low and high fire stages sequentially to control the supply water temperature at setpoint. The hot water controller setpoint shall be automatically reset or adjusted by outdoor air temperature, over a predetermined schedule 100 – 180 degrees F, inversely to the change in the outdoor air temperature, 0 - 60 degrees F. Boiler status & alarm shall be displayed at the operator workstation and local DDC panel. See combustion air damper, boiler high fire and Auto-Local switch.

Energy

Monitor supply temp, return temp, and system flow. Calculate BTUs for energy reporting. If there is a circ pump, it should be enabled and scheduled through DDC

ALARMS

Alarmed points that are conditional or seasonal shall be silenced when operating conditions make the alarm NULL.

COMBUSTION AIR

The combustion air can be for a boiler or boilers or domestic hot water heater or other equipment requiring combustion air. **As a general guideline each piece of equipment requiring combustion air shall have its own damper, actuator and blade sensing end switch not switches built into the actuator**. All controls by the project ATC vendor.

End switch model number **TS-475 Series**

COMBUSTION AIR

The boiler or domestic hot water operating controller, standalone or DDC, shall command the burner system into operation. The combustion air damper shall open and the damper proving end switch shall make its circuit before the system is allowed to fire. The damper actuator shall not be controlled by DDC but directly from the burner controls. **The damper shall fail open on loss of power**. State law requires proof that the damper is open before the boiler is allowed to fire.

BOILER Auto-Local Switch

Boiler Enable from DDC shall be commanded through a RIB RELAY with a HOA Switch (RIBU1S)

HOT WATER PUMPS

The heating system pumps can be duplex with DDC start stop and status. All controls by the project ATC vendor.

All real points and setpoints are to be viewable and adjustable at the BMS graphics.

PUMP CONTROL (simplex)

The outdoor air temperature controller shall start the hot water pump, which shall operate continually, when its ambient temperature falls below an adjustable setpoint, 60 degrees F.

PUMP CONTROL (duplex)

The outdoor air temperature controller shall start the lead hot water pump, which shall operate continually, when its ambient temperature falls below an adjustable setpoint, 60 degrees F.

PUMP LEAD-LAG

If the lead pump fails, the lag pump shall be automatically started and an alarm shall be sent to the operator workstations and maintain to be in alarm until corrected. The lag pump will be started and status proven, the failed lead pump shall be turned off. Once the failed pump status reports as true, the alarm will be released and the pump will be put back into rotation. (not external reset on the controls front end is needed)

PUMP ALTERNATION

Hot water pumps alternate every 168 hours (adj.) of run time. If pump excessed set run time hours an alarm shall be sent to the operator workstations and maintain to be in alarm until the run time has been reset. Selection of the lead pump is evaluated on a 168 hours' basis or a pump failure will initialize a pump rotation.

DIFFERENTIAL PRESSURE (2-way N.C. Valve)

The differential pressure controller shall modulate the normally closed control valve to control the differential pressure at an adjustable setpoint (if system is at min flow).

DIFFERENTIAL PRESSURE

The differential pressure controller shall modulate the pump variable frequency drive to control the differential pressure at an adjustable setpoint. For larger systems, differential pressure sensors shall be located on the header at each floor

DOMESTIC WATER

All controls by the project ATC vendor.

Monitor supply temp, return temp, and system flow. Calculate BTUs for energy reporting. If there is a circ pump, it should be enabled and scheduled through DDC

ALARMS

Alarmed points that are conditional or seasonal shall be silenced when operating conditions make the alarm NULL

MECHANICAL ROOM

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MECHANICAL ROOM VENTILATION

The space temperature controller shall open the outdoor and exhaust air dampers and start the fan to control the space temperature at an adjustable setpoint, 85 degrees F.

MECHANICAL ROOM VENTILATION and HEATING

The space temperature controller shall open the outdoor and exhaust air dampers and start the fan to control the space temperature at an adjustable setpoint, 85 degrees F.

The space temperature controller shall cycle the unit heater with the dampers closed to control the space temperature at an adjustable setpoint, 55 degrees F.

VAV BOX (cooling only)

Pressure independent systems only. All controls by the project ATC vendor.
Public areas - offices, classrooms and Interior rooms where greater comfort control is needed.

Standalone DDC controller, space and supply air and velocity sensors, modulating damper {NO or NC} device. All real points and setpoints are to be viewable and adjustable at the BMS graphics.

VAV BOX (cooling only)

Cooling - The velocity controller's setpoint will be reset directly to the change in space temperature over a predetermined min-MAX CFM schedule. The velocity controller will modulate the control damper, above minimum position, to control supply air CFM at setpoint when the space temperature controller is within the cooling proportional band.

Heating - The control damper will be at minimum position when the space temperature controller is within the heating proportional band.

STANDBY (occupancy sensor)

Control to the effective standby heating/cooling setpoints. Heating/Cooling setpoints have a 5 deg differential from the base setpoint. For Example: Thermostat setpoint is set to 70 deg. The effective heating setpoint is 65 deg and the effective cooling setpoint is 75 deg.
The occupancy sensor will index the system to standby, during the occupied mode only, when the space has been vacant longer than the sensor time delay value. The occupancy sensor with an adjustable time delay and an initial setting of 15 minutes will prevent the system from short cycling as occupants leave and enter the room.

UNOCCUPIED

The air-handling unit is off.
The space temperature controller will modulate the heating and/or cooling control valves sequentially without overlap and cycle the fan to control the space temperature at a setback or adjustable setpoint when the system is indexed to this mode by the BMS time-of-day schedule.
The occupancy sensor will put the unit back in OCC mode when occupancy is detected during scheduled unoccupied hours. Enabling the AHU back on during Unocc Mode based on Occ Sensors will be determined on a system to system basis.

VAV BOX w/REHEAT

Hot water & pressure independent systems only. All controls by the project ATC vendor. *Public areas - offices, classrooms and Interior rooms where greater comfort control is needed.*

Standalone DDC controller, space and supply air and velocity sensors, modulating heating {NO} device, modulating damper {NO or NC} device. All real points and setpoints are to be viewable and adjustable at the BMS graphics.

VAV BOX w/REHEAT

Cooling - The velocity controller's setpoint will be reset directly to the change in space temperature over a predetermined min-MAX CFM schedule. The velocity controller will modulate the control damper, above minimum position, to control supply air CFM at setpoint when the space temperature controller is within the cooling proportional band.

Heating - The space temperature controller will modulate the reheat valve, with the control damper in minimum position, to control the space temperature at an adjustable setpoint when the space temperature controller is within the heating proportional band.

Reheat should be controlled by VAV discharge air reset

Control to the effective heating/cooling setpoints. Heating/Cooling setpoints have a 2.5 deg differential from the base setpoint. For Example: Thermostat setpoint is set to 70 deg. The effective heating setpoint is 67.5 deg and the effective cooling setpoint is 72.5 deg.

Standalone DDC controller, space and supply air and velocity sensors, modulating heating {NO} device, modulating damper {NO or NC} device with Occupied-Standby-Unoccupied modes. All real points and setpoints are to be viewable and adjustable at the BMS graphics.

STANDBY (occupancy sensor)

Same as above

UNOCCUPIED

Same as above

VAV BOX w/REHEAT & RADIATION

Hot water & pressure independent systems only. All controls by the project ATC vendor. *Public areas - offices, classrooms and Interior rooms where greater comfort control is needed.*

Standalone DDC controller, space and supply air and velocity sensors, modulating heating {NO} devices, modulating damper {NO or NC} device with Occupied-Standby-Unoccupied modes. All real points and setpoints are to be viewable and adjustable at the BMS graphics.

Cooling - The velocity controller's setpoint will be reset directly to the change in space temperature over a predetermined min-MAX CFM schedule. The velocity controller will modulate the control damper, above minimum position, to control supply air CFM at setpoint when the space temperature controller is within the cooling proportional band.

Heating - The space temperature controller will modulate the reheat valve, with the control damper in minimum position, to control the space temperature at an adjustable setpoint when the space temperature controller is within the heating proportional band.

Control to the effective heating/cooling setpoints. Heating/Cooling setpoints have a 2.5 deg differential from the base setpoint. For Example: Thermostat setpoint is set to 70 deg. The effective heating setpoint is 67.5 deg and the effective cooling setpoint is 72.5 deg.

Reheat should be controlled by VAV discharge air reset

Radiation Valve is locked out when OAT > 50 deg

If OAT is below 0 deg (adj) then open the radiation valves

If the radiation valve is modulating then modulate the valve with the reheat command

If a 2 position radiation valve is used then enable operation if VAV DAT SP is greater than 50% of its discharge air reset span. Example. DAT Low = 55, DAT high=90, enable radiation when VAV discharge air temperature setpoint is 72.5 deg.

Standalone DDC controller, space and supply air and velocity sensors, modulating heating {NO} devices, modulating damper {NO or NC} device with Occupied-Standby-Unoccupied modes. All real points and setpoints are to be viewable and adjustable at the BMS graphics.

STANDBY (occupancy sensor)

Same as above

UNOCCUPIED

Same as above

NOTE - All VAV's and associated controls shall be located in an accessible location. Provide access doors as needed.

CO2 Control- In spaces that are required to have Demand Response Ventilation when the space CO2 is above setpoint (950 PPM adj) the vav will send a request to the associated AHU to increase OA flow.

Chilled Beam

Forthcoming Sequence.

SECTION 4 - Commissioning

PART 1 General

1.1 DESCRIPTION

A. The ATC shall work with, in all aspects, with the CCA during the commissioning process. The ATC is responsible for overseeing of control system manipulation for testing purposes.

B. Controls commissioning, part of the overall building commissioning process, is basically the act of putting functional systems into acceptable service. Putting functional systems into service is a systematic process of ensuring that all building control systems perform interactively according to the design intent and the owner's operational needs.

C. Non-functional systems are systems that do not work in harmony with other systems, do not meet the design intent and do not meet the owner's operational needs. [I.e. A single control loop may function properly by itself but the combination of functional loops can generate non-functional results].

D. Owner's operational needs are not just mechanical in nature but extend to the point naming conventions/abbreviations that appear in the operator workstation. Easy to understand conventions/abbreviations make it easier for all that use the systems.

E. Controls alone cannot achieve the design intent if the non-controls products do not meet their design intent. It is the responsibility of the automatic temperature controls contractor (ATCC) and controls commissioning person to advise the owner's representative or the owner of these non-achievable items.

F. The design intent is achieved by the collaboration of ATCC and others documenting the various areas of commissioning throughout the construction, acceptance and warranty periods with actual verification of performance.

G. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, performance testing and training.

H. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

   1. Verify that applicable equipment and systems are installed according to the

manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.

I. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.2 COORDINATION

A. Agent

1. The Independent Controls Commissioning Consultant or Owners Staff Member (Retro-Commissioning Engineer) maybe designated by the OWNER, in whole or part, as the controls commissioning agent (CCA).
2. The CCA person or persons shall review the control drawings and documents for contract compliance, not duplicating the designer roles and responsibilities but supporting them for this specialty product.
3. The CCA person or persons shall oversee functional performance testing of the con Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.

B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1. Tour with the ATCC commissioning person or persons.

1.3 COORDINATION

A. Agent

1. The Independent Controls Commissioning Consultant or Owners Staff Member (Retro-Commissioning Engineer) maybe designated by the OWNER, in whole or part, as the controls commissioning agent (CCA).
2. The CCA person or persons shall review the control drawings and documents for contract compliance, not duplicating the designer roles and responsibilities but supporting them for this specialty product.
3. The CCA person or persons shall oversee functional performance testing of the controls with the ATCC commissioning person or persons.

B. Scheduling

1. The Construction Manager or other project manager shall coordinate the scheduling of the ATCC and the CCA to perform the functional performance testing. The manager shall give the ATCC and the CCA a minimum of ten working days' notice to proceed with the functional performance testing. ATCC shall be substantially complete with all work, including graphics before the CCA is scheduled to perform functional testing.
2. It is the responsibility of the Construction Manager or other project manager to complete all other mechanical and electrical commissioning tests prior to the controls functional performance test. Listed below are some common items that must be completed before scheduling the functional performance test.
    a) All equipment electricity is available for use and the physical equipment is capable of operating correctly. I.E. correct fan or pump motor rotation.
    b) Hot and Chilled water availability.
    c) Steam availability.
    d) Air and water balancing completed.

1.4 DEFINITIONS

A. Commissioning: the act of putting the: correctly designed; fully verified; fully setup; fully checked out; fully statically tested; fully dynamically tested and fully functional systems into full service by the ATCC.

B. Verify: the act of visual inspecting by the ATCC to acknowledge that all controls are install properly as per manufacturer instructions.
C. Setup: the act of adjusting or setting: set points; pressure switch settings; circuit board jumps; and whatever other adjustments that are required to make the product function properly per manufacturer's instructions.
D. Checkout: the act of witnessing the controls, mechanical or electrical, response to signal changes after they have been verified and setup by the ATCC per manufacturer instructions.
E. Startup: the act of statically and dynamically testing individual control loops to see if the loop performs correctly as designed by the ATCC per manufacturer guidelines, see also pre-functional checklists. Startup is not functional performance testing.
F. Acceptance: the act of the ATCC person performing all of the above affixing their signature on the controls drawing or other form or document stating that the systems have been commissioned and are functioning properly to meet design intent. Attach function performance test results. See attached sample.
G. Prefunctional Checklist: a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment provided by the ATCC. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., jumpers or dip switch set, oil levels OK, on & off run times, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage setting of the zero & span setting of an electric actuator). The word prefunctional refers to before functional performance testing. Prefunctional checklists augment and are combined with the manufacturer's startup checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning agent will recommend. However, a

few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The controls commissioning agent only requires that the procedures be documented in writing, and does not witness much of the prefunctional check listing, except for larger or more critical systems.

H. Functional Performance Test: test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional performance testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences describe. Traditional air or water test and balancing (TAB) is not functional performance testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional performance testing is verifying that which has already been set up. The commissioning agent reviews and approves the functional performance test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. Functional performance tests are performed after prefunctional checklists and startups are complete.

I. Factory Testing: the testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

J. Monitoring: the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data-loggers or the trending capabilities of control systems.

K. Over-written Value: writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75 °F to verify economizer operation). See also "Simulated Signal."

L. Phased Commissioning: commissioning that is completed in phases (by floors, by mechanical system, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time. Must be at a minimum of a full day's work.

M. Sampling: functionally testing only a fraction of the total number of identical or near identical systems. The Owner's representative shall determine the percentage of the total number of systems to be sampled (e.g., 50% of all reheat systems per floor or per unit, and 100% of all other systems).If not stated then sampling percentage is equal to 100%.

N. Seasonal Performance Tests: Functional performance tests that are deferred until the system(s) will experience conditions closer to their design conditions.

O. Simulated Condition: A condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

P. Simulated Signal: disconnecting a sensor or controller (e.g., DDC PID) and using a signal generator to send an amperage, resistance or pressure signal to a transducer or a controller (e.g., Pneumatic, DDC, electric) to simulate an input or output signal value.

Q. Trending: monitoring using the building control system.

1.5 RESPONSIBILITIES

A. The ATCC shall provide, at appropriate time or as directed by the Architect, the on-site services of a competent factory trained Engineer or authorized representative of the manufacturer to commission the automatic temperature controls provided under this Contract.

B. The ATCC shall under their own direction execute and document their prefunctional checklists to be submitted through the project organizational structure to the OWNER or CCA for review before the functional performance testing begins.

C. The ATCC shall submit functional performance testing forms with testing procedures for each type of system to the CCA for review. The forms shall be submitted at a minimum of ten working days before any testing.

D. The ATCC shall provide a set of control drawings and/or other acceptance

documentation signed by the witnesses mentioned elsewhere in this specification, which will be used to summarize the results of the commissioning and performance of the system for the owner's record. No additional compensation will be allowed for the ATCC for such services.

E. The ATCC shall coordinate their commissioning with all other trades needed for successful systems commissioning process. The system shall be commissioned prior to Operation and Maintenance instructions.

F. The ATCC shall guarantee that the designed ATC systems will operate so as not to damage any mechanical systems and endanger anyone's life. Areas of concern should be sent to the OWNER with possible solutions at any time.

PART 2 – Products

TEST EQUIPMENT

A. All standard test equipment required to perform startup and checkout and functional performance testing shall be provided by the respective contractor for the equipment being tested.

B. Special vendor equipment, tools and instruments required for testing shall be included in the base bid price of the respective contractor and left with the owner, except for stand-alone data-logging equipment.

C. All test equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the specifications or tolerances equal to or more accurate then the device being tested.

D. Provide industry standard test equipment for performing the tests specified herein that meet NIST traceable & ISO 9001 standards.

E. All test equipment to be left with the OWNER shall be re-certified and calibrated before it is given to the OWNER.

F. All test equipment shall be recalibrated and/or repaired if dropped or damaged in any way since last calibration.

2.2 TEST PORTS

A. Controls

B. Duct air test ports can be a hole drilled into the duct and then capped or by access

panels.

C. Hydronic test ports can be the use of the local glass thermometer wells by insertion of the test thermometer into the well for the test, and then return the original thermometer to its well.

PART 3 - Execution

3.1 PREFUNCTIONAL CHECKLISTS, START-UP AND INITIAL CHECKOUT

A. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in- depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system. The ATCC shall use the control manufactures prefunctional checklists and procedures and add supplements to the control manufactures as required. Once the checklist are completed they shall be signed by the commissioning person and copies forwarded to the OWNER and CCA.

3.2 SENSOR CALIBRATION

A. Calibration of all sensors shall be included as part of the prefunctional checklists.

B. Verify that sensors are installed as per the manufacture instructions.

C. Verify that the sensor is within the tolerances in the table below. If not, install an offset value in DDC, calibrate or replace sensor.

3.3 ELECTRONIC ACTUATOR, TRANDDUCER

A. Calibration of all actuators, transducers and shall be included as part of the prefunctional checklists.

B. Verify that devices are installed as per the manufacture instructions.

C. Verify that the 0 to 100% output values from the DDC to the output devices reflect true percent output to percentage stroke of the control device or 95 percent true.

D. Split ranging within software is allowable.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. Objectives And Scope

1. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and contract documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation and certifiably ready for use.
2. In general, each system should be operated through all modes of operation (occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, equipment failure, etc. shall also be tested.

B. Test Methods

1. Functional performance testing and verification shall be achieved by manual testing (persons manipulate the equipment and observe performance).
2. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response.

Before simulating conditions or overwriting values, sensors, transducers and

devices shall have been calibrated.

4. Simulated signals using a signal generator which creates a simulated signal to test and calibrate transducers, and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values. Altering setpoints rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout setpoint to be 5°F above the current outside air temperature.

3.5 CONTROL DRAWINGS & GRAPHICS

A. The control drawings shall be revised to reflect all changes made to the control systems and issued to the OWNER in the owner's manuals as "AS-BUILT" drawings. Each control panel shall have a booklet of AS-BUILT control drawings of all the systems that apply to the controls inside the control panel.

B. The ATC contractor shall turnover to the OWNER a software set of all drawings, schedules, etc. that make up a complete set of working control drawing. All drawings shall be made using the Microsoft Visio software. All drawings, schedules, etc. shall have the ATCC border and title block information on every drawing page. All drawings shall be a minimum of 11x17 in size.

C. The ATCC shall purchase and turnover the above applications software to the OWNER if they do not already have the required software. The ATCC shall install the above applications software if it is not already done so.

3.6 TRAINING

Training shall be witnessed by CCA

SECTION 5 - Building names and abbreviations

BUILDING	DESCRIPTION	All New Control Abbreviations	Existing Control Abbreviations	Control System	Zone
0001	284 East Ave	284E	284	Honeywell	Trinity
0005	James M Jeffords Hall	JJH	JJH	Honeywell	Medplex
0010	Allen House	AH	AH	Honeywell - Adams Device	South
0012	Ira Allen Chapel	BC	BC	Johnson Controls	Davis
0013	Billings - Ira Allen Lect Hall	BC	BC, IRA	Johnson Controls	Davis
0016	Pierce Spaulding House	PSH	PSH	Honeywell - Adams Device	Trinity
0017	439 College St	439C	439C	Honeywell - Adams Device	Trinity
0020	109 S Propsect Annex	109A	109A	Honeywell - Adams Device	Trinity
0024	Quonset Storage Bldg	QNS	QNS		
0028	Outing Club Main Campus	OC	OC	Honeywell - Adams Device	Trinity
0032	Torrey Hall	TOR	TOR	Honeywell - Adams Device	Davis
0033	Dudley H Davis Center Complex	UC			
0034	Dudley H Davis Center	UC	UC	Honeywell	Davis
0036	Howe Memorial Library	HOWE	BHL, BH, HOWE	Johnson Controls	Davis
0038	Billings Ira Allen Complex	BC			
0039	Billings Addition	BC	BC, Billings, IRA	Johnson Controls	Davis
0040	Billings Library	BC	BC, Billings, IRA	Johnson Controls	Davis
0041	Blundell House	BL	BL	Honeywell - Adams Device	South
0042	86 S Williams St (Booth House)	86SW	86SW	Honeywell - Adams Device	Trinity
0043	86 S Williams Garage	86SW			
0048	Johnson House	JH	JH	Honeywell - Adams Device	Davis
0052	Englesby House	EG	EG	Honeywell	Trinity
0055	Englesby Shed	EG	EG		
0056	Englesby Garage	EG	EG		
0058	Ped U Cplx	PED			
0061	Ped U Elevator Equip	PED			
0064	Fleming Museum	FM	FM, FL	Johnson Controls	Davis
0065	LCOM Research Bldg (FireStone Research Building)	FSRB			
0067	The Courtyard at Given	GV			
0068	Given Complex	GV	GV	Honeywell (Some Johnson Controls)	Medplex
0070	Given B	GV	GV, GVB	Honeywell (Some Johnson Controls)	Medplex
0071	Given C	GV	GV, GVC	Honeywell (Some Johnson Controls)	Medplex
0072	Given D	GV	GV, GVD	Honeywell (Some Johnson Controls)	Medplex
0073	Given E	GV	GV, GVE	Honeywell (Some Johnson Controls)	Medplex
0074	Rowell Hall	RW	RW, Rowell	Honeywell	Medplex
0075	Health Science Rsch Facility	HSRF	HSRF	Johnson Controls	Medplex
0076	Health Science Rsch Fac Shed	HSRF	HSRF	Johnson Controls	Medplex
0078	479 Main St	479M	475_479	Honeywell - Adams Device	Davis
0079	Alumni House	ALUM	ALUM	Johnson Controls	Trinity
0080	Grasse Mount	GS	GS	Honeywell - Adams Device	Trinity
0081	Jack & Shirley Silver Pavilion (Alumni House Pavilion)	ALUM	ALUM	Johnson Controls	Trinity
0082	Hills Agri Science	HL	HL	Honeywell - Adams Device	Medplex
0083	Stafford Greenhouse	SF	SF	Honeywell	Medplex
0084	Stafford ET	SF	SF	Honeywell (Some Johnson Controls)	Medplex
0085	Stafford Head House	SF	SF	Honeywell	Medplex
0086	Marsh Life Science	MLS	ML, MLS	Johnson Controls	Medplex
0088	Aiken Center	AK	AK	Honeywell	Davis
0090	Mansfield House	MF	MF	Honeywell - Adams Device	Trinity

0094	Nicholson Bldg	NS	NS	Honeywell - Adams Device	Trinity
0101	Royall Tyler Complex	RTT	RTT	Honeywell	Davis
0102	Royall Tyler Theatre	RTT	RTT	Honeywell	Davis
0103	Central Heating Plant	CUP	Cage, CUP	Honeywell / DeltaV	Davis
0104	Chilled Water Plant	CUP	Cage, CUP	DeltaV	Davis
0106	Morrill Hall	MR	MR	Honeywell	Davis
0108	34 S Williams St (Womens Center)	34SW	34SW	Honeywell - Adams Device	Trinity
0109	34 S Williams St Garage	34SW	34SW		Trinity
0110	70 S Williams St	70SW	70SW	Honeywell - Adams Device	Trinity
0113	Old Mill Annex	OM	OM	Johnson Controls	Davis
0114	Old Mill	OM	OM	Johnson Controls	Davis
0115	Lafayette Hall	OM	OM,LAF, LAFF	Johnson Controls	Davis
0117	PFG Complex	PFG	PFG	Johnson Controls	South
0118	Patrick Gym-Multi Purp-Gymnstc	PFG	PFG	Johnson Controls	South
0119	Gutterson Field House	PFG	PFG	Johnson Controls	South
0120	Patrick Gymnastics	PFG	PFG	Johnson Controls	South
0121	Patrick Multipurpose	PFG	PFG	Johnson Controls	South
0122	Perkins Building	PK	PK, PG	Johnson Controls	Davis
0123	Recreation & Fitness Ctr	PFG	PFG	Johnson Controls	South
0124	Gutterson Parking Garage	PFG	PFG		South
0129	Moulton-Winder Field Bldg	MWF	MWF		South
0130	Pomeroy Hall	PR	PR	Honeywell	South
0131	Pomeroy Barn	PR	PR		South
0132	Pomeroy Garage	PR	PR		South
0134	Dewey Hall	DW	DW, Dewey	Johnson Controls	Trinity
0135	Dewey Garage	DW			
0136	Nolin House	NH	NH	Honeywell - Adams Device	Davis
0138	Adams Building	AB	AB	Honeywell - Adams Device	Davis
0139	Track & Field Building	Track	Track	Honeywell - Adams Device	South
0140	Virtue Field Bleachers	VirtueField	VirtueField		
0141	Virtue Field Press Box	VirtueField	VirtueField		
0142	Redstone Lodge	Red_L			
0143	Southwick Complex	SW	SW		
0144	Southwick Hall	SW	SW		
0145	Music Building	SW			
0146	Tarrent Event Center	TEC			
0148	Terrill Bldg	TER	TER	Honeywell	Davis
0150	STEM Complex	STEM			
0151	Discovery Hall	STEML	STEML	Johnson Controls	Davis
0153	Innovation Hall	STEMC	STEMC	Johnson Controls	Davis
0155	Kalkin-Ifshin Complex	KL			
0156	Votey Hall	VT	VT, VH, Vote	Honeywell (Some Johnson Controls)	
0157	Kalkin Building	KL	KL, Kalk	Johnson Controls (Some Honeywell)	Davis
0158	Ifshin Hall	KL	Ifshin	Johnson Controls	Davis
0160	Waterman Building	WM	WM, Waterman	Johnson Controls (Adams Device Honeywell)	Trinity
0161	Lattie F Coor House	438	438	Honeywell	Trinity
0162	440 College St	440C	440C	Johnson Controls	Trinity
0164	Wheeler House	WH	WH	Honeywell - Adams Device	Trinity
0165	Wheeler House Barn	WH	WH		

0168	Williams Hall	WL	WL	Honeywell – Johnson Controls	Davis
0172	Pearl House	PH	PH	Honeywell - Adams Device	Trinity
0174	Henry Lord House	HLH	HLH	Honeywell - Adams Device	Trinity
0176	Benedict House (31 South Prospect)	31SP	31SP	Honeywell - Adams Device	Trinity
0180	Jacobs House (146 South Williams)	146SW	146SW	Honeywell - Adams Device	Trinity
0184	Bittersweet	BS	BS	Honeywell - Adams Device	Trinity
0185	Bittersweet Garage	BS	BS		
0187	172 S Prospect	172SP			
0188	Wadhams House (178 South Prospect)	178SP	178SP	Honeywell - Adams Device	South
0189	178 S Prospect St Garage	178SP			
0192	Clement House (194 South Prospect)	194SP	194SP	Honeywell - Adams Device	South
0193	Admissions Visitor Center	AD, UVM_AD	AD, UVM_AD	Honeywell	South
0197	UVM Rescue Facility	RF	RF	Honeywell - Adams Device	Trinity
0198	280 East Ave (IMF) (The Instrumentation and Model Facility)	IMF, LR	IMF, LR	Honeywell	Trinity
0199	Library Res Annex	LR	LR	Honeywell	Trinity
0202	322 S Prospect St	322SP	322SP	Honeywell - Adams Device	South
0203	322 S Prospect St Garage	322SP	322SP		
0211	460 S Prospect St	460SP	460SP	Honeywell - Adams Device	South
0212	466 S Prospect St	466SP	466SP	Honeywell - Adams Device	South
0213	466 S Prospect St Barn	466SP	466SP		
0214	474 S Prospect St	474SP			
0218	481 Main St	481M	481MainSt	Honeywell - Adams Device	South
0240	UVM Med Ctr 1 S Prospect Cmplx	UHC	UHC	Honeywell - Adams Device	Utility
0241	UVM Med Ctr 1 S Prospect Old H	UHC	UHC	Honeywell - Adams Device	Utility
0242	UVM Med Ctr 1 S Prospect St Jo	UHC	UHC	Honeywell - Adams Device	Utility
0243	UVM Med Ctr 1 S Prospect Rehab	UHC	UHC	Honeywell - Adams Device	Utility
0244	UVM Med Ctr 1 S Prospect Arnld	UHC	UHC	Honeywell - Adams Device	Utility
0245	UVM Med Ctr s S Prospect Clnic	UHC	UHC	Honeywell - Adams Device	Utility
0246	UVM Med Ctr 1 S Prospect Boilr	UHC	UHC	Honeywell - Adams Device	Utility
0247	UVM Med Ctr 1 S Prospect Guard	UHC	UHC	Honeywell - Adams Device	Utility
0297	Interfaith Center	IFC	IFC	Honeywell - Adams Device	South
0300	Central Campus Res Hall Cmplx	CCRH	CCRH	Johnson Controls	Davis
0301	Central Campus Res Hall East	CCRH	CCRH	Johnson Controls	Davis
0302	Central Campus Res Hall West	CCRH	CCRH	Johnson Controls	Davis
0303	Central Campus Bicycle Storage	CCRH_BS			
0320	C P W Complex	CWP	CWP	Honeywell	South
0321	Christie Hall	CWP	CWP	Honeywell	South
0322	Patterson Hall	CWP	CWP	Honeywell	South
0323	Wright Hall	CWP	CWP	Honeywell	South
0328	Converse Hall	CV	CV	Honeywell	Davis
0332	Coolidge Hall	CL	CL	Honeywell	South
0342	Jeanne Mance Hall	JM	JM	Honeywell	Trinity
0344	M A T Complex	MAT	MAT	Honeywell	South
0345	Marsh Hall	MAT	MAR, MAT	Honeywell	South
0346	Tupper Hall	MAT	TUPR, MAT	Honeywell	South
0347	Austin Hall	MAT	AUS, MAT	Honeywell	South
0352	M S H Complex	MSH	MSH	Honeywell	South
0353	Mason Hall	MSH	Mason, MAS, MSH	Honeywell	South
0354	Simpson Hall	MSH	MSH, Simp, RSD	Honeywell	South
0355	Hamilton Hall	MSH	MSH, Ham	Honeywell	South

0360	Redstone Hall	RED_H	RS	Honeywell	South
0364	Robinson Hall	RN	RN	Honeywell	South
0368	Slade Hall	SL	SL	Johnson Controls	South
0372	W D W Complex	WDW	WDW	Honeywell	South
0373	Wing Hall	WDW	WDW, WN, Wing	Honeywell	South
0374	Davis Hall	WDW	WDW, DV, Davis	Honeywell	South
0375	Wilks Hall	WDW	WDW, WL, Wilks	Honeywell	South
0376	H M Complex	HM	HM	Honeywell	South
0377	Millis Hall	HM	HM, Mill	Honeywell	South
0378	H M Commons	HM	HM	Honeywell	South
0379	Harris Hall	HM	HM, HAR	Honeywell	South
0384	L L Complex	LL	LL	Honeywell	South
0385	L L Commons	LL	LL	Honeywell	South
0386	Living Learning A	LLA	LLA	Honeywell	South
0387	Living Learning B	LLB	LLB	Honeywell	South
0388	Living Learning C	LLC	LLC	Honeywell	South
0389	Living Learning D	LLD	LLD	Honeywell	South
0390	Living Learning E	LLE	LLE	Honeywell	South
0391	University Heights North 1	UHN1	UHN1		
0392	University Heights North 2 & 3	UHN2, UHN3	UHN2, UHN3		
0393	University Heights South 2 & 3	UHS2, UHS3	UHS2, UHS3		
0394	University Heights South 1	UHS1	UHS1		
0395	Univ Hgts Res Learn Complx	UH	UH		
0397	Redstone Lofts Complex	RED_LC			
0401	Mann Hall	MN	MN	Honeywell	Trinity
0402	Delehanty Hall	DH	DH	Honeywell	Trinity
0403	Ira Allen School	IA	IA	Honeywell	Trinity
0404	Farrell Hall	FRL	Far, Farrell, FRL	Honeywell	Trinity
0405	St Josephs Villa	VIL	Vil	Honeywell - Adams Device	Trinity
0406	Trinity Boiler House	TBH	TBH	Honeywell	Trinity
0407	Mcauley Hall	MH	MH	Honeywell	Trinity
0408	Mercy Hall	MC	MC	Honeywell	Trinity
0409	McCann Hall	MCN	MCN	Honeywell	Trinity
0410	Richardson Hall	RI	RI	Honeywell	Trinity
0411	Hunt Hall	HNT	HNT	Honeywell	Trinity
0412	Sichel Hall	SI	SI	Honeywell	Trinity
0413	Ready Hall	RD	RD	Honeywell	Trinity
0414	252 Colchester Ave (Cottages)	252CT	252CT	Honeywell - Adams Device	Trinity
0415	254 Colchester Ave (Cottages)	254CT	254CT	Honeywell - Adams Device	Trinity
0416	256 Colchester Ave (Cottages)	256CT	256CT	Honeywell - Adams Device	Trinity
0417	258 Colchester Ave (Cottages)	258CT	258CT	Honeywell - Adams Device	Trinity
0418	50 Fletcher Pl	50FP			
0419	23 Mansfield Ave	23MF	23MF	Honeywell - Adams Device	Trinity
0425	Redstone Apartment Complex	RED_AC			
0450	Centennial Court Apt Complex	CCA			
0500	Cohen Hall	Cohen	Taft, Cohen	Johnson Controls	Trinity
0502	Catamount Store	CAT_S			
0506	Gables Montecito	GM			
0507	Towne Brooke Cmns CT	TBCC			

0508	VT Dept of Health - Colchester	VDHC			
0509	400 Avenue D Williston	400AD			
0510	112 COLCHESTER AVE	112C			
0515	Dorset St Prof Ctr	DPC			
0516	Avalon Norwalk Apartments	ANA			
0519	140 Kennedy Dr	140K			
0522	Chittenden Emrgcy Food Shelf	CEFS			
0523	Spinner Place	SP			
0526	Howard Dean Educ Ctr	HDEC			
0528	Library Storage Facility	LSF			
0529	UVM Computer Tech Park	CTechP			
0539	19 Roosevelt Highway	19RH			
0543	208 Flynn Avenue (Flynn Freezer Farm)	FF	FF	Honeywell	South
0545	Colchester Research Facility	CRF	CRF	Honeywell	Medplex
0563	Crew Club Boat House Storage	CCBHS			
0564	Broad Strt Commons Plattsburgh	BSCP			
0566	14 Hudson Ave Glens Falls	14HAGF			
0567	401 Water Tower Circle	401WT			
0584	Community Sailing Ctr	CSC			
0621	E A Building 1111	FEA1111			
0650	E A Building 310	FEA310			
0651	E A Building 311	FEA311			
0652	E A Building 312	FEA312			
0661	E A Building 321 (Training & Compliance Office)	TCO	TCO	Honeywell - Adams Device	South
0670	E A Building 330	FEA330			
0671	E A Building 331 (Carpentry Shop)	FEA331	FEA331	Honeywell - Adams Device	South
0681	E A Building 340 (Auto & Metal Building)	AMR	AMR	Johnson Controls	South
0690	E A Building 350	FEA350			
0700	Hort Research Complex	HRC			
0701	HRC Blasberg Lab	HRC_BL			
0702	HRC Storage Building	HRC_SB			
0703	HRC Fertilizer Shed	HRC_FS			
0704	HRS Greenhouse 3	HRC_GH3			
0705	HRC Trickle Pump	HRC_TP			
0707	HRC Electric Pump 2	HRC_EP2			
0708	HRC Electric Pump	HRC_EP1			
0709	HRC Apple Storage	HRC_AS			
0710	HRC Pole Barn	HRC_PB			
0711	HRC Greenhouse West	HRC_GHW			
0712	HRC Greenhouse East	HRC_GHE			
0716	Wolcott Field Office	WFO			
0717	BRC Greenhouse 4	BRCGH_GH4	BRCGH_GH4	Honeywell - Adams Device (Wireless to AdamsDevice)	
0718	BRC Greenhouse 3	BRCGH_GH3	BRCGH_GH3	Honeywell - Adams Device (Wireless to AdamsDevice)	
0719	BRC Trailer	BRC_T			
0720	Bio Research Complex (spear St. Sewer Ejector Pumps Here)	BRC, SSS	BRC, SSS	Honeywell - Adams Device	
0721	BRC 663 Spear St	BRC_663S		Honeywell - Adams Device (Wireless Hub Here)	
0722	BRC 659 Spear St	BRC_659S			
0723	BRC Entomology Research	ET	ET	Honeywell - Adams Device	South
0724	BRC BioResearch Lab	BR	BR		

0725	BRC 657 Spear St	BRC_657S			
0726	BRC Entomology Shed	ET	ET		
0727	BRC 665 Spear St (Large Animal Facility)	LAF	LAF	Honeywell - Adams Device	South
0728	BRC Enviromental Safety Facility	ES	ES	Honeywell	South
0729	BRC Greenhouse 2	BRCGH_GH2	BRCGH_GH2	Honeywell - Adams Device (Wireless to AdamsDevice)	
0730	JER Research FOR Complex	JRC			
0731	JRC Lab Shop	JRC_L			
0732	JRC Residence	JRC_R			
0733	JRC Pesticide Storage	JRC_P			
0734	JRC Storage Building	JRC_S			
0735	JRC Forrest E Orr Conserv Ctr	JRC_F			
0736	JRC Fire Hose Storage	JRC_H			
0740	JRC CMT Char Barn	JRC_B			
0741	JRC Water Reserve	JRC_W			
0743	JRC Cement Bl In	JRC_C			
0750	Proctor Research Complex	PRC			
0751	PRC Research Lab	PRC_L			
0752	PRC Maple Prodctn Rsch Fac	PRC_M			
0754	PRC Instr Shelter	PRC_I			
0757	PRC Red Shed/Original Lab	PRC_R			
0758	PRC Sugar House	PRC_S			
0760	PRC Tank Shed	PRC_T			
0761	PRC Inst Trlr	PRC_IT			
0762	PRC Barrel Shed	PRC_B			
0763	PRC Three Bay Shed	PRC_TB			
0764	PRC Red Series Shed	PRC_R			
0770	Miller Research & Educatnl Ctr	MRC	MRC	Honeywell - Adams Device	South
0771	MREC Livestock Holding	MRC_LH			
0772	MREC Fitzsimmons Arena	MRC_FA			
0773	MREC Classroom	MRC_CL			
0779	MREC Storage	MRC_S			
0780	MREC Hay & Commodities	MRC_HC			
0782	MREC Nutrition Research Bldg	MRC_NR			
0784	MREC North Farm House	MRC_NF			
0787	Wheelock Barn	WEB			
0788	MREC Dry Cow Facility	MRC_CB	MRC_CB	Honeywell - Adams Device	South
0790	MREC Hardacre Equine Center	MRC_EC	MRC_EC	Honeywell - Adams Device	South
0791	MREC Maternity Barn	MRC_MB			
0792	MREC Youngstock Facility	MRC_YF			
0793	MREC Cream/Equine Sawdust Shed	MRC_SS			
0794	MREC Constructed Wetlands Shed	MRC_WS			
0795	MREC Milking Parlor&Cream Barn	MRC_CB			
0796	MREC Research Barn	MRC_RB			
0798	Outing Club Cabin	OC_C			
0800	Morgan Horse Complex	MHF			
0820	MHF Blacksmith Shop	MHF_BS			
0822	MHF Shed	MHF_S			
0824	MHF Main House Garage	MHF_MHG			
0825	MHF House 1	MHF_H1			

0826	MHF Main Barn	MHF_MB			
0827	MHF Main House & Office	MHF_MHO			
0829	MHF Pump House	MHF_PH			
0831	MHF Remount Barn	MHF_RB			
0832	MHF House 2	MHF_H2			
0833	MHF Brood Mares	MHF_BM			
0834	MHF Training Hll	MHF_TH			
0836	MHF Colt Barn	MHF_CB			
0837	MHF Sawdust Shed	MHF_SS			
0838	MHF Storage & Repair	MHF_SR			
0861	Rubenstein Ecosystem Lab	RB	RB	Honeywell	South
0862	GD Aiken Forestry Research Sci Lab	FOR			
0863	GD Aiken Forestry Research HdhsGrnhs	FOR			
0864	GD Aiken Forestry Research Garage	FOR			
0865	GD Aiken Forestry Research Strge Shd	FOR			
0866	Forestry Research Complex	FOR	FOR	Automated Logic / Honeywell - Adams Device	South
0922	EXT Rutland 271 North Main St	EXT_RU			
0923	EXT Orleans County 316 Main St	EXT_OC			
0924	EXT Addison Cty 23PondLn	EXT_AC			
0926	EXT Bennington County 320 Main	EXT_BC			
0928	EXT Caledonia Cty 374EmrsnFlRd	EXT_CC			
0930	EXT Franklin County 278 Main S	EXT_FC			
0932	EXT Lamiolle County 29 Sunset	EXT_LC			
0939	EXT Alburgh VT 146 Line Alburg	EXT_AL			
0940	EXT Windham County	EXT_WC			
0941	EXT WA Cty 327 Rte 302 Berlin	EXT_BE			
0942	EXT Engineering Brandon	EXT_EB			
0949	Centennial Field Complex	CFC			
0956	CFC Lapointe Field House	CFC_LFH			
0957	CFC HVAC & Elec Shop (Utilities Shop)	UTS	UTS	Honeywell - Adams Device	Trinity
0960	CFC Grounds Garage Pmp	CFC_GP			
0961	CFC Grounds Garage	GG	GG	Honeywell - Adams Device	Trinity
0962	CFC Grounds Building	CFC_GB			
0963	CFC Maintenance Facility	CFC_MF			
0971	CFC Maintenance Barn	CFC_MB			
0972	CFC Baseball Concession	CFC_BC			
0973	CFC Baseball Stand	CFC_BS			
0975	CFC Ticket Storage	CFC_TS			
0977	CFC Storage A	CFC_SA			
0980	CFC Visitor Field House (Centennial Field Storage)	CFS	CFS	Honeywell - Adams Device	Trinity
3500	Livak Track & Field Track Only	LTFT			
3501	Livak Inner Field	LIF			
3502	Moulton-Winder Field	MEFD			
3503	Virtue Field	Virtue Field	Virtue Field		
3504	Virtue-Moulton-Livak Perimeter	VMLP			
3505	Intramural Field 5	IF5			
3506	Intramural Field 6	IF6			
3507	CFC Baseball Field	CFC_BF			
3508	CFC Soccer Field	CFC_SF			
3575	Andrew Harris Commons	ANHC			

3638	Univ Heights Ampitheatre	UHA			
3671	Redstone Water Tower	RED_WT			
3672	Redstone Woods	RED_WD			
5031	Bolton Outing Club	BOC			
5032	Centennial Court Apartments	CCA			
5043	Edlund Tract South	ETS			
5055	Auclair North Tract	ANT			
5056	Auclair South Tract	AST			
5057	Ewing Gentry Tract	EGT			
5058	Gentry Tract	GET			
5059	Guillmette Tract	GMT			
5060	Hubbard Tract	HBT			
5061	Lafleur Tract	LFT			
5119	Carse Property	CP			

SECTION 6 - Building Management System (BMS) and Direct Digital Control (DDC) point names and expansions

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor		Units	Pt Type	Comments
HS.101A	HS.101A.CUHFC		HS	101A	CUHFC	Cab Unit Htr Fan Cmd	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.CUHFS		HS	101A	CUHFS	Cab Unit Htr Fan Status	OFF	ON	DI	Typical Room Points
HS.101A	HS.101A.CUHV		HS	101A	CUHV	Cab Unit Htr Valve	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.DHumV		HS	101A	DHumV	Duct Humidity Valve	%		AO	Typical Room Points
HS.101A	HS.101A.DSAH		HS	101A	DSAH	Duct Sup Air Hmidity	%RH		AI	Typical Room Points
HS.101A	HS.101A.FCUFC		HS	101A	FCUFC	Fan Coil Unit Fan Commnd	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.FCUFS		HS	101A	FCUFS	Fan Coil Unit Fan Status	OFF	ON	DI	Typical Room Points
HS.101A	HS.101A.FCUV		HS	101A	FCUV	Fan Coil Unit Valve	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.RadV		HS	101A	RadV	Radation Valve Closed	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.RadV		HS	101A	RadV	Radation Valve Cmd	%		AO	Typical Room Points
HS.101A	HS.101A.RHE		HS	101A	RHE	Reheat Enthalpy	BTU		AI	Typical Room Points
HS.101A	HS.101A.RHH		HS	101A	RHH	Reheat Humidity	%RH		AI	Typical Room Points
HS.101A	HS.101A.RHSAT		HS	101A	RHSAT	Reheat Supply Air Temp	DEG F		AI	Typical Room Points
HS.101A	HS.101A.RHT		HS	101A	RHT	Reheat Temp	DEG F		AI	Typical Room Points
HS.101A	HS.101A.RHV		HS	101A	RHV	Reheat Valve	%		AO	Typical Room Points
HS.101A	HS.101A.RmCO		HS	101A	RmCO	Room Carbon Monoxide	PPM		AI	Typical Room Points
HS.101A	HS.101A.RmCO2		HS	101A	RmCO2	Room Carbon Dioxide	PPM		AI	Typical Room Points
HS.101A	HS.101A.RmCO2Sp		HS	101A	RmCO2Sp	Room CarbonDioxide Setpt	PPM		AD	Typical Room Points
HS.101A	HS.101A.RmCOSp		HS	101A	RmCOSp	RoomCarbonMonoxide Setpt	PPM		AD	Typical Room Points
HS.101A	HS.101A.RmE		HS	101A	RmE	Room Enthalpy	BTU		AI	Typical Room Points
HS.101A	HS.101A.RmESp		HS	101A	RmESp	Room Enthalpy Setpt	BTU		AD	Typical Room Points
HS.101A	HS.101A.RmH		HS	101A	RmH	Room Humidity	%RH		AI	Typical Room Points
HS.101A	HS.101A.RmHSp		HS	101A	RmHSp	Room Humidity Setpt	%RH		AD	Typical Room Points
HS.101A	HS.101A.RmOS		HS	101A	RmOS	Room Occupancy Sensor	OFF	ON	DI	Typical Room Points
HS.101A	HS.101A.RmP		HS	101A	RmP	Room Pressure	INWC		AI	Typical Room Points
HS.101A	HS.101A.RmPSp		HS	101A	RmPSp	Room Pressure Setpt	PSI		AD	Typical Room Points
HS.101A	HS.101A.RmRSp		HS	101A	RmRSp	Room Remote Setpt	DEG F		AD	Typical Room Points
HS.101A	HS.101A.RmT		HS	101A	RmT	Lab ###$ Room Temp	DEG F		AI	Typical Room Points
HS.101A	HS.101A.RmT		HS	101A	RmT	Room ###$ Temp	DEG F		AI	Typical Room Points
HS.101A	HS.101A.RmTSp		HS	101A	RmTSp	Room Temp Setpt	DEG F		AD	Typical Room Points
HS.101A	HS.101A.RmWCSp		HS	101A	RmWCSp	Room Warmer Cooler Setpt	DEG F		AD	Typical Room Points
HS.101A	HS.101A.STANBY		HS	101A	STANBY	Standby Mode	NORMAL	STANBY	BD	Typical Room Points
HS.101A	HS.101A.UHC		HS	101A	UHC	Unit Heater Cmd	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.UHFC		HS	101A	UHFC	Unit Heater Fan Cmd	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.UHFS		HS	101A	UHFS	Unit Heater Fan Status	OFF	ON	DI	Typical Room Points
HS.101A	HS.101A.UHV		HS	101A	UHV	Unit Heater Valve	OFF	ON	DO	Typical Room Points
HS.101A	HS.101A.VAVSAT		HS	101A	VAVSAT	VAV Box Supply Air Temp	DEG F		AI	Typical Room Points
HS.101A	HS.101A.ZDmp		HS	101A	ZDmp	Zone Damper Cmd	%		AO	Typical Room Points
HS.101A	HS.101A.ZNDPT		HS	101A	ZNDPT	Zone Dew Pt Temp	DEG F		AI	Typical Room Points
HS.101A	HS.101A.ZNE		HS	101A	ZNE	Zone Enthalpy	BTU		AI	Typical Room Points
HS.101A	HS.101A.ZNH		HS	101A	ZNH	Zone Humidity	%RH		AI	Typical Room Points
HS.101A	HS.101A.ZNP		HS	101A	ZNP	Zone Pressuresure	INWC		AI	Typical Room Points
HS.101A	HS.101A.ZNSp		HS	101A	ZNSp	Zone Setpt	DEG F		AD	Typical Room Points

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.101A	HS.101A.ZNT		HS	101A	ZNT	Zone Temp	DEG F		AI	Typical Room Points
HS.102A	HS.102A.Dmp		HS	102A	Dmp	Damper Cmd	%		AO	Hood System Points In Room
HS.102A	HS.102A.FHExF		HS	102A	FHExF	Fume Hood Exh Flow	CFM		AI	Hood System Points In Room
HS.102A	HS.102A.FHJam		HS	102A	FHJam	Fume Hood Jam	NORMAL	ALARM	BD	Hood System Points In Room
HS.102A	HS.102A.FHSash		HS	102A	FHSash	Fume Hood Sash Position	%		AD	Hood System Points In Room
HS.102A	HS.102A.GExhAlm		HS	102A	GExhAlm	General Exhaust Alm	NORMAL	ALARM	DI	Hood System Points In Room
HS.102A	HS.102A.GExhF		HS	102A	GExhF	General Exhaust Flow	CFM		AI	Hood System Points In Room
HS.102A	HS.102A.MuAAlm		HS	102A	MuAAlm	Makeup Air Alm	NORMAL	ALARM	DI	Hood System Points In Room
HS.102A	HS.102A.MuAF		HS	102A	MuAF	Makeup Air Flow	CFM		AI	Hood System Points In Room
HS.102A	HS.102A.MuAT		HS	102A	MuAT	Makeup Air Temp	DEG F		AI	Hood System Points In Room
HS.102A	HS.102A.RadV		HS	102A	RadV	Radation Valve Cmd	%		AO	Hood System Points In Room
HS.102A	HS.102A.RehtV		HS	102A	RehtV	Reheat Valve Cmd	%		AO	Hood System Points In Room
HS.102A	HS.102A.RmH		HS	102A	RmH	Room Humidity	%RH		AI	Hood System Points In Room
HS.102A	HS.102A.RmOS		HS	102A	RmOS	Room Occupancy Sensor	UNOCC	OCC	DI	Hood System Points In Room
HS.102A	HS.102A.RmP		HS	102A	RmP	Room Pressuresure	INWC		AI	Hood System Points In Room
HS.102A	HS.102A.RmT		HS	102A	RmT	Room Temp	DEG F		AI	Hood System Points In Room
HS.103A	HS.103A.RmT		HS	103A	RmT	Electric Room Temp	DEG F		AI	Electric or Elevator Points
HS.104A	HS.104A.HP##C		HS	104A	HP##C	Heat Pump## Cmd	OFF	ON	DO	Heat Pump Points
HS.104A	HS.104A.HP##S		HS	104A	HP##S	Heat Pump## Status	OFF	ON	DI	Heat Pump Points
HS.105A	HS.105A.TB1IsoH		HS	105A	TB1IsoH	Room Humidity	%RH		AI	Isolation Room Points
HS.105A	HS.105A.TB1IsoP		HS	105A	TB1IsoP	Room Diff Pressure	INWC		AI	Isolation Room
HS.105A	HS.105A.TB1IsoT		HS	105A	TB1IsoT	Room Temp	DEG F		AI	Isolation Room
HS.130A	HS.130A.Door1		HS	130A	Door1	Lab Exterior Door	ACESS	SECURE	DI	Security
HS.AHU#	HS.AHU#.ACC1Ena		HS	AHU#	ACC1Ena	Air Cooled Cond1 Enable	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.BLDP		HS	AHU#	BLDP	Building Static Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.BldPCtlr		HS	AHU#	BldPCtlr	Building Pressure Ctlr			PID	
HS.AHU#	HS.AHU#.CCH		HS	AHU#	CCH	Cooling Coil Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CCSAT		HS	AHU#	CCSAT	Clg Coil Sup Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CCT		HS	AHU#	CCT	Cooling Coil Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CCV		HS	AHU#	CCV	Cooling Coil Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.CDAT		HS	AHU#	CDAT	Clg Disch Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CDATSp		HS	AHU#	CDATSp	Clg Disch Air Temp SetPt	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CDDmp		HS	AHU#	CDDmp	Cold Deck Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.CDDP		HS	AHU#	CDDP	Cold Deck Diff Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CDE		HS	AHU#	CDE	Cold Deck Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CDH		HS	AHU#	CDH	Cold Deck Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CDSp		HS	AHU#	CDSp	Cold Deck Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.CDT		HS	AHU#	CDT	Cold Deck Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CDV		HS	AHU#	CDV	Cold Deck Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.CDVP		HS	AHU#	CDVP	Cold Deck Vel Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CLGC		HS	AHU#	CLGC	Cooling Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.ClgCtlr		HS	AHU#	ClgCtlr	Cooling Ctlr			PID	
HS.AHU#	HS.AHU#.ClgLkSp		HS	AHU#	ClgLkSp	Cooling Lockout Setpt	DEG F		AD	Air Handling Unit

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.AHU#	HS.AHU#.CLGS		HS	AHU#	CLGS	Cooling Status	OFF	ON	BD	Air Handling Unit
HS.AHU#	HS.AHU#.ClgSp		HS	AHU#	ClgSp	Cooling Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.CLGV		HS	AHU#	CLGV	Cooling Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.CO2L		HS	AHU#	CO2L	Carbon Dioxide Level	PPM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.COL		HS	AHU#	COL	Carbon Monoxide Level	PPM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.CSAT		HS	AHU#	CSAT	Clg Sup Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DADPT		HS	AHU#	DADPT	Discharge Air DewPt Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DAE		HS	AHU#	DAE	Discharge Air Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DAF		HS	AHU#	DAF	Discharge Air Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DAH		HS	AHU#	DAH	Discharge Air Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DAHSp		HS	AHU#	DAHSp	DischargeAirHumiditySetpt	%RH		AD	Air Handling Unit
HS.AHU#	HS.AHU#.DALLCtlr		HS	AHU#	DALLCtlr	Disch Air Low Limit Ctlr			PID	
HS.AHU#	HS.AHU#.DAP		HS	AHU#	DAP	Discharge Air Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DAPSp		HS	AHU#	DAPSp	Discharge Air Pres Setpt	INWC		AD	Air Handling Unit
HS.AHU#	HS.AHU#.DAT		HS	AHU#	DAT	Discharge Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DATCtlr		HS	AHU#	DATCtlr	Disch Air Temp Ctlr			PID	
HS.AHU#	HS.AHU#.DATSp		HS	AHU#	DATSp	Discharge Air Temp Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.DAVP		HS	AHU#	DAVP	Discharge Air Vel Pres	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DSASP		HS	AHU#	DSASP	Duct Sup Air Static Pres	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.DSASPSp		HS	AHU#	DSASPSp	DuctSupAirStatcPresSetpt	INWC		AD	Air Handling Unit
HS.AHU#	HS.AHU#.DSSPCtlr		HS	AHU#	DSSPCtlr	Duct Sup StaticPres Ctlr			PID	
HS.AHU#	HS.AHU#.DX1C		HS	AHU#	DX1C	Dx Cooling Stage 1 Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.DX2C		HS	AHU#	DX2C	Dx Cooling Stage 2 Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.EAD		HS	AHU#	EAD	Exh Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.EADmp		HS	AHU#	EADmp	Exhaust Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.EAE		HS	AHU#	EAE	Exhaust Air Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EAF		HS	AHU#	EAF	Exhaust Air Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EAH		HS	AHU#	EAH	Exhaust Air Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EAP		HS	AHU#	EAP	Exhaust Air Pressures	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EASP		HS	AHU#	EASP	Exhaust Air Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.EAT		HS	AHU#	EAT	Exhaust Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EAVP		HS	AHU#	EAVP	Exhaust Air Vel Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.ECONC		HS	AHU#	ECONC	Economizer Cmd	OFF	ON	BD	Air Handling Unit
HS.AHU#	HS.AHU#.ECONSp		HS	AHU#	ECONSp	Economizer Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.EF##C		HS	AHU#	EF##C	Exhaust Fan Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.EF##DP		HS	AHU#	EF##DP	Exhaust Fan Diff Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EF##I		HS	AHU#	EF##I	Exhaust Fan Current	AMPS		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EF##IV		HS	AHU#	EF##IV	Exhaust Fan Inlet Vanes	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.EF##S		HS	AHU#	EF##S	Exhaust Fan Status	OFF	ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.EF##VFDC		HS	AHU#	EF##VFDC	Exhaust Fan Drive Cmd	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.EF##VFDF		HS	AHU#	EF##VFDF	Exhaust Fan Drive Fault	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.EF##VFDS		HS	AHU#	EF##VFDS	Exhaust Fan Drive Status	%		AI	Air Handling Unit
HS.AHU#	HS.AHU#.EVAPP		HS	AHU#	EVAPP	Evaporator Pressure	PSI		AI	Air Handling Unit

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.AHU#	HS.AHU#.FBDmp		HS	AHU#	FBDmp	Face Bypass Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.FBSWS		HS	AHU#	FBSWS	Face Bypass Swovr Status	DAMPER	VALVE	BD	Air Handling Unit
HS.AHU#	HS.AHU#.FBSWSp		HS	AHU#	FBSWSp	Face Bypass Swovr Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.FFltrDP		HS	AHU#	FFltrDP	Final Filter Diff Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.FFltrS		HS	AHU#	FFltrS	Final Filter Status	CLEAN	DIRTY	DI	Air Handling Unit
HS.AHU#	HS.AHU#.FltrDP		HS	AHU#	FltrDP	Filter Diff. Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.FltrS		HS	AHU#	FltrS	Filter Status	CLEAN	DIRTY	DI	Air Handling Unit
HS.AHU#	HS.AHU#.FrzP##C		HS	AHU#	FrzP##C	Freeze Pump Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.FrzP##S		HS	AHU#	FrzP##S	Freeze Pump Status	OFF	ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.GlyCtlr		HS	AHU#	GlyCtlr	Glycol Supply Temp Ctlr			PID	
HS.AHU#	HS.AHU#.GlyP##C		HS	AHU#	GlyP##C	Glycol Pump Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.GlyP##S		HS	AHU#	GlyP##S	Glycol Pump Status	OFF	ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.GlyRT		HS	AHU#	GlyRT	Glycol Return Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.GlyST		HS	AHU#	GlyST	Glycol Supply Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.GlySTSp		HS	AHU#	GlySTSp	Glycol Supply Temp Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.GlyT		HS	AHU#	GlyT	Glycol Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.GlyV		HS	AHU#	GlyV	Glycol Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HCE		HS	AHU#	HCE	Htg Coil Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HCFBD		HS	AHU#	HCFBD	Htg Coil Face Bypass Dpr	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HCH		HS	AHU#	HCH	Htg Coil Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HCRWT		HS	AHU#	HCRWT	Htg Coil Return Wtr Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HCSAT		HS	AHU#	HCSAT	Htg Coil Sup Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HCSATSp		HS	AHU#	HCSATSp	Htg Coil Sup Air Temp Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.HCSWT		HS	AHU#	HCSWT	Htg Coil Supply Wtr Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HCT		HS	AHU#	HCT	Htg Coil Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HCTSp		HS	AHU#	HCTSp	Htg Coil Temp Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.HCV		HS	AHU#	HCV	Heating Coil Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HCV		HS	AHU#	HCV	Htg Coil Valve	CLOSED	OPEN	DO	Air Handling Unit
HS.AHU#	HS.AHU#.HCV13		HS	AHU#	HCV13	Htg Coil 1/3 Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HCV23		HS	AHU#	HCV23	Htg Coil 2/3 Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HDAT		HS	AHU#	HDAT	Htg Disch Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HDH		HS	AHU#	HDH	Hot Deck Humidity	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HeatWhlS		HS	AHU#	HeatWhlS	Heat Wheel Status	OFF	ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.HeatWhlV		HS	AHU#	HeatWhlV	Heat Wheel Velocity	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HHLCtlr		HS	AHU#	HHLCtlr	Humidity High Limit Ctlr			PID	
HS.AHU#	HS.AHU#.HREAT		HS	AHU#	HREAT	Heat Recv Exh Air T	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HREEAT		HS	AHU#	HREEAT	Heat Recv Exh Ent Air T	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HRELAT		HS	AHU#	HRELAT	Heat Recv Exh Lev Air T	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HRPC		HS	AHU#	HRPC	Heat Recv Pump Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.HRSAT		HS	AHU#	HRSAT	Heat Recv Sup Air T	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HRSATSp		HS	AHU#	HRSATSp	Heat Recv SupAir T Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.HRSEAT		HS	AHU#	HRSEAT	Heat Recv Sup Ent Air T	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HRSLAT		HS	AHU#	HRSLAT	Heat Recv Sup Lev Air T	DEG F		AI	Air Handling Unit

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.AHU#	HS.AHU#.HRSWT		HS	AHU#	HRSWT	Heat Recv Sup Wtr T	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.HRSWTSp		HS	AHU#	HRSWTSp	Heat Recv SupWtr T Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.HRV		HS	AHU#	HRV	Heat Recv Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.HSPAlm		HS	AHU#	HSPAlm	High Static Pressure Alarm	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.HSPLCtlr		HS	AHU#	HSPLCtlr	High Static PresLmt Ctlr			PID	
HS.AHU#	HS.AHU#.HTAlm		HS	AHU#	HTAlm	High Temp Alarm	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.HTG1C		HS	AHU#	HTG1C	Heating Stage One Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.HTG2C		HS	AHU#	HTG2C	Heating Stage Two Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.HTGC		HS	AHU#	HTGC	Heating Cmd	OFF	ON	BD	Air Handling Unit
HS.AHU#	HS.AHU#.HTGSp		HS	AHU#	HTGSp	Heating Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.Hum1C		HS	AHU#	Hum1C	Humidifier Stage 1 Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.Hum2C		HS	AHU#	Hum2C	Humidifier Stage 2 Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.HumCtlr		HS	AHU#	HumCtlr	Humidity Ctlr			PID	
HS.AHU#	HS.AHU#.HumIV		HS	AHU#	HumIV	Humidifier Isolate Valve	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.HumV		HS	AHU#	HumV	Humidifier Valve Cmd	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.ISODmp		HS	AHU#	ISODmp	Isolation Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.LTA		HS	AHU#	LTA	Low Temp Alarm	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.LTD		HS	AHU#	LTD	Low Temp Detector	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.MADmp		HS	AHU#	MADmp	Mix Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.MAE		HS	AHU#	MAE	Mix Air Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.MAF		HS	AHU#	MAF	Mixed Air Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.MAH		HS	AHU#	MAH	Mixed Air Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.MALLCtlr		HS	AHU#	MALLCtlr	Mix Air Low Limit Ctlr			PID	
HS.AHU#	HS.AHU#.MALLT		HS	AHU#	MALLT	Mix Air Low Limit Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.MALLTSp		HS	AHU#	MALLTSp	MixAirLowLimit TempSetpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.MAP		HS	AHU#	MAP	Mixed Air Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.MASmkAlm		HS	AHU#	MASmkAlm	Mix Air Smoke Alarm	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.MAT		HS	AHU#	MAT	Mixed Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.MATCtlr		HS	AHU#	MATCtlr	Mix Air Temp Ctlr			PID	
HS.AHU#	HS.AHU#.MATSp		HS	AHU#	MATSp	Mixed Air Temp Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.MINPOSSp		HS	AHU#	MINPOSSp	Minimum Position Setpt	%		AD	Air Handling Unit
HS.AHU#	HS.AHU#.MOISTURE		HS	AHU#	MOISTURE	Moisture Detect	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.OAD		HS	AHU#	OAD	Outdoor Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.OADES		HS	AHU#	OADES	OA Dpr EndSwitch	OFF	ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.OADmp		HS	AHU#	OADmp	Outdoor Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.OADPT		HS	AHU#	OADPT	Outdoor Air Dew Pt Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAE		HS	AHU#	OAE	Outdoor Air Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAF		HS	AHU#	OAF	Outdoor Air Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAFltr		HS	AHU#	OAFltr	Outdoor Air Filter	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAH		HS	AHU#	OAH	Outdoor Air Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAP		HS	AHU#	OAP	Outdoor Air Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAT		HS	AHU#	OAT	Outdoor Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OATSp		HS	AHU#	OATSp	Outdoor Air Temp Setpt	DEG F		AD	Air Handling Unit

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.AHU#	HS.AHU#.OAV		HS	AHU#	OAV	Outdoor Air Volume	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAVP		HS	AHU#	OAVP	Outdoor Vel Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAWBT		HS	AHU#	OAWBT	Outdoor Air Wet Bulb Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.OAWBTSp		HS	AHU#	OAWBTSp	OutdoorAir WetBulb Setpt	DEG F		AD	Air Handling Unit
HS.AHU#	HS.AHU#.OUCmd		HS	AHU#	OUCmd	Occpancy Cmd	UNOCC	OCC	DO	Air Handling Unit
HS.AHU#	HS.AHU#.PFltrDP		HS	AHU#	PFltrDP	PreFilter Diff Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.PFltrS		HS	AHU#	PFltrS	PreFilter Diff Status	CLEAN	DIRTY	DI	Air Handling Unit
HS.AHU#	HS.AHU#.PHC		HS	AHU#	PHC	Preheat Cmd	OFF	ON	BD	Air Handling Unit
HS.AHU#	HS.AHU#.PHDAT		HS	AHU#	PHDAT	Preheat Disch Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.PHSAT		HS	AHU#	PHSAT	Preheat Sup Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.PHSATSp		HS	AHU#	PHSATSp	Preheat SupAirTemp Setpt	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.PHtgCtlr		HS	AHU#	PHtgCtlr	Preheat Temp Ctlr			PID	
HS.AHU#	HS.AHU#.PHV		HS	AHU#	PHV	Preheat Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.Purge		HS	AHU#	Purge	System Purge	NORMAL	PURGE	DI	Air Handling Unit
HS.AHU#	HS.AHU#.RADmp		HS	AHU#	RADmp	Return Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.RADPT		HS	AHU#	RADPT	Return Air Dew Pt Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RadV		HS	AHU#	RadV	Radiation Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.RAE		HS	AHU#	RAE	Return Air Enthalpy	BTU		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RAF		HS	AHU#	RAF	Return Air Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RAFCtlr		HS	AHU#	RAFCtlr	Return Air Flow Ctlr			PID	
HS.AHU#	HS.AHU#.RAH		HS	AHU#	RAH	Return Air Humidity	%RH		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RAP		HS	AHU#	RAP	Return Air Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RASD		HS	AHU#	RASD	Return Air Smk Detector	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.RASDmp		HS	AHU#	RASDmp	Return Air Smoke Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.RASP		HS	AHU#	RASP	Return Air Static Pressure	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RAT		HS	AHU#	RAT	Return Air Temp	DEG F		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RATHL		HS	AHU#	RATHL	Return Air Temp Hi Limit	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.RAVP		HS	AHU#	RAVP	Return Air Velocity Pres	INWC		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RFAlm		HS	AHU#	RFAlm	Return Fan Alarm	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.RFC		HS	AHU#	RFC	Return Fan Cmd	OFF	ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.RFDmp		HS	AHU#	RFDmp	Return Fan Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.RFF		HS	AHU#	RFF	Return Fan Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RFI		HS	AHU#	RFI	Return Fan Current	AMPS		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RFIVD		HS	AHU#	RFIVD	Return Fan InletVaneDmpr	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.RFS		HS	AHU#	RFS	Return Fan Status	OFF	ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.RFVFDC		HS	AHU#	RFVFDC	Return Fan Drive Cmd	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.RFVFDF		HS	AHU#	RFVFDF	Return Fan Drive Fault	NORMAL	ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.RFVFDS		HS	AHU#	RFVFDS	Return Fan Drive Status	%		AI	Air Handling Unit
HS.AHU#	HS.AHU#.RHCtlr		HS	AHU#	RHCtlr	Reheat Ctlr			PID	
HS.AHU#	HS.AHU#.RHV		HS	AHU#	RHV	Reheat Valve	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.SADmp		HS	AHU#	SADmp	Supply Air Damper	%		AO	Air Handling Unit
HS.AHU#	HS.AHU#.SAF		HS	AHU#	SAF	Supply Air Flow	CFM		AI	Air Handling Unit
HS.AHU#	HS.AHU#.SAFltr		HS	AHU#	SAFltr	Supply Air Filter	INWC		AI	Air Handling Unit

System Name	Full Point Name	Area/Bldg Bldg/Flr	System	Device	Descriptor	Units	Pt Type	Comments
HS.AHU#	HS.AHU#.SAH	HS	AHU#	SAH	Supply Air Humidity	%RH	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SAHiSP	HS	AHU#	SAHiSP	Supply Air Hi StaticPres	INWC	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SALLCtlr	HS	AHU#	SALLCtlr	Sup Air Low Limit Ctlr		PID	
HS.AHU#	HS.AHU#.SALoSP	HS	AHU#	SALoSP	Supply Air Lo StaticPres	INWC	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SASD	HS	AHU#	SASD	Supply AIR Smk Detector	NORMAL ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.SASDmp	HS	AHU#	SASDmp	Supply Air Smoke Damper	%	AO	Air Handling Unit
HS.AHU#	HS.AHU#.SASP	HS	AHU#	SASP	Supply Air Static Pres	INWC	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SAT	HS	AHU#	SAT	Supply Air Temp	DEG F	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SATCtlr	HS	AHU#	SATCtlr	Supply Air Temp Ctlr		PID	
HS.AHU#	HS.AHU#.SAVP	HS	AHU#	SAVP	Supply Air Velocity Pres	INWC	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SFAlm	HS	AHU#	SFAlm	Supply Fan Alarm	NORMAL ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.SFC	HS	AHU#	SFC	Supply Fan Cmd	OFF ON	DO	Air Handling Unit
HS.AHU#	HS.AHU#.SFDmp	HS	AHU#	SFDmp	Supply Fan Damper	%	AO	Air Handling Unit
HS.AHU#	HS.AHU#.SFDP	HS	AHU#	SFDP	Supply Fan Diff Pressure	INWC	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SFF	HS	AHU#	SFF	Supply Fan Flow	CFM	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SFI	HS	AHU#	SFI	Supply Fan Current	AMPS	AI	Air Handling Unit
HS.AHU#	HS.AHU#.SFIVD	HS	AHU#	SFIVD	Supply Fan InletVaneDmpr	%	AO	Air Handling Unit
HS.AHU#	HS.AHU#.SFS	HS	AHU#	SFS	Supply Fan Status	OFF ON	DI	Air Handling Unit
HS.AHU#	HS.AHU#.SFVFDC	HS	AHU#	SFVFDC	Supply Fan Drive Cmd	%	AO	Air Handling Unit
HS.AHU#	HS.AHU#.SFVFDF	HS	AHU#	SFVFDF	Supply Fan Drive Fault	NORMAL ALARM	DI	Air Handling Unit
HS.AHU#	HS.AHU#.SFVFDS	HS	AHU#	SFVFDS	Supply Fan Drive Status	%	AI	Air Handling Unit
HS.AHU#	HS.AHU#.ShdnC	HS	AHU#	ShdnC	Shutdown Cmd	NORMAL SHUTDN	BD	Air Handling Unit
HS.AHU#	HS.AHU#.VDC	HS	AHU#	VDC	Vol. Damper Cmd	%	AO	Air Handling Unit
HS.AHU#	HS.AHU#.VentC	HS	AHU#	VentC	Vent Mode Cmd	NORMAL VENT	BD	Air Handling Unit
HS.AHU#	HS.AHU#.WetFlrS	HS	AHU#	WetFlrS	Wet Floor Sensor	NORMAL ALARM	DI	Air Handling Unit
HS.Bldg	HS.Bldg.ACAlm	HS	Bldg	ACAlm	Air ComPressuresor Alarm	NORMAL ALARM	DI	General Building Points
HS.Bldg	HS.Bldg.ACP	HS	Bldg	ACP	Air ComPressuresor Pressuresur	PSI	AI	General Building Points
HS.Bldg	HS.Bldg.ADAlm	HS	Bldg	ADAlm	Air Dryer Alarm	NORMAL ALARM	DI	General Building Points
HS.Bldg	HS.Bldg.CAC#P	HS	Bldg	CAC#P	Ctrl Air Comprsr# Pres	PSI	AI	General Building Points
HS.Bldg	HS.Bldg.CAC#S	HS	Bldg	CAC#S	Ctrl Air Comprsr# Status	NORMAL ALARM	DI	General Building Points
HS.Bldg	HS.Bldg.DEMAND	HS	Bldg	DEMAND	Demand Limit Input	%	AI	General Building Points
HS.Bldg	HS.Bldg.DHWP#S	HS	Bldg	DHWP#S	Dom Hot Wtr Pump# Status	OFF ON	DI	General Building Points
HS.Bldg	HS.Bldg.DHWSV	HS	Bldg	DHWSV	Dom Hot Wtr Steam Valve	%	AO	General Building Points
HS.Bldg	HS.Bldg.DHWT	HS	Bldg	DHWT	Domestic Hot Wtr Temp	DEG F	AI	General Building Points
HS.Bldg	HS.Bldg.DHWTSp	HS	Bldg	DHWTSp	DomesticHotWtr TempSetpt	DEG F	AD	General Building Points
HS.Bldg	HS.Bldg.DWP	HS	Bldg	DWP	Domestic Water Pressure	PSI	AI	General Building Points
HS.Bldg	HS.Bldg.EF##C	HS	Bldg	EF##C	Toilet Exh Fan## Cmd	OFF ON	DO	
HS.Bldg	HS.Bldg.EF##C	HS	Bldg	EF##C	Gen Exh Fan## Cmd	OFF ON	DO	
HS.Bldg	HS.Bldg.EF##S	HS	Bldg	EF##S	Toilet Exh Fan## Status	OFF ON	DI	
HS.Bldg	HS.Bldg.EF##S	HS	Bldg	EF##S	Gen Exh Fan## Status	OFF ON	DI	
HS.Bldg	HS.Bldg.ISOV	HS	Bldg	ISOV	Isolation Valve	%	AO	General Building Points
HS.Bldg	HS.Bldg.KW	HS	Bldg	KW	Building Power	KW	AI	General Building Points
HS.Bldg	HS.Bldg.KWH	HS	Bldg	KWH	Building Eng. Cons	KWH	AI	General Building Points

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.Bldg	HS.Bldg.OCCC		HS	Bldg	OCCC	Occupied Cmd	UNOCC	OCC	DO	General Building Points
HS.Bldg	HS.Bldg.OCCS		HS	Bldg	OCCS	Occupied Status	UNOCC	OCC	BD	General Building Points
HS.Bldg	HS.Bldg.StmF		HS	Bldg	StmF	Steam Flow	LBS/HR		AI	General Building Points
HS.Bldg	HS.Bldg.StmP		HS	Bldg	StmP	Steam Pressure	PSI		AI	General Building Points
HS.Bldg	HS.Bldg.StmT		HS	Bldg	StmT	Steam Temp	DEG F		AI	General Building Points
HS.Bldg	HS.Bldg.StmV		HS	Bldg	StmV	Steam Valve	%		AO	General Building Points
HS.Bldg	HS.Bldg.SUMWIN		HS	Bldg	SUMWIN	Summer Winter Cmd	SUMMER	WINTER	BD	General Building Points
HS.Bldg	HS.Bldg.WaterF		HS	Bldg	WaterF	Building Water Flow	GPM		AI	General Building Points
HS.Bldg	HS.Bldg.WtrTnkL		HS	Bldg	WtrTnkL	Water Tank Level	IN		AI	General Building Points
HS.CHWS	HS.CHWS. CT#BpV		HS	CHWS	CT#BpV	Clg Twr# Bypass Valve	%		AO	Chilled Water System
HS.CHWS	HS.CHWS. CWBpV		HS	CHWS	CWBpV	Cond Wtr Bypass Valve	%		AO	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#Alm		HS	CHWS	Chlr#Alm	Chiller# Alarm	NORMAL	ALARM	DI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#C		HS	CHWS	Chlr#C	Chiller# Cmd	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#CP		HS	CHWS	Chlr#CP	Chiller# Condensor Pres	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#DP		HS	CHWS	Chlr#DP	Chiller# Wtr Diff Pressures	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#ENA		HS	CHWS	Chlr#ENA	Chiller# Enable	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#RP		HS	CHWS	Chlr#RP	Chiller# Return Wtr Pres	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#Rst		HS	CHWS	Chlr#Rst	Chiller# Wtr Reset	DEG F		AD	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#RWF		HS	CHWS	Chlr#RWF	Chiller# Return Wtr Flow	GPM		AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#RWT		HS	CHWS	Chlr#RWT	Chiller# Return Wtr Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#S		HS	CHWS	Chlr#S	Chiller # Status	OFF	ON	DI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#Sp		HS	CHWS	Chlr#Sp	Chiller# Wtr Setpt	DEG F		AD	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#SP		HS	CHWS	Chlr#SP	Chiller# Wtr Supply Pres	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#SWF		HS	CHWS	Chlr#SWF	Chiller# Supply Wtr Flow	OFF	ON	AI	Chilled Water System
HS.CHWS	HS.CHWS.Chlr#SWT		HS	CHWS	Chlr#SWT	Chiller# Supply Wtr Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWDP		HS	CHWS	CHWDP	Chilled Wtr Diff Pressures	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWRF		HS	CHWS	CHWRF	Chilled Wtr Return Flow	GPM		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWRP		HS	CHWS	CHWRP	Chilled Wtr Return Pres	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWRst		HS	CHWS	CHWRst	Chilled Wtr Reset	DEG F		AD	Chilled Water System
HS.CHWS	HS.CHWS.CHWRT		HS	CHWS	CHWRT	Chilled Wtr Return Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWSF		HS	CHWS	CHWSF	Chilled Wtr Supply Flow	GPM		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWSP		HS	CHWS	CHWSP	Chilled Wtr Supply Pres	PSI		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWST		HS	CHWS	CHWST	Chilled Wtr Supply Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.CHWSTSp		HS	CHWS	CHWSTSp	Chilled Wtr SupTempSetpt	DEG F		AO	Chilled Water System
HS.CHWS	HS.CHWS.CT#C		HS	CHWS	CT#C	Clg Tower# Cmd	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.CT#Dmp		HS	CHWS	CT#Dmp	Clg Tower# Damper	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.CT#S		HS	CHWS	CT#S	Clg Tower# Status	OFF	ON	DI	Chilled Water System
HS.CHWS	HS.CHWS.CT#SmpT		HS	CHWS	CT#SmpT	Clg Tower# Sump Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.CT#V		HS	CHWS	CT#V	Clg Tower# Valve	%		AO	Chilled Water System
HS.CHWS	HS.CHWS.CT#VFDC		HS	CHWS	CT#VFDC	Clg Tower# Drive Cmd	%		AO	Chilled Water System
HS.CHWS	HS.CHWS.CT#VFDF		HS	CHWS	CT#VFDF	Clg Tower# Drive Fault	NORMAL	ALARM	DI	Chilled Water System
HS.CHWS	HS.CHWS.CT#VFDS		HS	CHWS	CT#VFDS	Clg Tower# Drive Status	%		AI	Chilled Water System
HS.CHWS	HS.CHWS.CT#Vib		HS	CHWS	CT#Vib	Clg Tower# Vibration	NORMAL	ALARM	DI	Chilled Water System

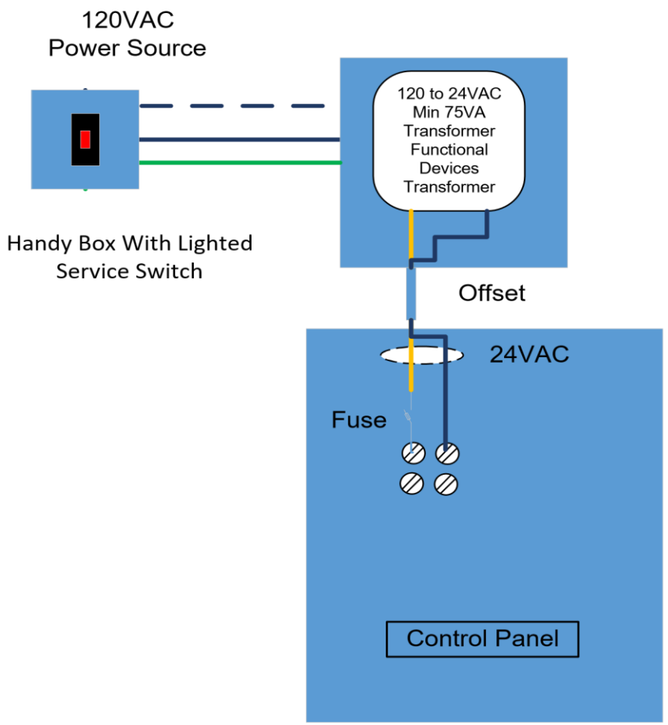
System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.CHWS	HS.CHWS.CWRF		HS	CHWS	CWRF	Cond Water Return Flow	GPM		AI	Chilled Water System
HS.CHWS	HS.CHWS.CWRFS		HS	CHWS	CWRFS	Cond Water Return FlowSw	OFF	ON	DI	Chilled Water System
HS.CHWS	HS.CHWS.CWRT		HS	CHWS	CWRT	Cond Water Return Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.CWSFS		HS	CHWS	CWSFS	Cond Water Supply FlowSw	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.CWST		HS	CHWS	CWST	Cond Water Supply Temp	DEG F		AI	Chilled Water System
HS.CHWS	HS.CHWS.CWSTSp		HS	CHWS	CWSTSp	CondWater Supply T Setpt	DEG F		AD	Chilled Water System
HS.CHWS	HS.CHWS.P##C		HS	CHWS	P##C	CHW Pump## Cmd	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.P##C		HS	CHWS	P##C	CW Pump## Cmd	OFF	ON	DO	Chilled Water System
HS.CHWS	HS.CHWS.P##S		HS	CHWS	P##S	CHW Pump## Status	OFF	ON	DI	Chilled Water System
HS.CHWS	HS.CHWS.P##S		HS	CHWS	P##S	CW Pump## Status	OFF	ON	DI	Chilled Water System
HS.CHWS	HS.CHWS.P##VFDC		HS	CHWS	P##VFDC	CHW Pump## Drive Cmd	%		AO	Chilled Water System
HS.CHWS	HS.CHWS.P##VFDC		HS	CHWS	P##VFDC	CW Pump## Drive Cmd	%		AO	Chilled Water System
HS.CHWS	HS.CHWS.P##VFDF		HS	CHWS	P##VFDF	CHW Pump## Drive Fault	NORMAL	ALARM	DI	Chilled Water System
HS.CHWS	HS.CHWS.P##VFDF		HS	CHWS	P##VFDF	CW Pump## Drive Fault	NORMAL	ALARM	DI	Chilled Water System
HS.CHWS	HS.CHWS.P##VFDS		HS	CHWS	P##VFDS	CHW Pump## Drive Status	%		AI	Chilled Water System
HS.CHWS	HS.CHWS.P##VFDS		HS	CHWS	P##VFDS	CW Pump## Drive Status	%		AI	Chilled Water System
HS.FIRE	HS.FIRE.FAPAlm		HS	FIRE	FAPAlm	Fire Alarm Panel Alarm	NORMAL	ALARM	DI	Fire Alam System
HS.FIRE	HS.FIRE.FAPTrbl		HS	FIRE	FAPTrbl	Fire Alarm Panel Trouble	NORMAL	ALARM	DI	Fire Alam System
HS.HRU#	HS.HRU#.EAT		HS	HRU#	EAT	Exhaust Air Temp	DEG F		AI	Heat Recovers Unit
HS.HRU#	HS.HRU#.EF1C		HS	HRU#	EF1C	Exhaust Fan# Cmd	OFF	ON	DO	Heat Recovers Unit
HS.HRU#	HS.HRU#.EF1S		HS	HRU#	EF1S	Exhaust Fan# Status	OFF	ON	DI	Heat Recovers Unit
HS.HRU#	HS.HRU#.FBDmp		HS	HRU#	FBDmp	Face & Bypass Damper	%		AO	Heat Recovers Unit
HS.HRU#	HS.HRU#.SAT		HS	HRU#	SAT	Supply Air Temp	DEG F		AI	Heat Recovers Unit
HS.HRU#	HS.HRU#.SF#C		HS	HRU#	SF#C	Supply Fan Cmd	OFF	ON	DO	Heat Recovers Unit
HS.HRU#	HS.HRU#.SF#S		HS	HRU#	SF#S	Supply Fan Status	OFF	ON	DI	Heat Recovers Unit
HS.HWS	HS.HWS.Blr1Alm		HS	HWS	Blr1Alm	Boiler1 Alarm	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.Blr1C		HS	HWS	Blr1C	Boiler1 Cmd	OFF	ON	DO	Heating Water System
HS.HWS	HS.HWS.Blr1E		HS	HWS	Blr1E	Boiler1 Enable	DISABLE	ENABLE	DO	Heating Water System
HS.HWS	HS.HWS.Blr1FF		HS	HWS	Blr1FF	Boiler1 Flame Failure	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.Blr1HF		HS	HWS	Blr1HF	Boiler1 High Fire	OFF	ON	DO	Heating Water System
HS.HWS	HS.HWS.Blr1RWT		HS	HWS	Blr1RWT	Boiler1 ReturnWater Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.Blr1S		HS	HWS	Blr1S	Boiler1 Status	OFF	ON	DI	Heating Water System
HS.HWS	HS.HWS.Blr1SFM		HS	HWS	Blr1SFM	Boiler1 Steam Flow Meter	LBS/HR		AI	Heating Water System
HS.HWS	HS.HWS.Blr1SWT		HS	HWS	Blr1SWT	Boiler1 SupplyWater Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.Blr2Alm		HS	HWS	Blr2Alm	Boiler2 Alarm	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.Blr2C		HS	HWS	Blr2C	Boiler2 Cmd	OFF	ON	DO	Heating Water System
HS.HWS	HS.HWS.Blr2E		HS	HWS	Blr2E	Boiler2 Enable	DISABLE	ENABLE	DO	Heating Water System
HS.HWS	HS.HWS.Blr2FF		HS	HWS	Blr2FF	Boiler2 Flame Failure	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.Blr2HF		HS	HWS	Blr2HF	Boiler2 High Fire	OFF	ON	DO	Heating Water System
HS.HWS	HS.HWS.Blr2RWT		HS	HWS	Blr2RWT	Boiler1 ReturnWater Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.Blr2S		HS	HWS	Blr2S	Boiler2 Status	OFF	ON	DI	Heating Water System
HS.HWS	HS.HWS.Blr2SFM		HS	HWS	Blr2SFM	Boiler1 Steam Flow Meter	LBS/HR		AI	Heating Water System
HS.HWS	HS.HWS.Blr2SWT		HS	HWS	Blr2SWT	Boiler1 SupplyWater Temp	DEG F		AI	Heating Water System

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.HWS	HS.HWS.BSWT		HS	HWS	BSWT	Boilers Sup Wtr Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.BSWTSp		HS	HWS	BSWTSp	Boilers SupWtrTemp Setpt	DEG F		AD	Heating Water System
HS.HWS	HS.HWS.CondL		HS	HWS	CondL	Condensate Level	LEVEL		AI	Heating Water System
HS.HWS	HS.HWS.DPCtlr		HS	HWS	DPCtlr	Diffential Pressure Ctlr			PID	
HS.HWS	HS.HWS.ExpTHL		HS	HWS	ExpTHL	Expansion Tank High Level	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.ExpTLL		HS	HWS	ExpTLL	Expansion Tank Low Level	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.HCV		HS	HWS	HCV	Htg Control Valve	%		AO	Heating Water System
HS.HWS	HS.HWS.HtgCtlr		HS	HWS	HtgCtlr	Heating Ctlr			PID	
HS.HWS	HS.HWS.HWCtlr		HS	HWS	HWCtlr	Hot Water Temp Ctlr			PID	
HS.HWS	HS.HWS.HWCV		HS	HWS	HWCV	Hot Water Control Valve	%		AO	Heating Water System
HS.HWS	HS.HWS.HWDP		HS	HWS	HWDP	Hot Water Diff Pressure	PSI		AI	Heating Water System
HS.HWS	HS.HWS.HWDPSp		HS	HWS	HWDPSp	Hot Water DiffPres Setpt	PSI		AD	Heating Water System
HS.HWS	HS.HWS.HWDPV		HS	HWS	HWDPV	Hot Water Diff PresValve	%		AO	Heating Water System
HS.HWS	HS.HWS.HWRF		HS	HWS	HWRF	Hot Water Return Flow	GPM		AI	Heating Water System
HS.HWS	HS.HWS.HWRP		HS	HWS	HWRP	Hot Water Return Pressure	PSI		AI	Heating Water System
HS.HWS	HS.HWS.HWRT		HS	HWS	HWRT	Hot Water Return Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.HWSF		HS	HWS	HWSF	Hot Water Supply Flow	GPM		AI	Heating Water System
HS.HWS	HS.HWS.HWSP		HS	HWS	HWSP	Hot Water Supply Pressure	PSI		AI	Heating Water System
HS.HWS	HS.HWS.HWST		HS	HWS	HWST	Hot Water Supply Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.HWSTSp		HS	HWS	HWSTSp	HotWaterSupply TempSetpt	DEG F		AD	Heating Water System
HS.HWS	HS.HWS.HX13V		HS	HWS	HX13V	Heat Exchanger 1/3 Valve	%		AO	Heating Water System
HS.HWS	HS.HWS.HX23V		HS	HWS	HX23V	Heat Exchanger 2/3 Valve	%		AO	Heating Water System
HS.HWS	HS.HWS.HxCtlr		HS	HWS	HxCtlr	Heat Exchanger Ctlr			PID	
HS.HWS	HS.HWS.HXV		HS	HWS	HXV	Heat Exchanger Valve	%		AO	Heating Water System
HS.HWS	HS.HWS.OAH		HS	HWS	OAH	Outdoor Air Humidity	%RH		AI	Heating Water System
HS.HWS	HS.HWS.OAT		HS	HWS	OAT	Outdoor Air Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.OATSp		HS	HWS	OATSp	Outdoor Air Temp Setpt	DEG F		AD	Heating Water System
HS.HWS	HS.HWS.P1C		HS	HWS	P1C	Hot Wtr Pump1 Cmd	OFF	ON	DO	Heating Water System
HS.HWS	HS.HWS.P1FS		HS	HWS	P1FS	Hot Wtr Pump 1 Flow Sw	OFF	ON	DI	Heating Water System
HS.HWS	HS.HWS.P1I		HS	HWS	P1I	Hot Wtr Pump 1 Current	AMPS		AI	Heating Water System
HS.HWS	HS.HWS.P1S		HS	HWS	P1S	Hot Wtr Pump1 Status	OFF	ON	DI	Heating Water System
HS.HWS	HS.HWS.P1VFDC		HS	HWS	P1VFDC	Hot Wtr Pump1 Drive	%		AO	Heating Water System
HS.HWS	HS.HWS.P1VFDC		HS	HWS	P1VFDC	Hot Wtr Pump1 Drive Cmd	%		AO	Heating Water System
HS.HWS	HS.HWS.P1VFDF		HS	HWS	P1VFDF	Hot Wtr Pump1 DriveFault	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.P1VFDS		HS	HWS	P1VFDS	Hot Wtr Pump1DriveStatus	%		AI	Heating Water System
HS.HWS	HS.HWS.P2C		HS	HWS	P2C	Hot Wtr Pump2 Cmd	OFF	ON	DO	Heating Water System
HS.HWS	HS.HWS.P2FS		HS	HWS	P2FS	Hot Wtr Pump 2 Flow Sw	OFF	ON	DI	Heating Water System
HS.HWS	HS.HWS.P2I		HS	HWS	P2I	Hot Wtr Pump 2 Current	AMPS		AI	Heating Water System
HS.HWS	HS.HWS.P2S		HS	HWS	P2S	Hot Wtr Pump2 Status	OFF	ON	DI	Heating Water System
HS.HWS	HS.HWS.P2VFDC		HS	HWS	P2VFDC	Hot Wtr Pump2 Drive	%		AO	Heating Water System
HS.HWS	HS.HWS.P2VFDC		HS	HWS	P2VFDC	Hot Wtr Pump2 Drive Cmd	%		AO	Heating Water System
HS.HWS	HS.HWS.P2VFDF		HS	HWS	P2VFDF	Hot Wtr Pump2 DriveFault	NORMAL	ALARM	DI	Heating Water System
HS.HWS	HS.HWS.P2VFDS		HS	HWS	P2VFDS	Hot Wtr Pump2DriveStatus	%		AI	Heating Water System

System Name	Full Point Name	Area/Bldg	Bldg/Flr	System	Device	Descriptor	Units		Pt Type	Comments
HS.HWS	HS.HWS.RWT		HS	HWS	RWT	Return Water Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.SFM		HS	HWS	SFM	Steam Flow Meter	LBS/HR		AI	Heating Water System
HS.HWS	HS.HWS.SWT		HS	HWS	SWT	Supply Water Temp	DEG F		AI	Heating Water System
HS.HWS	HS.HWS.SWTSp		HS	HWS	SWTSp	Supply Water Temp Setpt	DEG F		AD	Heating Water System
HS.HWS	HS.HWS.WDP		HS	HWS	WDP	Water Diff Pressure	PSI		AI	Heating Water System
HS.MdAir	HS.MdAir.CO		HS	MdAir	CO	Medical Air CO High	NORMAL	ALARM	DI	Medical Air Equipment
HS.MdAir	HS.MdAir.DntlATP		HS	MdAir	DntlATP	Dental Air Tank Pressure	PSI		AI	Medical Air Equipment
HS.MdAir	HS.MdAir.DntlVacm		HS	MdAir	DntlVacm	Dental Vacuum Tank Pres	INHG		AI	Medical Air Equipment
HS.MdAir	HS.MdAir.LagPump		HS	MdAir	LagPump	Medical Vac Lag Pump	NORMAL	ALARM	DI	Medical Air Equipment
HS.MdAir	HS.MdAir.LVP1S		HS	MdAir	LVP1S	Lab Vacum Pump1 Status	INHG		DI	Medical Air Equipment
HS.MdAir	HS.MdAir.MAC1S		HS	MdAir	MAC1S	Med Air Comp1 Status	NORMAL	ALARM	DI	Medical Air Equipment
HS.MdAir	HS.MdAir.MAirDPT		HS	MdAir	MAirDPT	Medical Air Dew Pt Temp	NORMAL	ALARM	DI	Medical Air Equipment
HS.MdAir	HS.MdAir.MAT1P		HS	MdAir	MAT1P	Medical Air Tank1 Pres	PSI		AI	Medical Air Equipment
HS.MdAir	HS.MdAir.MVT1P		HS	MdAir	MVT1P	Medical Vacuum Tank1 Pres	INHG		AI	Medical Air Equipment
HS.MdAir	HS.MdAir.VP1S		HS	MdAir	VP1S	Vacum Pump1 Status	NORMAL	ALARM	DI	Medical Air Equipment
HS.MdAir	HS.MdAir.VP2S		HS	MdAir	VP2S	Vacum Pump2 Status	NORMAL	ALARM	DI	Medical Air Equipment
HS.MdGas	HS.MdGas.NOxEmRes		HS	MdGas	NOxEmRes	Nit Ox Emg Reserve	NORMAL	ALARM	DI	Medical Gases
HS.MdGas	HS.MdGas.NOxLinPr		HS	MdGas	NOxLinPr	Nit Ox Lo Line Pressure	NORMAL	ALARM	DI	Medical Gases
HS.MdGas	HS.MdGas.OxHiPress		HS	MdGas	OxHiPress	Oxgn Hi Line Pressure	NORMAL	ALARM	DI	Medical Gases
HS.MdGas	HS.MdGas.OxLLinPr		HS	MdGas	OxLLinPr	Oxgn Lo Line Pressure	NORMAL	ALARM	DI	Medical Gases
HS.MdGas	HS.MdGas.OxRecLvl		HS	MdGas	OxRecLvl	Oxgn Record Level	NORMAL	ALARM	DI	Medical Gases
HS.MdGas	HS.MdGas.OxResFal		HS	MdGas	OxResFal	Oxgn Reserve Fail	NORMAL	ALARM	DI	Medical Gases
HS.MdGas	HS.MdGas.OxResUse		HS	MdGas	OxResUse	Oxgn Reserve Use	NORMAL	ALARM	DI	Medical Gases
HS.PWR	HS.PWR.EMG#Alm		HS	PWR	EMG#Alm	Emergency Gen Alarm	NORMAL	ALARM	DI	Power Related Points
HS.PWR	HS.PWR.EmG#Hz		HS	PWR	EmG#Hz	Emergency Gen Hertz	HTZ		AI	Power Related Points
HS.PWR	HS.PWR.EmG#I		HS	PWR	EmG#I	Emergency Gen Current	AMPS		AI	Power Related Points
HS.PWR	HS.PWR.EMG#I		HS	PWR	EMG#I	Diesel Gen. Amperage	AMPS		AI	Power Related Points
HS.PWR	HS.PWR.EmG#Kw		HS	PWR	EmG#Kw	Emergency Gen Kilowatts	KW		AI	Power Related Points
HS.PWR	HS.PWR.EmG#Kwh		HS	PWR	EmG#Kwh	Emergency Gen Kilowatt Hr	KWH		AI	Power Related Points
HS.PWR	HS.PWR.EmG#RS		HS	PWR	EmG#RS	Emergency Gen Run Status	OFF	ON	DI	Power Related Points
HS.PWR	HS.PWR.EMG#S		HS	PWR	EMG#S	Diesel Gen Status	OFF	ON	DI	Power Related Points
HS.PWR	HS.PWR.EmG#V		HS	PWR	EmG#V	Emergency Gen RMS Volts	VOLTS		AI	Power Related Points
HS.PWR	HS.PWR.NormEPwr		HS	PWR	NormEPwr	Normal-Emergency Power	NORMAL	EMRGNC	DI	Power Related Points

SECTION 7 – Details and Sketches

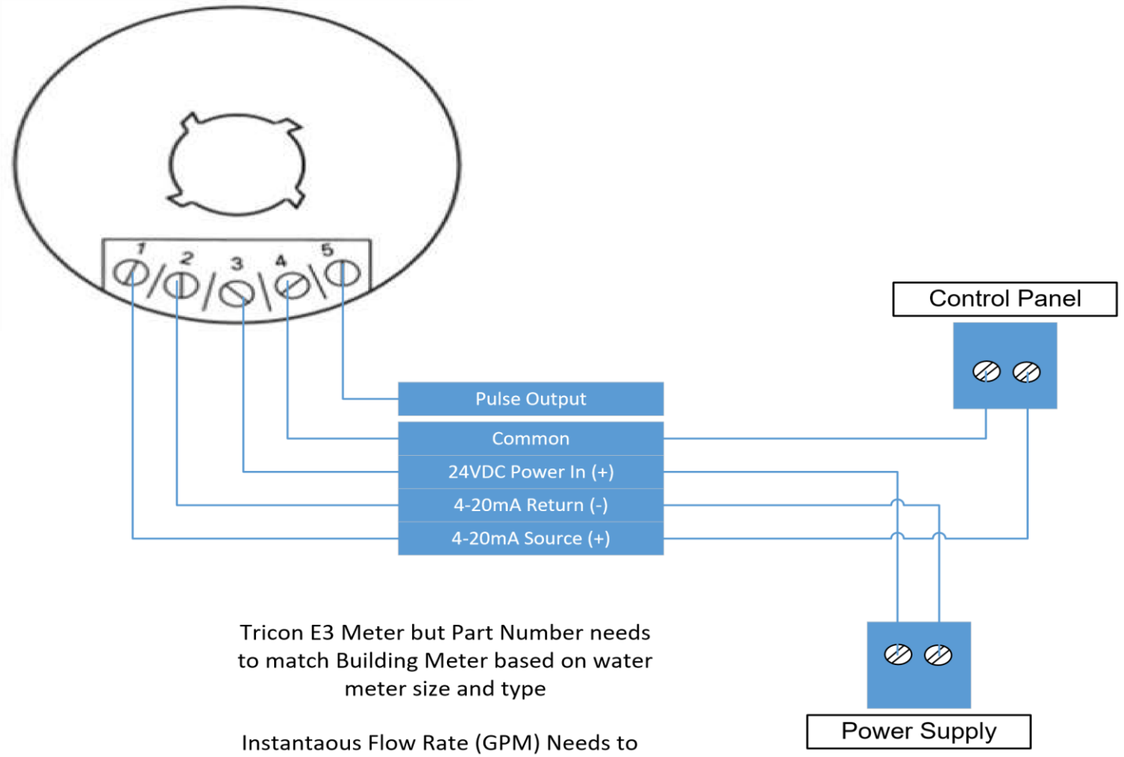
Panel 24 Volt Transformer Detail



Bill of Materials

Device	Qty	Description	Vendor
1221-PLC	1	Leviton Lighted Switch	Leviton
CTR4SI/EN-024V	1	Fuse Block 24V	

Water Meter Wiring Detail



Tricon E3 Meter but Part Number needs to match Building Meter based on water meter size and type

Instantaous Flow Rate (GPM) Needs to be totalized (Gallons)

Bill of Materials

Device	Qty	Description	Vendor
Power Supply	1	SMP3	SMP3 pow er supply/charger converts a low voltage AC input into a 6VDC, 12VDC or 24VDC output.
Mounting Hardware	1	CLIP1	Mounting Hardw are for SMP3
Mounting Hardware	1	ST3	Mounting Hardw are for SMP3

Shark Meter Wiring Detail

Modbus RTU

Ethernet comes from
Switch X Port X

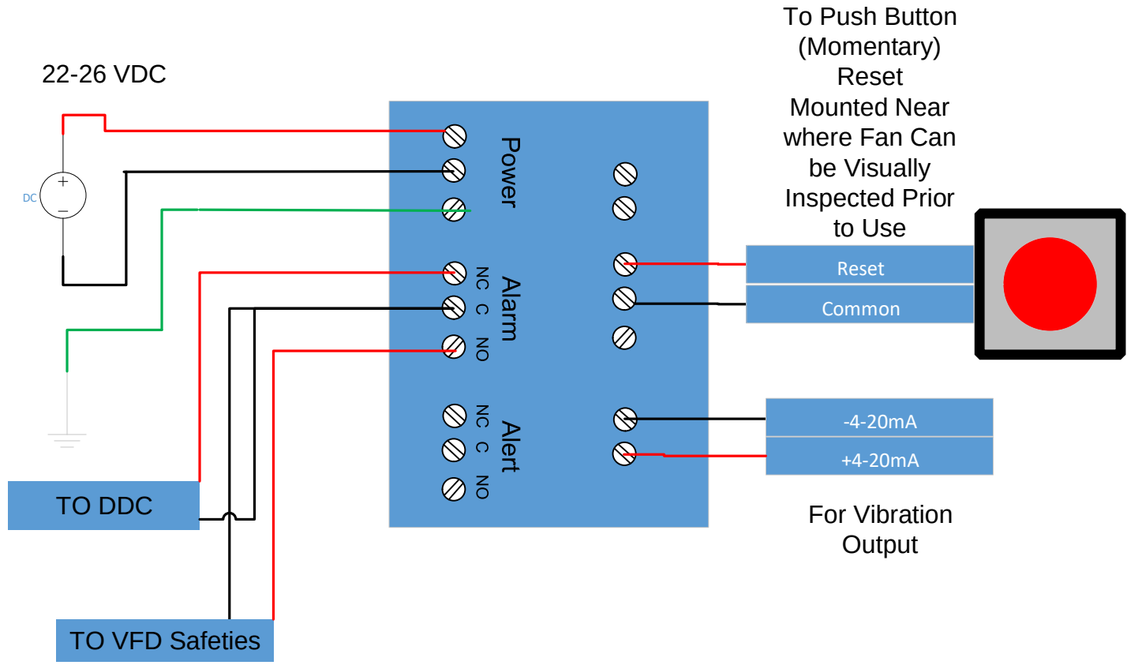
IP address: (assign per Controls Group)
Subnet:
Gateway:
Network Connection to Network Services
Switches

Service Switch to be Wired for the Shark
Meter Based on needs (Breaker or switch).

Bill of Materials

Device	Qty	Description	Vendor
ENCSHK200-120-60-10-V2-D2-INP100S-X	1	120/220 Volt Shark Meter 200	Electro Industries
ENCSHK200-277-60-10-V2-D2-INP100S-X	1	277 Volt Shark Meter 200	Electro Industries

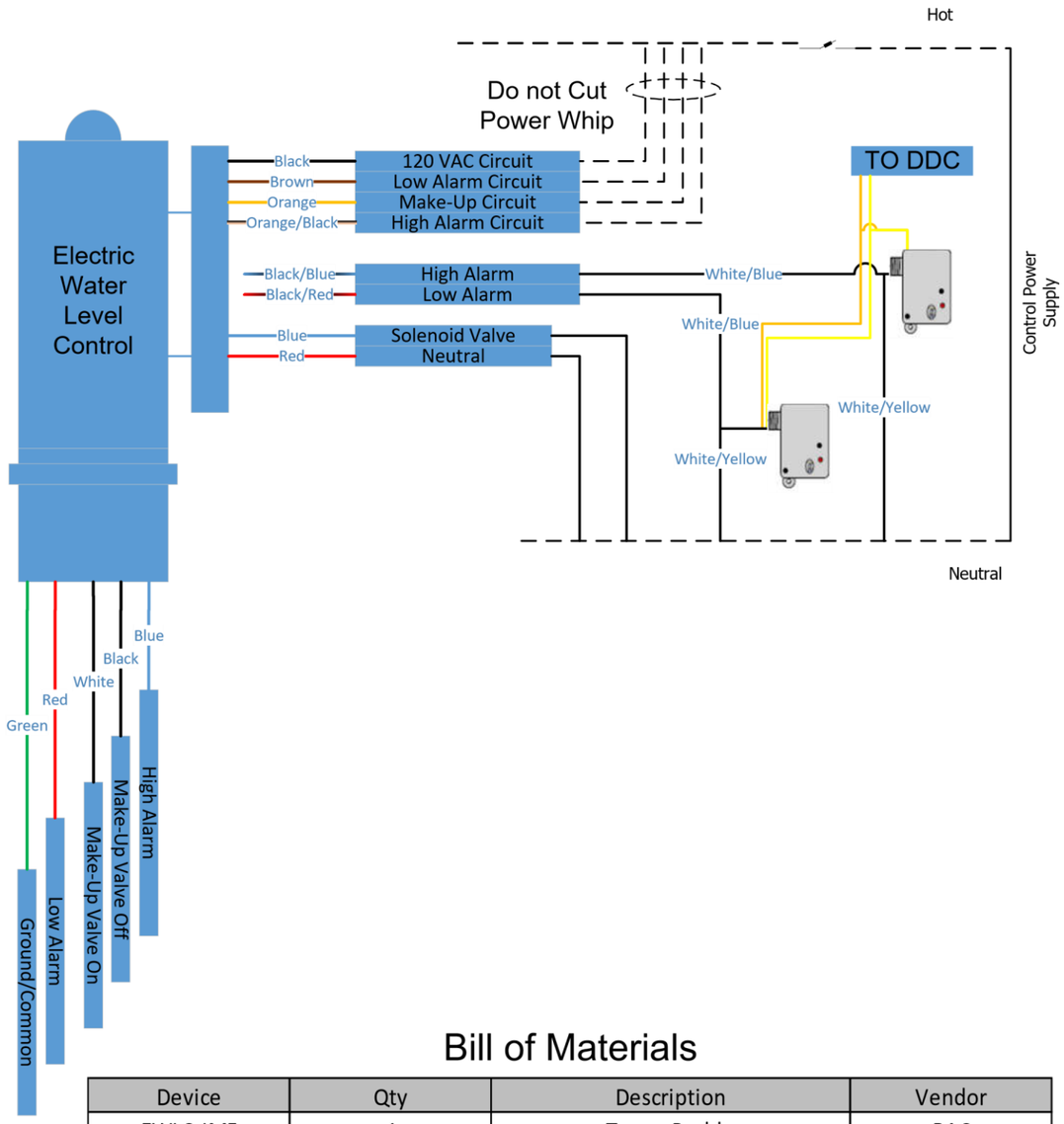
Vibration Switch Wiring Detail



Bill of Materials

Device	Qty	Description	Vendor
685B0011A10	1	IMI Sensor	IMI
W22PB-ER-11	1	Push Button	Alps Controls
CF1PB	1	Reset Enclosure	Alps Controls

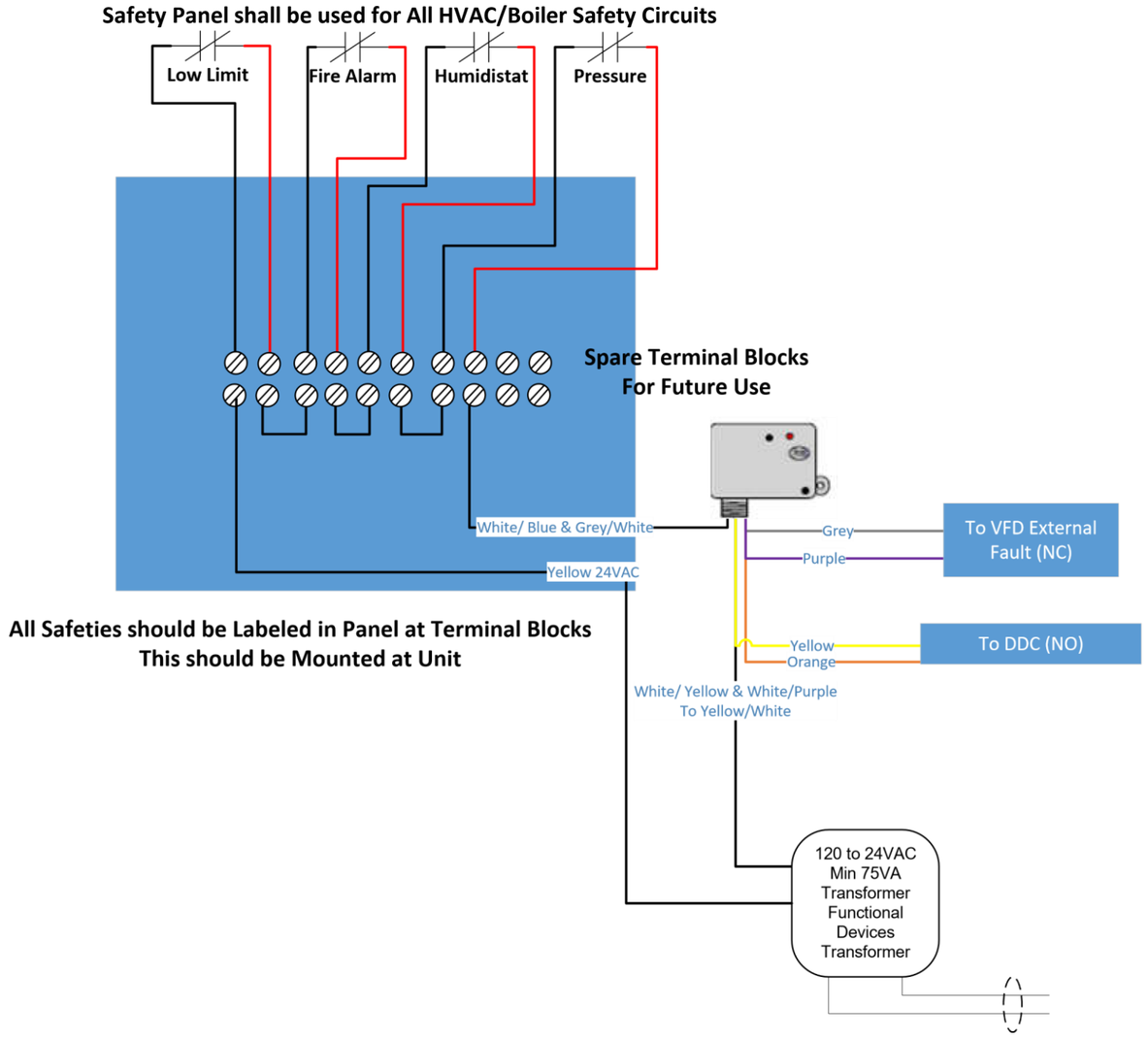
Tower Probe Wiring Detail



Bill of Materials

Device	Qty	Description	Vendor
EWLC-IM5	1	Tower Proble	BAC
RIBU1C	1	RIB Relay	Functional Devices

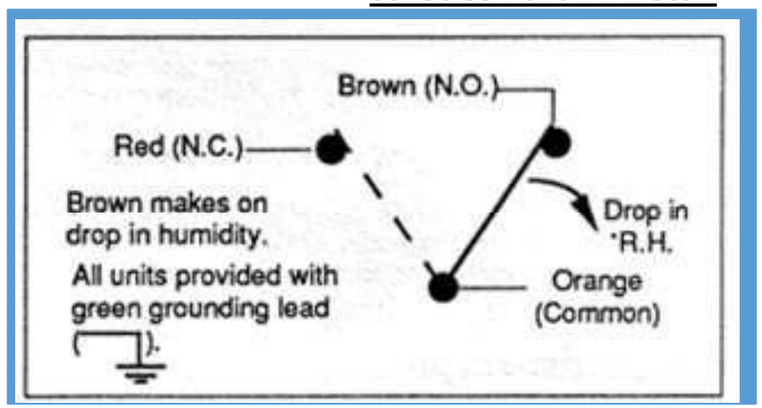
Safety Circuit Wiring Detail



Bill of Materials

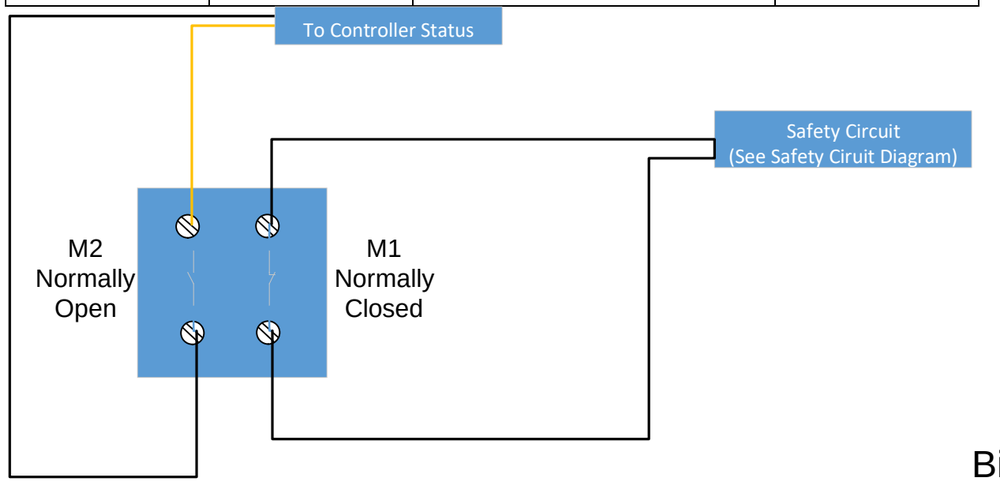
Device	Qty	Description	Vendor
RIBU2C	1	RIB Relay	Functional Devices

Safeties Part #1 Detail



For High Limit Cutout

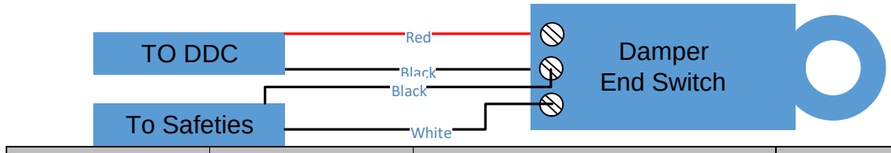
Device	Qty	Description	Vendor
HC-201	1	Barber Colman HC-201	Barber-Colman



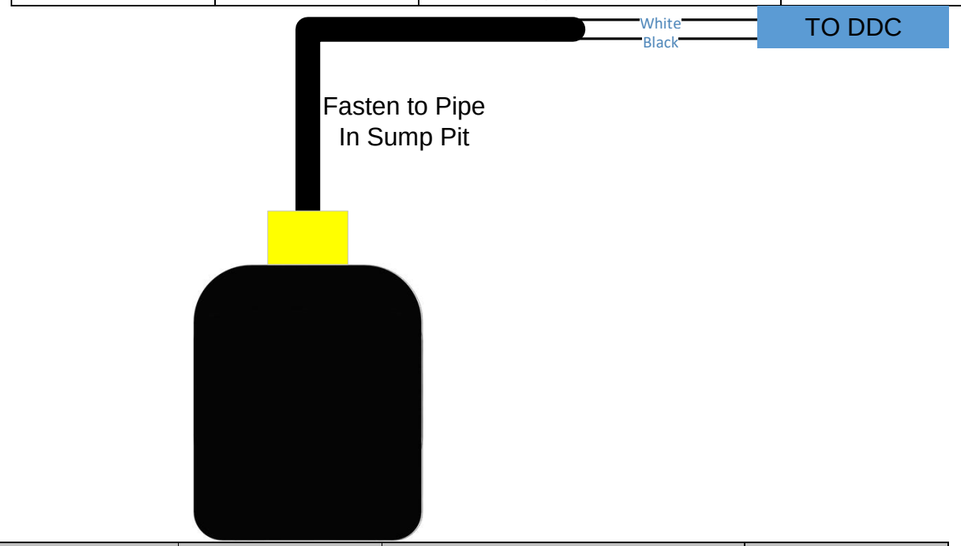
Bill of Materials

Device	Qty	Description	Vendor
A70GA	1	Series A70 Low Temperature Cutout	JCI

Safeties Part #2 Detail



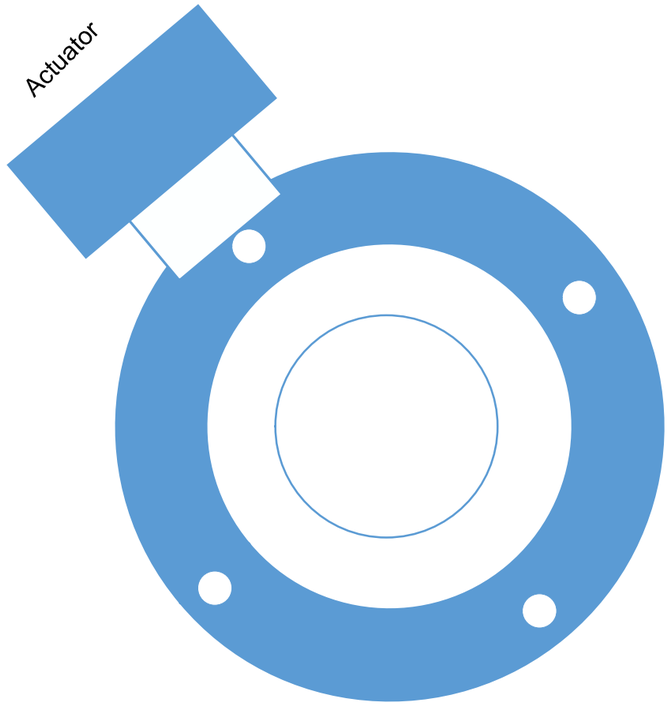
Device	Qty	Description	Vendor
TS-475	1	Kele Damper 1/2 Inch End Switch	Kele
TSI-475	1	Kele Damper 1 Inch End Switch	Kele



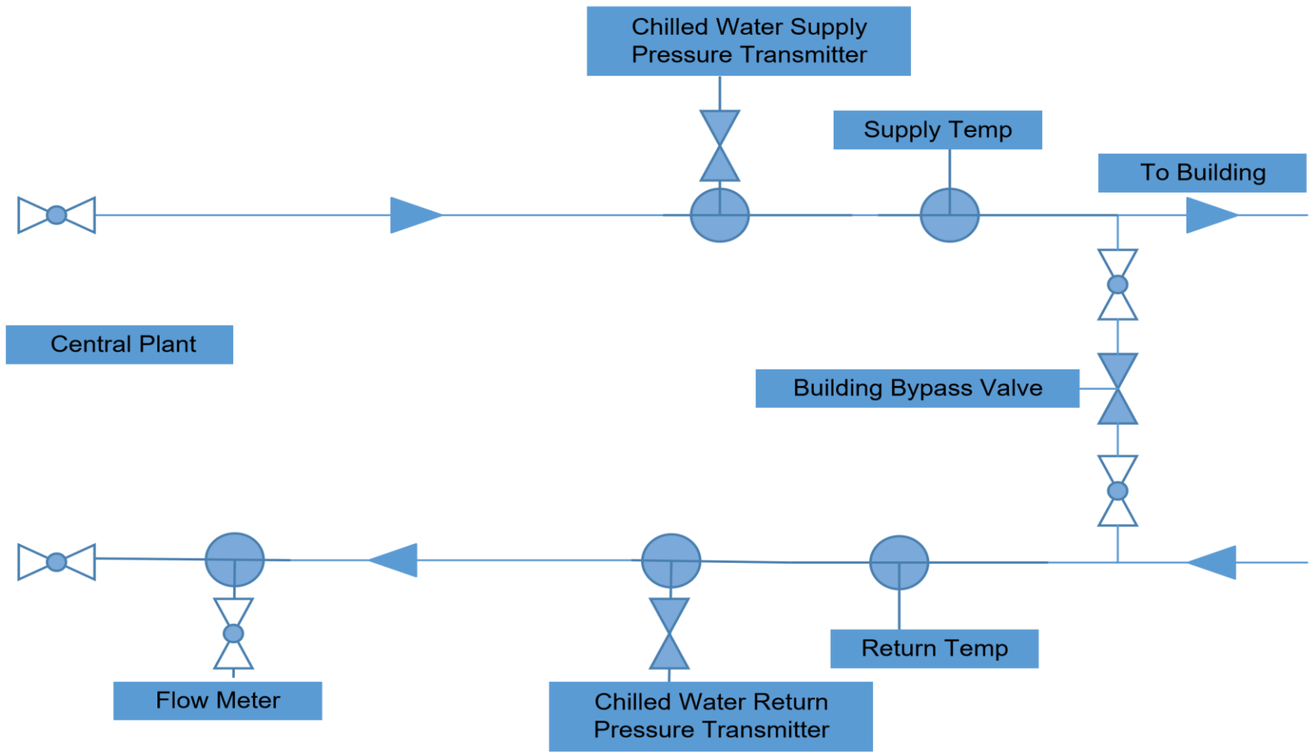
Device	Qty	Description	Vendor
10-0743	1	Mechanical Float Switch	Zoeller
10-0689	1	Weight for Switch	Zoeller

Steam Valve Detail

Valve Installed at 45 Degree Angle



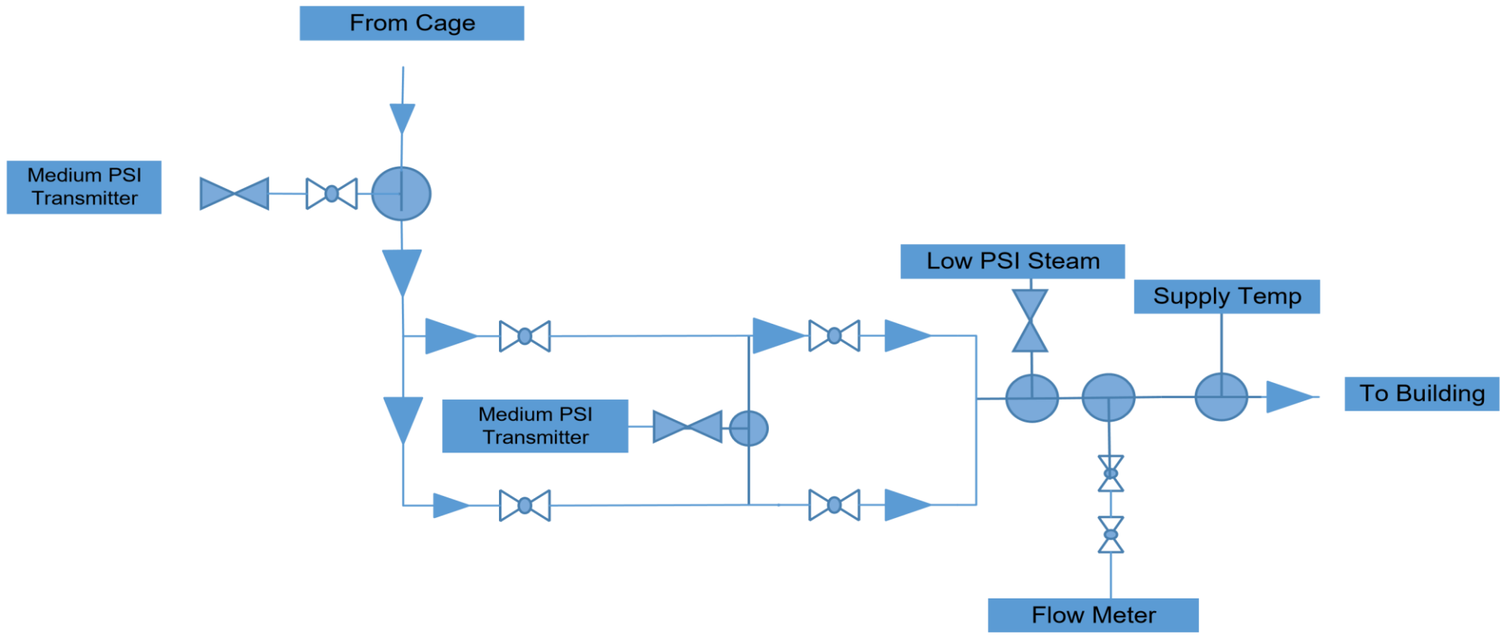
Building Chilled Water Pressure Detail



Bill of Materials

Device	Qty	Description	Vendor
2051S	2	Rosemount Transmitter	Rosemount
306	2	Rosemount Manifold	Rosemount
BV75-CS3-15#/DS24-180#	1	Bypass Valve	Bray
TBD	1	Flow Meter	TBD
TBD	2	Temp Sensor	TBD
TBD	2	Well	TBD

Steam Pressure Reducing Valve Stations

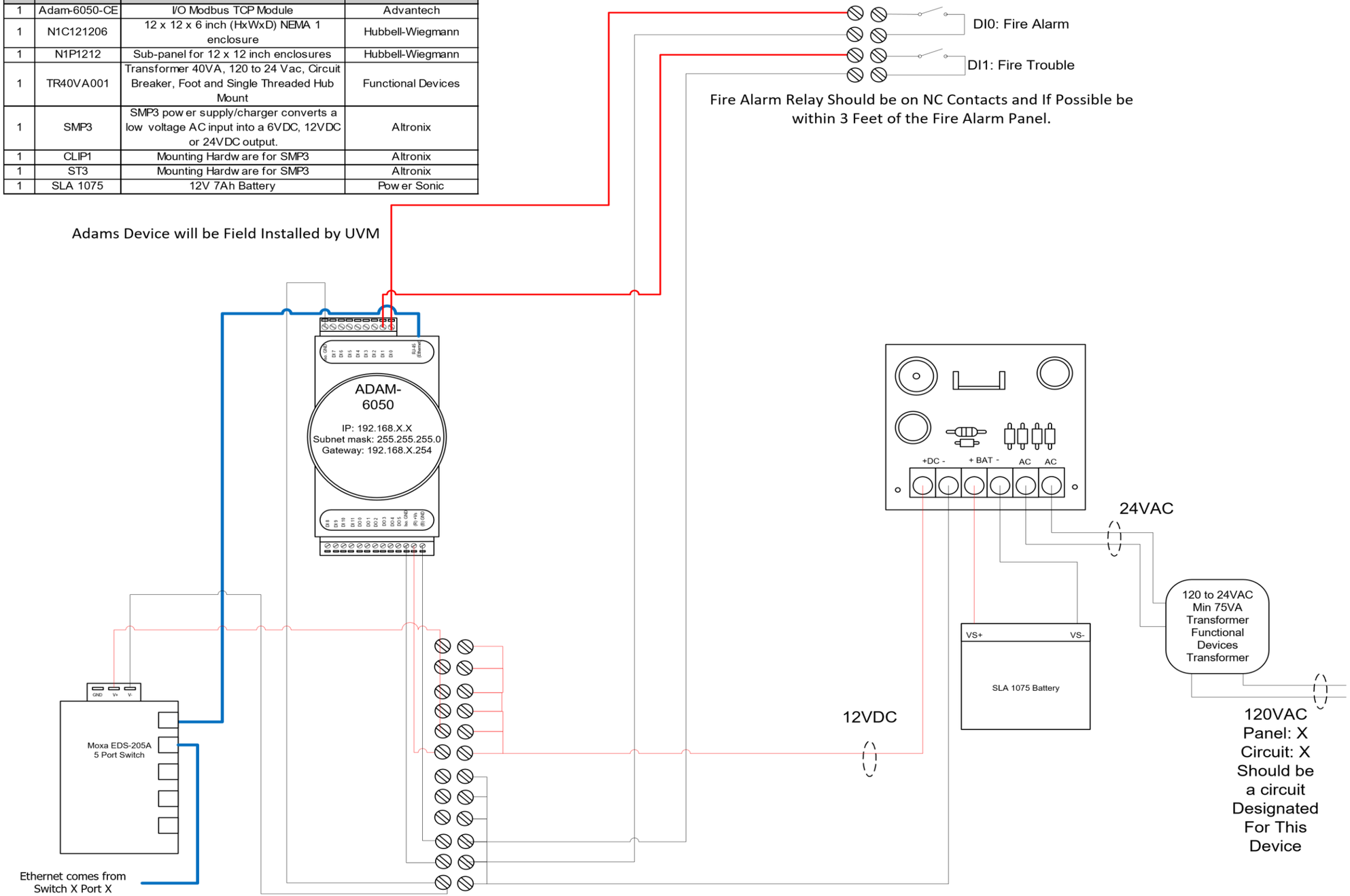


Bill of Materials

Device	Qty	Description	Vendor
2051S	3	Rosemount Transmitter	Rosemount
306	3	Rosemount Manifold	Rosemount
TBD	1	Flow Meter	TBD
TBD	1	Temp Sensor	TBD

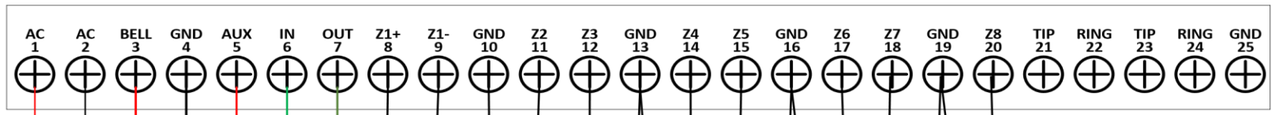
Adams Device Wiring Detail

Bill Of Materials			
QTY	PART NUMBER	DESCRIPTION	VENDER
1	Adam-6050-CE	I/O Modbus TCP Module	Advantech
1	N1C121206	12 x 12 x 6 inch (HxWxD) NEMA 1 enclosure	Hubbell-Wiegmann
1	N1P1212	Sub-panel for 12 x 12 inch enclosures	Hubbell-Wiegmann
1	TR40VA001	Transformer 40VA, 120 to 24 Vac, Circuit Breaker, Foot and Single Threaded Hub Mount	Functional Devices
1	SMP3	SMP3 power supply/charger converts a low voltage AC input into a 6VDC, 12VDC or 24VDC output.	Altronix
1	CLIP1	Mounting Hardware for SMP3	Altronix
1	ST3	Mounting Hardware for SMP3	Altronix
1	SLA 1075	12V 7Ah Battery	Power Sonic



Security Wiring Detail

Honeywell/Ademco Vista 20 P



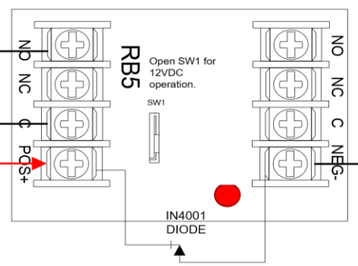
Entrance Key Pad
Address=16

Plug In transformer that states do not remove. Plugged by the panel

Horn

Horn is Optional, Based on Site

TO BMS For Alarm



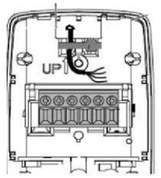
Bill of Materials

Device	Qty	Description	Vendor
Vista 20P	1	Intrusion Panel	Honeywell
6160	1	Custom Alpha Keypad	Honeywell
Wave2	1	Two Tone Siren	Honeywell
RB5	1	Relay	Altronix

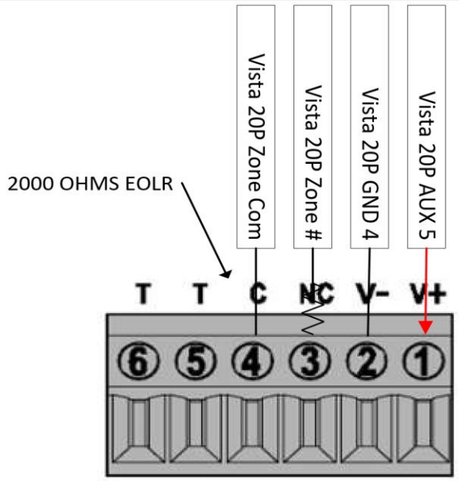
Intrusion Alarm Parts

DT8050 Dual Tec Motion Sensor

Exterior Of Sensor



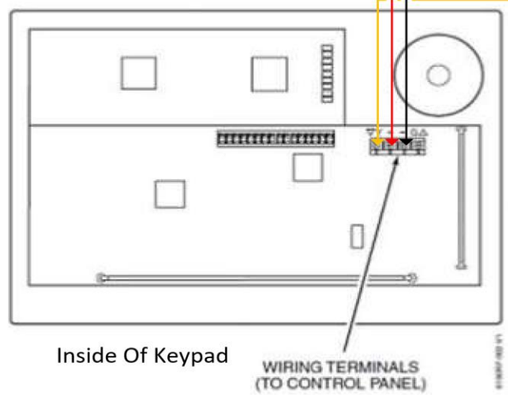
Inside Of Sensor



Door Switch

6160 Custom Alpha Key Pad

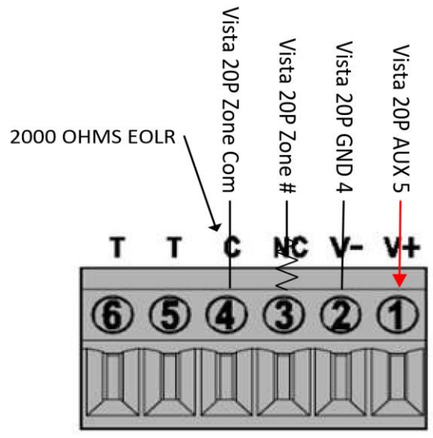
Exterior Of Keypad



Inside Of Keypad

IS-280CM Motion Sensor

Exterior Of Sensor

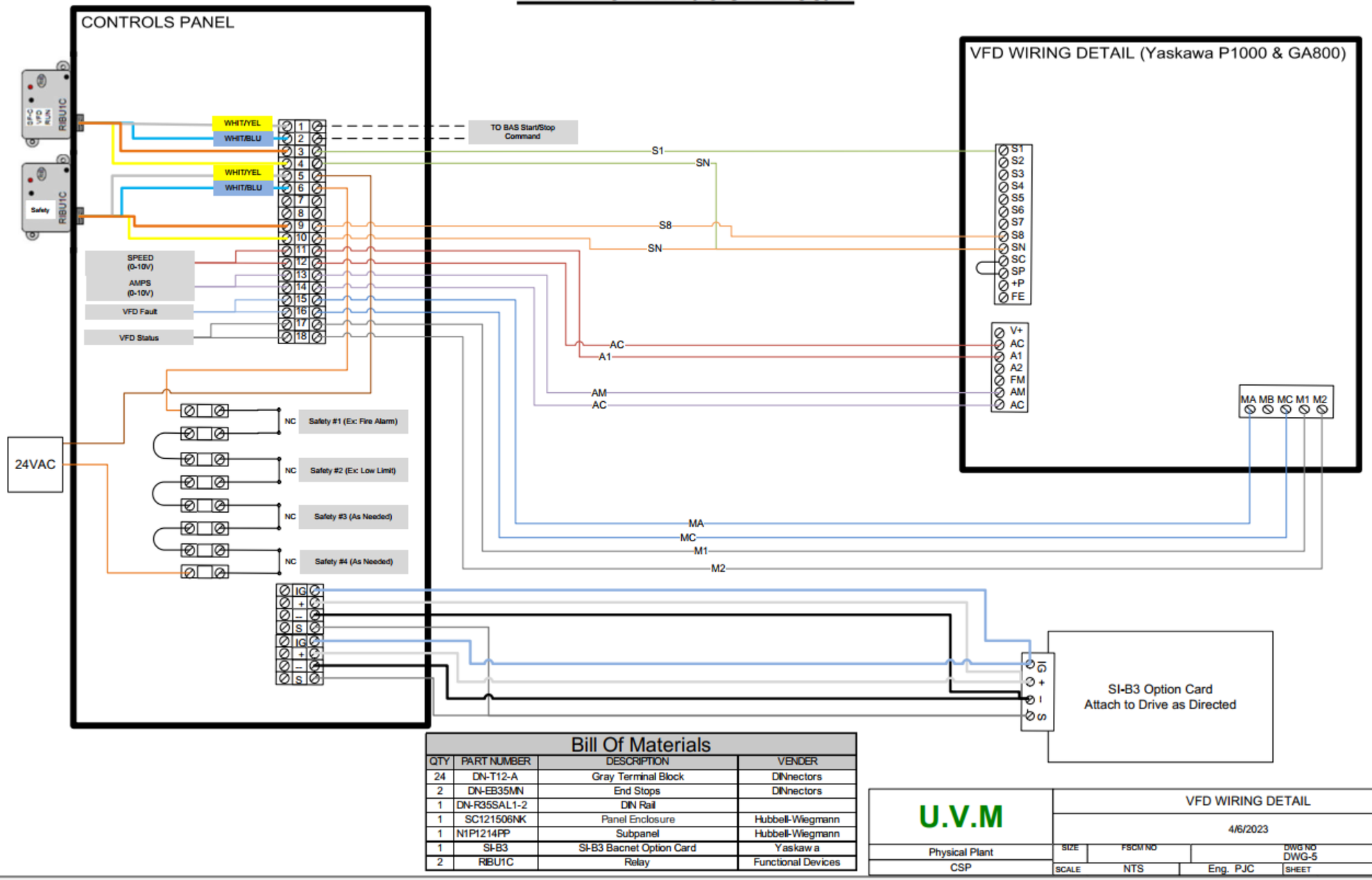


Bill of Materials

Device	Qty	Description	Vendor
DT850 Dual Teck Motion Sensor	1	WallMount Motion Sensor	Honeywell
IS-280CM Motion Sensor	1	Ceiling Mount Motion Sensor	Honeywell
Door Switch	1	Door Switch	Nascom Inc
RB5	1	Relay	Altronix
6160 Custom Alpha Keypad	1	Keypad	Honeywell

Door Switch part number is based on the Door

VFD Termination Detail



Bill Of Materials

QTY	PART NUMBER	DESCRIPTION	VENDER
24	DN-T12-A	Gray Terminal Block	DINnectors
2	DN-EB35MN	End Stops	DINnectors
1	DN-R35SAL1-2	DIN Rail	
1	SC121506NK	Panel Enclosure	Hubbell-Wiegmann
1	N1P1214PP	Subpanel	Hubbell-Wiegmann
1	SI-B3	SI-B3 Bacnet Option Card	Yaskawa
2	RIBU1C	Relay	Functional Devices

U.V.M	VFD WIRING DETAIL		
	4/6/2023		
Physical Plant	SIZE	FSCM NO	DWG NO DWG-5 / REV A.B.
CSP	SCALE NTS	Eng. PJC	SHEET

VFD Points to map via Bacnet bus.

Step 4 — BACnet Node Addressing and Related Drive Parameters

BACnet Node Addressing

The BACnet node address is configurable by parameter F6-45 in the drive. This defines the physical address of the drive on the MS/TP network. In addition, both the Device Object Instance Identifier (parameters F6-48 and F6-49) and the Device Object Name are configurable. These allow the drive to have a virtual address and simplify the controller configuration.
After setting the addressing, a controller can initiate communication to the drive. The drive will perform the specified function and then send a response back to the controller. The drive will usually respond immediately, but may delay its response until it gets the token for commands that may take extra local processing time.

Related Drive Parameters

The following parameters are used to set up the drive for operation with the option. Parameter setting instructions can be found in the drive Quick Start Guide or Technical Manual. Confirm proper setting of the all parameters in the table below, before starting network communications. After changing parameter settings, cycle power to the drive for the new settings to take effect.

No.	Name	Description	Values
b1-01 <1>	Frequency Reference Selection	0: Operator 1: Terminals - A1 or A2 2: MEMOBUS/Modbus 3: Option PCB 4: Pulse Input	Default: 1 Range: 0 to 4 (Set to 3 for BACnet)
b1-02	Run Command Selection	0: Digital Operator 1: Digital input terminals 2: MEMOBUS/Modbus 3: Option PCB	Default: 1 Range: 0 to 3 (Set to 3 for BACnet)
F6-45	Drive Node Address	Sets the BACnet MS/TP MAC address (physical node address).	Default: 1 Range: 0 to 127
F6-46	Comm. Speed Selection	Sets the comm. speed. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	Default: 3 Range: 0 to 8
F6-47	Drive Transmit Wait Time	Sets the time the drive waits after receiving data from a master before transmiting response data.	Default: 5 ms Range: 5 to 65
F6-48 <2>	BACnet Device Object Identifier 0	Set the Instance Identifier of the BACnet Device Object, where the F6-48 value is the least signifi-cant word.	Default: 1 Range: 0 to FFFFH
F6-49 <2>	BACnet Device Object Identifier 1	Set the Instance Identifier of the BACnet Device Object, where the F6-49 value is the most signifi-cant word.	Default: 0 Range: 0 to 3FH

<1> To start and stop the drive with the option master device using serial communications, set b1-02 to 3. To control the drive frequency reference via the master device, set b1-01 to 3.
<2> These parameters set the Instance Identifier of the BACnet Device Object, where the F6-48 value is the least significant word and the F6-49 value is the most significant word.

Example 1: Set the Device Object Instance Identifier of "1234". 1234 decimal is equal to 4D2H (hexadecimal). Set F6-48 to 4D2H and F6-49 to 0.
Example 2: Set Device Object Instance Identifier to "1234567". 1234567 decimal is equal to 12D687H. Set F6-48 to D687H and set F6-49 to 12H.

Step 5 — BACnet Objects and Accessing Drive Parameters

Present Value Access
The Present Value (PV) of BACnet objects can be read. In addition, some PVs can be written or commanded. A commandable PV is similar to writing the value, but the value is actually written into a priority array. The value occupying the highest priority in the array will be used by the drive. The convention for showing how the PV is accessed is C = Commandable, Value written to a priority array. R = Readable, Value is read-only, W = Writable, Value written to the drive.

Binary Value Objects

Object ID	Object Name	Modbus Adress	Active Text	Inactive Text	PV Access
BV1	Run FWD Cmd	0001H:bit 0	RUN	OFF	C
BV2	Run REV Cmd	0001H:bit 1	REV	OFF	C
BV3	Ext Fault Cmd	0001H:bit 2	FAULT	OFF	C
BV4	Fault Reset Cmd	0001H:bit 3	RESET	OFF	C
BV5	Com Net Cmd	0001H:bit 4	COM	LOCAL	C
BV6	Com Cntrl Cmd	0001H:bit 5	COM	LOCAL	C
BV7	MF Input 3 Cmd	0001H:bit 6	ON	OFF	C
BV8	MF Input 4 Cmd	0001H:bit 7	ON	OFF	C
BV9	MF Input 5 Cmd	0001H:bit 8	ON	OFF	C
BV10	MF Input 6 Cmd	0001H:bit 9	ON	OFF	C
BV11	MF Input 7 Cmd	0001H:bit 10	ON	OFF	C
BV12	Set Fault Contact Cmd	0009H:bit 6	ENABLE	OFF	C
BV13	RUN-STOP	0020H:bit 0	RUN	OFF	R
BV14	REV-FWD	0020H:bit 1	REV	FWD	R
BV15	READY	0020H:bit 2	READY	OFF	R
BV16	FAULT	0020H:bit 3	FAULTED	OFF	R
BV17	Data Set Error	0020H:bit 4	ERROR	OFF	R
BV18	Overcurrent – Gnd Fault	0021H:bit 0	OC-GF	OFF	R
BV19	Main Ckt Overvoltage	0021H:bit 1	OV	OFF	R
BV20	Drive Overload	0021H:bit 2	OL2	OFF	R
BV21	Drive Overheat	0021H:bit 3	OH1-OH2	OFF	R
BV22	Fuse Blown	0021H:bit 5	PUF	OFF	R
BV23	PI Feedback Loss	0021H:bit 6	FBL	OFF	R
BV24	External Fault	0021H:bit 7	EF0-EF	OFF	R
BV25	Hardware Error	0021H:bit 8	CPF	OFF	R
BV26	Mtr Ovrld-OvrTorque	0021H:bit 9	OL1-OL3	OFF	R
BV27	Overspeed	0021H:bit 10	OS-DEV	OFF	R
BV28	Main Ckt Undervoltage	0021H:bit 11	UV	OFF	R
BV29	MCU, Crtl Pwr Sy Err	0021H:bit 12	UV1-2-3	OFF	R
BV30	Output Phase Loss	0021H:bit 13	LF	OFF	R
BV31	Communication Error	0021H:bit 14	CE	OFF	R
BV32	Operator Disconnect	0021H:bit 15	OPR	OFF	R
BV33	Operating	002CH:bit 0	OPERATING	OFF	R
BV34	Zero Speed	002CH:bit 1	ON	OFF	R
BV35	Frequency Agree	002CH:bit 2	ON	OFF	R
BV36	Desired Freq Agree	002CH:bit 3	ON	OFF	R
BV37	Frequency Detect 1	002CH:bit 4	ON	OFF	R
BV38	Frequency Detect 2	002CH:bit 5	ON	OFF	R
BV39	Drv Startup Complete	002CH:bit 6	ON	OFF	R
BV40	Low Voltage Detect	002CH:bit 7	ON	OFF	R
BV41	Base Block	002CH:bit 8	ON	OFF	R
BV42	Frequency Ref Mode	002CH:bit 9	COM	LOCAL	R
BV43	Run Command Mode	002CH:bit 10	COM	LOCAL	R
BV44	Overtorque Detect	002CH:bit 11	ON	OFF	R
BV45	Frequency Refer Lost	002CH:bit 12	ON	OFF	R
BV46	Retry Error	002CH:bit 13	ON	OFF	R
BV47	Modbus Comms Error	002CH:bit 14	ON	OFF	R
BV48	Modbus Timeout Error	002CH:bit 15	ON	OFF	R
BV49	CRC Error	003DH:bit 0	ON	OFF	R
BV50	Invalid Data Length	003DH:bit 1	ON	OFF	R
BV51	Parity Error	003DH:bit 3	ON	OFF	R
BV52	Overrun Error	003DH:bit 4	ON	OFF	R
BV53	Framing Error	003DH:bit 5	ON	OFF	R
BV54	Timeout Error	003DH:bit 6	ON	OFF	R
BV55	Parameter Accept	0910H:bit 0	ON	OFF	W
BV56	Parameter Enter	0900H:bit 0	ON	OFF	W
BV57	Drive Comms Error	-	ON	OFF	R

Binary Input Objects

Object ID	Object Name	Modbus Address	Active Text	Inactive Text	PV Access
BI1	Input Terminal 1	002BH:bit 0	ON	OFF	R
BI2	Input Terminal 2	002BH:bit 1	ON	OFF	R
BI3	Input Terminal 3	002BH:bit 2	ON	OFF	R
BI4	Input Terminal 4	002BH:bit 3	ON	OFF	R
BI5	Input Terminal 5	002BH:bit 4	ON	OFF	R
BI6	Input Terminal 6	002BH:bit 5	ON	OFF	R
BI7	Input Terminal 7	002BH:bit 6	ON	OFF	R
BI8	Multi-Function Out 1	0020H:bit 5	ON	OFF	R
BI9	Multi-Function Out 2	0020H:bit 6	ON	OFF	R

Binary Output Objects

Object ID	Object Name	Modbus Address	Active Text	Inactive Text	PV Access
BO1	MF Output M1-M2	0009H:bit 0	ON	OFF	C
BO2	MF Output M3-M4	0009H:bit 1	ON	OFF	C
BO3	MF Output M5-M6	0009H:bit 2	ON	OFF	C
BO4	Ref Set:PI Setpoint	000FH:bit 1	ON	OFF	C
BO5	Ref Set:Term S5 IN	0001H:bit 8	ON	OFF	C
BO6	Ref Set:Term S6 IN	0001H:bit 9	ON	OFF	C
BO7	Ref Set:Term S7 IN	0001H:bit 10	ON	OFF	C

Analog Outputs Objects

Object ID	Object Name	Modbus Adress	Precision	Range	Units	PV Acess
AO1	Analog Output 1 Level	0007H	XXXX.X	0 to 100.0	%	C
AO2	Analog Output 2 Level	0008H	XXXX.X	0 to 100.0	%	C

Analog Inputs Objects

Object ID	Object Name	Modbus Adress	Precision	Range	Units	PV Access
AI1	Analog Input 1 Level	004EH	XXXX.X	–	%	R
AI2	Analog Input 2 Level	004FH	XXXX.X	–	%	R
AI3	Not Used AI3	–	–	–	–	–
AI4	Not Used AI4	–	–	–	–	–
AI5	Not Used AI5	–	–	–	–	–
AI6	Display Format o1-03	0502H	XXXXX	–	–	R
AI7	Scale Format b5-20	01E2H	XXXXX	–	–	R
AI8	Inverter Model o2-04	050BH	XXXXX	–	–	R
AI9	Rated Current n9-01	05D0H	XXXX.X	–	Amps	R

Analog Value Objects

Object ID	Object Name	Modbus Adress	Precision	Range	Units	PV Access
AV1	Operation Cmd	0001H	XXXXX	0 to 65535	–	C
AV2	Frequency Cmd	0002H	XXX.XX Dep. on o1-03	0.00 to 600.00	Hz (o1-03)	C
AV3	PI Setpoint Cmd	0036H	XXX.XX	0.00 to 100.00	%	C
AV4	MF Output 1 Cmd	0039H	XXXXX	0 to 65535	–	C
AV5	Reference Select Cmd	002FH	XXXXX	–	–	C
AV6	Drive Status	0020H	XXXXX	–	–	R
AV7	Fault Details	0021H	XXXXX	–	–	R
AV8	Data Link Status	0022H	XXXXX	–	–	R
AV9	Frequency Reference	0040H	XXX.XX Dep. on o1-03	–	Hz (o1-03)	R
AV10	Output Frequency	0041H	XXX.XX Dep. on o1-03	–	Hz (o1-03)	R
AV11	Output Voltage	0045H	XXXX.X	–	Volts	R
AV12	Output Current	0042H	XXXX.X (>11 kVA) XXX.XX (<=11 kVA)	–	Amps	R
AV13	Output Power	0047H	XXXX.X (>11 kVA) XXX.XX (<=11 kVA)	–	Watts	R
AV14	Torque Reference	0048H	XXXX.X	–	%	R
AV15	MF Input Status	0028H	XXXXX	–	–	R
AV16	Drive Status 2	002CH	XXXXX	–	–	R
AV17	MF Output Status	002DH	XXXXX	–	–	R
AV18	DC Bus Voltage	0031H	XXXX.X	–	Volts	R
AV19	PI Feedback Level	0038H	XXXX.X	–	%	R
AV20	PI Input Level	0039H	XXXX.X	–	%	R
AV21	PI Output Level	003AH	XXXX.X	–	%	R
AV22	CPU Software	005BH	XXXXX	–	–	R
AV23	Flash Number	004DH	XXXXX	–	–	R
AV24	Comm Error Detail	003DH	XXXXX	–	–	R
AV25	kVA Setting	050BH	XXXXX	–	–	R
AV26	Control Method	0102H	XXXXX	–	–	R
AV27	Accel Time	0200H	XXXX.X (C1-10 = 1) XXX.XX (C1-10 = 0)	0.0 to 6000.0 (C1-10=1) 0.00 to 600.00 (C1-10 = 0)	Sec	W
AV28	Decel Time	0201H	XXXX.X (C1-10 = 1) XXX.XX (C1-10 = 0)	0.0 to 6000.0 (C1-10=1) 0.00 to 600.00 (C1-10 = 0)	Sec	W
AV29	Parameter Number	–	XXXXX	0 to FFFFH	–	W
AV30	Parameter Data	–	XXXXX	0 to FFFFH	–	W

Accessing Drive Parameters

Reading Drive Parameters
Reading drive parameters not listed in the analog or digital objects is accomplished using
AV29 and AV30 as shown below:
1. In decimal, write the desired Modbus register to AV29.
2. In decimal, read the value at the given register from AV30.
For example, to read the Frequency Reference Upper Limit, read from parameter d2-01. Parameter d2-01 is located at Modbus register 0288H, which is decimal 649.
Set AV29 to "649"
Read AV30 to get the value.

Enter Command
Enter Commands are only required when using AV29 and AV30 to write drive parameters. An Enter command is not required when reading or writing to the other BACnet objects.
When writing parameters to the drive from a controller using BACnet communications, an Enter command must be issued to enable these parameters. This section describes the types and functions of the Enter commands.

Writing Drive Parameters
Writing drive parameters not listed in the analog or digital objects is accomplished using
AV29, AV30, and BV55 or BV56 as shown below:
1. In decimal, write the desired Modbus register to AV29.
2. In decimal, write the value to be written into AV30.
3. At this point the value is pending. One of two actions must be taken to complete the writing process:

Set BV55 to "ON" to move data to active memory.
Set BV56 to "ON" to move data into active memory and save to non-volatile memory.
For example, to reset the KWH Monitor, write a value of "1" to parameter o1-12. Parameter o1-12 is located at Modbus register 0512H, which is decimal 1298.
Set AV29 to "1298"
Set AV30 to "1"
Set BV55 to "ON".

Enter Command Types
The drive supports two types of Enter commands as shown in the table below.

BACnet Object	Modbus Address	Description
BV55 (Write "ON")	0910H (bit 0)	Writes data in the active RAM only. Parameter changes are lost when the drive is shut off.
BV56 (Write "ON")	0900H (bit 0)	Simultaneously writes data into the EEPROM (non-volatile memory) of the drive and enables the data in active RAM. Parameter changes remain after cycling power.

AV33 Kwh Consumed

AV35 Drive Run Time

Step 6 — Error Codes

Display	Description
bUS	Option Communication Error.
	The connection was lost after establishing initial communication. Only detected when the run command frequency reference is assigned to an option card.
EF0	Option Card External Fault.
	An external fault condition is present.
oFA00	Option Card Connection Error at Option Port CN5-A.
	Option compatibility error.
oFA01	Option Card Fault at Option Port CN5-A.
	Option not properly connected.
oFA03 to oFA06, oFA10, oFA11	Option Card Error Occurred at Option Port CN5-A.
oFA12 to oFA17	Option Card Connection Error (CN5-A).
oFA30 to oFA43	Communication Option Card Connection Error (CN5-A).
CALL	Serial Communication Transmission Error.
	Communication has not yet been established.