Point Naming Standards

By James F. Butler, Member ASHRAE; and **Robert Veelenturf, P.E.**

The benefits of having consistent and useful point names in building automation systems are becoming more apparent as computerized systems containing hundreds or thousands of points are being deployed in commercial and industrial buildings. Well-chosen point names can provide useful information about installed systems to the people responsible for maintaining, modifying, and interconnecting various building systems. As well, software that performs automated analysis of HVAC system performance may benefit from the consistent application of a point naming standard.

This article discusses methods for developing and implementing point naming standards, with particular emphasis on the implementation of point naming standards in BACnet-based HVAC control systems. An example of a point naming standard that is currently being used in a performance analysis and fault detection system at the authors' company is featured.

Background

Computerized HVAC control systems (aka, direct digital control [DDC] systems) are now common in commercial and industrial buildings. Most of these systems make use of networks that allow data and control commands to be transmitted between the controllers and human interfaces in the system.

Data items in DDC systems are often referred to as "points." Examples of points are a sensor measurement, an actuator signal, and a software value (sometimes referred to as a "virtual point" or a "software point"). Simple DDC devices such as networked thermostats may have only a handful of points, whereas a sophisticated programmable controller might have the capacity to contain thousands of points.

In BACnet, a point is usually represented by a BACnet object. A number of standard BACnet object types are used for different purposes. For example, a temperature input point might be represented as a BACnet Analog Input object, and an on/off output point might be represented as a Binary Output object. Every BACnet object contains several properties. Each property is a container for a piece of information.

Point Names in Design Documents

The HVAC control system design process may result in the creation of one or more point lists, which should contain, at minimum, information about all of the points in a control system that are required for the sequences of operation or other system functions. Every point in a point list has a point name, and those point names typically appear in system diagrams and sequences of operation. (Note that in ASHRAE Guideline 13-2007, a points list is referred to as an "object list".) Point names used in the design engineer's point lists and other control system design documents will not necessarily be used verbatim by the technician that configures the control system.

Point Names in DDC Systems

Every point in a DDC system should have a name and/or an alphanumeric identifier. The point name, which is a human readable text string, can serve two purposes:

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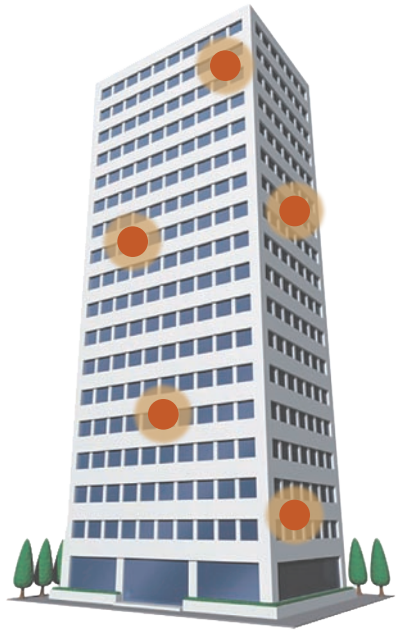
1. To uniquely identify a point within a controller or, in some cases, within the entire control system.
2. To describe the function of the point for the benefit of people who are operating or working on the DDC system.

The potential value of point names to provide concise, on-line information about control system points is already widely known. Until recently point names were not used for computer-based analysis and, therefore, did not need to strictly adhere to a particular standard. The benefits of standardization are particularly high for organizations that operate and maintain large control systems.

Here are some guidelines for the design of point naming standards:

1. Begin the design of a point naming standard by identifying the range of possible uses and users of the point names. For example, will point labels on operator workstation graphics follow the standard? Will programmers use the standard to reference points within control logic? Ultimately, point names may have to meet practical constraints on string length, ease of interpretation and ease of typing.
2. It is often necessary for point names to be unique within a building, control system or organization.
3. Point names should consist of discrete components. Typical components include the point's location, system, equipment, and type.
4. Abbreviations for locations, systems, equipment types and point types should be used, and they should be standardized. Choose abbreviations that are easily understandable by building system operations and maintenance staff without frequent reference to other documentation.
5. It is important to clearly distinguish control points from feedback points.
6. Avoid potential problems related to the inconsistent use of upper/lower case characters by specifying which case should be used.



Design documents often contain a variety of useful information about specific points (e.g., sensor model numbers), but it is not feasible for point names to store all of that information. In most cases, a point name will only contain enough information so as to allow the point's function within the system to be clearly understood by building operators and engineers. Any remaining information about the points either remains exclusively in the design documents, or the information is extracted from the documents and associated with point names elsewhere.

An Example Point Naming Standard

As a part of our company's business, we developed a point naming standard that we use to identify all of the points that we monitor in our customers' buildings. This point naming standard is designed so that every point at a customer site can be assigned a unique point name. It is important that the point names can be understood by our engineers, but we also needed a point naming standard that would allow our proprietary data analysis software to be able to understand the function of every named point within our customers' systems.

In our point naming standard, a point name is constructed from a sequence of several elements, each describing some attribute of the point that is important for our application. Here are some of the types of attributes that a point name might include:

- Building;
- Category (air distribution, plant, process, spaces, utilities);
- Equipment type (e.g., cooling tower, constant air volume terminal unit, modulating control valve, electric meter);
- Space type (e.g., floor, room, zone); and
- Point Type (e.g., zone temperature, signal, power).

In constructing each element of the point name, we combine an abbreviation representing a particular attribute with an optional "index." The attribute abbreviations have been standardized to facilitate software-based pattern matching. The index is used to distinguish between multiple instances of an attribute (e.g., multiple sensors with similar functions in

Attribute	Index
BLDG (building)	Alumni
PLANT	
CHLR (chiller)	1
CHWST_SP (chilled water supply temperature setpoint)	
Point Name: BLDG-ALUMNI/PLANT/CHLR-1/CHWST_SP	

Table 1: Point name elements for the chilled water supply temperature setpoint of Chiller 1 (Example 1).

Attribute	Index
BLDG	Sports Arena
UTILS (utilities)	
ELEC (electricity)	
METER_E (electric meter)	Main
PWR_ELEC (power)	
Point Name: BLDG-SPORTS_ARENA/UTILS/ELEC/METER_E-MAIN/PWR_ELEC	

Table 3: Point name elements for the electric power being measured by the main meter in a sports arena (Example 3).

the same piece of equipment), or it can be used when additional information about the attribute is needed.

Here are some examples of how point names can be constructed.

Example 1: A point name is required for the chilled water supply temperature setpoint of Chiller 1 at the Alumni building of a large state university.

Three point name elements are explicitly mentioned in the description: a point type (chilled water supply temperature setpoint), a piece of equipment (Chiller 1), and a building (Alumni). Our engineers would add a category element indicating that the point is considered to be part of the central plant. Specifying the particular type of chiller would be beneficial for some applications. The elements are summarized in *Table 1*.

The point name elements are combined in a specified way to form the entire point name. Elements are separated by the forward slash character ("/"), and attributes are separated from their respective indices using the hyphen character ("-"): BLDG-ALUMNI/PLANT/CHLR-1/CHWST_SP.

Note that the elements proceed in order based on "has a" relationships between the elements. The Alumni building has a central plant, which has a Chiller 1, which has a chilled water supply temperature setpoint.

Attribute	Index
BLDG	Biology
SPACES	
FL (floor)	2
Z (zone)	Lecture Hall
Z_T (zone temperature sensor)	3
Point Name: BLDG-BIOLOGY/SPACES/FL-2/Z-LECTURE_HALL/Z_T-3	

Table 2: Elements of a point name constructed using a zone-oriented view of the point (Example 2).

Attribute	Index
BLDG	Smith
AIR_DIST	
AHU	1
SA (supply airstream)	2
CC_CHW (cooling coil – chilled water)	
DAT (discharge air temperature)	
Point Name: BLDG-SMITH/AIR_DIST/AHU-1/SA-2/CC_CHW/DAT	

Table 4: Point name elements for the cooling coil in the second supply airstream of a complex, built-up air handler in the Smith building (Example 4).

Example 2: A point name is required for the third room temperature sensor in the lecture hall located on the second floor of the Biology building.

For sensors located in occupied areas of the building, the name of the zone where the sensor is installed is probably the most useful information about the corresponding sensor point. *Table 2* is the element table for a point name constructed using a zone-oriented view of the point.

The resulting point name is: BLDG-BIOLOGY/SPACES/FL-2/Z-LECTURE_HALL/Z_T-3.

Example 3: A point name is required for the electric power being measured by the main meter in the Sports Arena.

Utility metering points are sometimes brought into a building automation system, and they are useful for energy analysis. We added a utilities category for these points. *Table 3* is an element table for this example.

The resulting point name is: BLDG-SPORTS_ARENA/UTILS/ELEC/METER_E-MAIN/PWR_ELEC.

Example 4: A point name is required for a temperature sensor that is downstream of the cooling coil (cooled by chilled water)

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in the second supply airstream of a complex, built-up air handler in the Smith building.

The point naming method should be able to handle complex devices such as built-up air handlers. The particular air handler in the example has multiple supply airstreams, and each may have multiple coils and sensors. It is useful to be able to specify a particular point within the context of a named section of a complex device, in this case the second supply airstream. *Table 4* (see Page B18) is the element table for this example.

The resulting point name is: BLDG-SMITH/AIR_DIST/AHU-1/SA-2/CC_CHW/DAT.

Anticipating the Need for Change

A point naming standard will likely require some new feature that was not originally anticipated. Designing flexibility into the point naming standard makes it easier to add new features. New point types and equipment types probably will need to be added to the standard over time, and more substantial changes may eventually be needed.

For example, if the building engineers decide that they want to add site information to the point naming standard, is the point naming standard flexible enough to handle such a change? In our company's point naming standard, we could add a new element for the site information because our standard does not set a limit on number of components in a point name. Returning to Example 1, the new site element would be added to the point name as follows: SITE-PHOENIX/BLDG-ALUMNI/PLANT/CHLR-1/CHWST_SP.

Point Name Implementation in BACnet Systems

The BACnet protocol is designed in such a way that useful point names can often be placed directly into the various BACnet objects in the devices in a control system. This is generally preferable to only storing point names in separate documentation such as spreadsheet tables; point names that are easily visible to system operators and system maintenance staff are more likely to be kept up to date.

Although BACnet defines properties in every object that might be appropriate for the storage of customer-determined point names, some creativity may be required to work around the limitations of specific control products. Here are some of the building blocks that the BACnet protocol provides.

- All BACnet objects: All objects contain an Object Name property, which contains a printable text string; the contents of the Object Name property must be unique among all objects within a single BACnet device. An object may also contain a Description property that contains a printable text string.
- Device object: Every BACnet device is required to have one Device Object. Like all BACnet objects, the Device Object contains an Object Name property, which contains a printable text string; the contents of the Device Object's Object Name property must be unique among all Device Objects within a BACnet internetwork. The Device Object may also contain a Location property that contains a printable text string.
- Analog objects: All Analog Objects are required to have a Units property whose contents specify the engineering units of the object.

Before developing a plan for the implementation of point names within specific BACnet compliant control products, it is necessary to understand certain characteristics of those control products. Here are three questions that should be answered:

1. Does the product support the Location property in the Device Object? If so, what is the maximum length of the contents of that property?
2. Does the product support the Description property in all objects? If not, which objects may contain a Description property? What is the maximum length of the contents of that property?
3. Can the contents of the Object Name property of all objects be modified? If so, what is the maximum length of the contents of the Object Name property, and are there any other restrictions on its contents (e.g., forbidden symbols or other syntactic rules)?

Armed with this information, the building engineer can develop a method for mapping the components of the desired point naming standard into properties in the BACnet objects. Here is an example of a method that should work in many BACnet-compliant products:

- The Location property of the Device Object will contain the location of the equipment (e.g., BLDG-SMITH/RM-BASE_MECH_RM) or the zone served by the equipment (e.g., BLDG-BIOLOGY/FL-2/Z-LECTURE_HALL).
- The Object Name property of the Device Object will contain the equipment type and index (e.g., AHU-1). In case of a BACnet system that spans multiple buildings, it may be necessary to also include the building name to satisfy BACnet's uniqueness requirement (e.g., BLDG-SMITH/AHU-1).
- The Object Name property of the analog, binary and multistate objects will contain the point type, index, and other identifying information (e.g., Z_T-3 or SA-2/CC_CHW/DAT). If the object names of these objects are assigned automatically by the manufacturer and cannot be modified by the customer, then this information will be placed in the object's Description property.
- The Units property of each analog object will contain the correct engineering units for that object.
- The Description property of the Device Object will be reserved for other information about the control device.

Conclusion

Point names can provide useful information to the people who install, operate and maintain building automation systems. Large organizations will particularly benefit from the use of a point naming standard that is tailored to the organization's specific needs. The consistent application of a point naming standard can make it easier to deploy software for automated system performance analysis.

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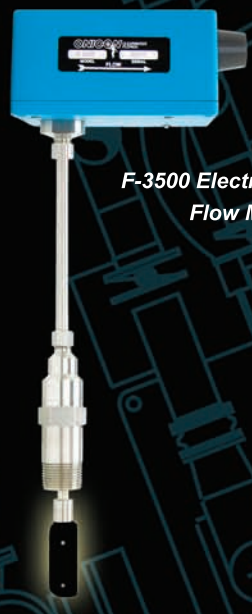

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