ADDENDA

ANSI/ASHRAE Addendum cm to
ANSI/ASHRAE Standard 135-2020

BACnet®

A Data Communication Protocol for Building Automation and Control Networks

Approved by ASHRAE and by the American National Standards Institute on December 31, 2024.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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[This foreword, the table of contents, the introduction, and the "rationales" on the following pages are not part of this standard. They are merely informative and do not contain requirements necessary for conformance to the standard.]

FOREWORD

The modifications to the standard made by Addendum cm are the result of change proposals made pursuant to the ASHRAE continuous maintenance procedures and of deliberations within Standing Standard Project Committee 135. The changes are summarized below.

135-2020*cm*-1 BACnet Energy Services Interface, p. 3

In the following document, language to be added to existing clauses of ANSI/ASHRAE 135-2020 is indicated through the use of *italics*, while deletions are indicated by ~~strikethrough~~. Where entirely new subclauses are proposed to be added, plain type is used throughout. Only this new and deleted text is open to comment at this time. All other material in this document is provided for context only and is not open for public review comment except as it relates to the proposed changes.

The use of placeholders like XX, YY, ZZ, X1, X2, NN, x, n, ? etc., should not be interpreted as literal values of the final published version. These placeholders will be assigned actual numbers/letters only after final publication approval of the addendum.

135-2020*cm*-1 BACnet Energy Services Interface

Rationale

While BACnet Web Services provides a tool for accessing building control data from building systems, BACnet does not have defined formats and standard paths to access complex energy service data such as that are exchanged between building systems and external energy service providers. As buildings become a more important resource to balance electric grid supply and demand, interactions with external providers need to be standardized, and access to data about those interactions (for analysis purposes) requires standard formats and access methods.

ANNEX AD - BACNET ENERGY SERVICES INTERFACE (NORMATIVE)

(This annex is part of this standard and is required for its use.)

This annex introduces the BACnet Energy Services Interface (BACnet ESI) for the access of complex building data via BACnet web services (Annex W).

AD.1 Introduction to BACnet ESI

The BACnet ESI enables a building Energy Data Client (Figure AD-1) to access complex structured energy service data e.g., data received from an energy service provider (ESP) along with data tied to building response to the energy service. ESP information may include demand response (DR) signals via OpenADR, utility-validated meter data via Green Button standard formats and weather data from a weather data provider. BACnet ESI version 1 focuses on demand response. In the DR use case, DR signals arrive and are acted upon by the BACnet Energy Services Interface Energy Manager (ESI-EM, Figure AD-1). The ESI-EM communicates externally with the ESP and Energy Data Clients, and internally with building system controllers and databases.

The BACnet ESI enables the energy data client to access complex structured data via BACnet Web Services (B/WS). The building itself could have a control network that does not use BACnet. B/WS is a generic web services protocol designed for communicating building control information, including complex signal data communicated via the external energy service protocols.

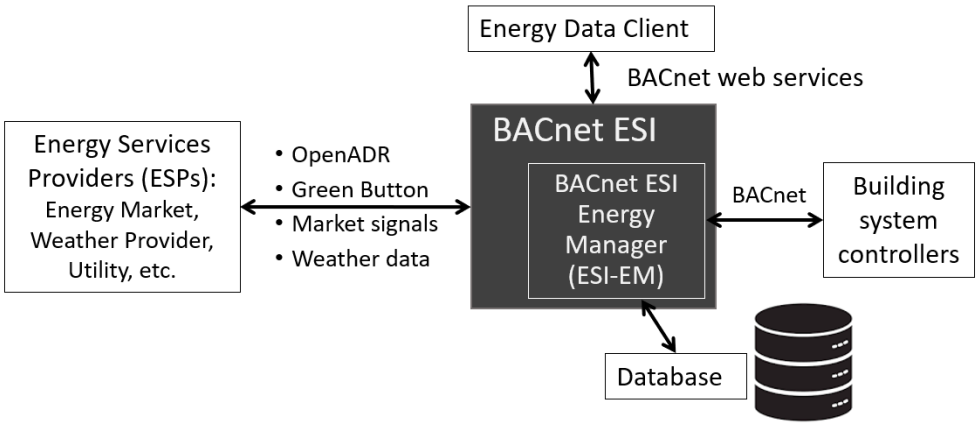

Figure AD-1. BACnet ESI architecture for retrieving structured energy data. That data may come from energy service providers or from internal building system controllers.

Figure AD-1 shows a typical configuration with a BACnet ESI Energy Manager hosted by the building automation system. The Facility Smart Grid Information Model describes the ESI-EM as a top-level energy manager that interacts with outside energy service providers via the ESP Interfaces. Internally, the ESI-EM interacts with various devices (Figure AD-1 right side) according to some policy for device control on the building network side to carry out energy management in response to ESP signals. For example, if a DR event signal is received indicating an elevated level of required DR, the EM policy may specify raising office temperature setpoints and shedding some low priority loads. The ESI-EM may issue commands to device control points or use the BACnet Load Control Object as an indirect way to pass on event information to a subordinate energy manager. However, the specific implementation in a building is not in scope in this annex

In some cases, there may be no control actions tied to interactions with the ESP. For example, the facility may receive weather alerts or utility-validated meter data. The BACnet ESI will enable an energy data client to access these weather alerts and meter data. An energy auditor may want access to meter data that comes directly from a facility meter as well as validated meter data accessed via Green Button from the ESP.

The scope of this annex is the Energy Data Client interactions at the top of Figure AD-1. This annex presents data compositions that collect information linked to specific energy services and explains how to access that data via B/WS. The data definitions are made available in CSML at data.ashrae.org. Clause AD.2 presents three data compositions specific to DR event data retrieval. Future versions of this annex may include additional data compositions such as weather data access or information related to energy market interactions.
In order to provide energy service-related data to clients, the BACnet ESI-EM must have access to data passing through the ESP interfaces to capture and store these messages in a database. The information in the messages must then be composed to provide them in the format specified in this annex and made available via B/WS. B/WS (Annex W) and the CSML information model (Annex Y) provide the building data access methods and formats. A filtered query (as defined in Clause W.8) might be used to retrieve event information for a specific event or for all events within a specific date range.

The data tree is as shown in Figure AD-2. The .energy tree organizes energy-related data in a building. The tree shown here identifies “electric” data under .energy. Other energy services might include energy market transactions, which may not be only electric, e.g., gas, water or steam. Under the electric branch, one category is “demandResponse” which is the focus of this annex in its initial form. Other electric services might include power quality data provision, or provision of standard electric tariff data

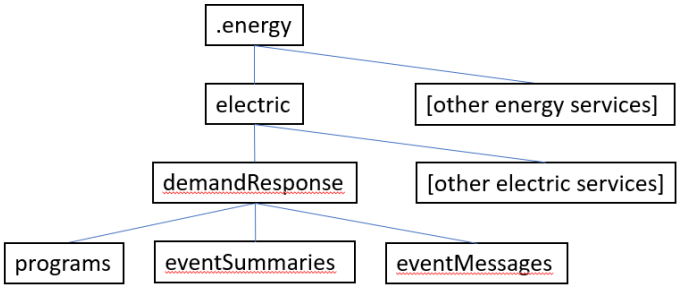

Figure AD-2. BACnet web services .energy data tree.

AD.2 BACnet ESI Data Classes

AD.2.1 DR Event Data

This subclause presents three data compositions and methods for retrieval of DR event-related data with formats derived from the OpenADR schema.

1. DREventSummary provides a summary of event information for one or more events.
2. DRProgram provides basic OpenADR metadata describing the program plus a pointer to associated DR meter data.
3. DRMessageLog provides a log of DR messages received or sent which may include multiple events across more than one DR program.

OpenADR is the international standard (IEC 62746-10-1) for demand response communications via event signals, typically used for the connection from utility to aggregator or utility to customer energy management system. OpenADR defines the messages that move between a virtual top node (VTN, typically a utility) and virtual end node (VEN, at the customer facility). An event message provides event details such as start time, duration, level (severity) or price, and status. There may be modifications to event details as time progresses leading up to an event. An event ID will remain unchanged for each event.

OpenADR is a service-oriented protocol, not control protocol. It is up to a facility controller to implement some local control policy. The amount of load response (typically for peak shaving application) may or may not be mandated in a DR program agreement. Measurement and verification of response is typically performed by comparison of utility meter data against a calculated baseline. Whether there is a baseline or not and how that baseline is calculated is DR program specific.

The identity of an OpenADR VTN is unique to a DR program, and each program participant is represented by a VEN specific to the DR program. A given building owner may possibly participate in more than one DR program. OpenADR events are tied to a specific DR program and the building energy performance in response to event signals are tied to energy use as recorded by one or more utility meters.

The DREventSummary data formats are based primarily on OpenADR 3.0, but the BACnet ESI data formats are not identical and do not include all of the OpenADR data model. This Annex defines the formats for serving data to the energy data client and does not specify where those data come from. How a DR protocol (OpenADR or other) might be mapped to the BACnet ESI schema is out of scope.

When querying the BACnet ESI for event data, a building client may request information on events tied to a specific program, a specific event, all events, or only active, pending or completed events during a given time period. DREventSummary provides information about each event and indicates the DR program that the event is associated with. A client may also request DR program information to learn which meters serve which DR programs. Finally, a client may request a log of messages via the DRMessageLog.

Section AD.3.1 presents data access methods for retrieving DR event, program and message log data.

Section AD.4.1 presents the data definitions for these event, program and log components.

AD.2.1.1 Event Summary

The DREventSummary composition defined in Clause AD.4.1.1 composes event information from different OpenADR messages exchanged between the OpenADR VTN and the customer VEN. DREventSummary includes event ID, VEN ID, program ID, start time and duration of each event, with

event signal data, modification times and other data elements. The program ID serves as the connector between an event and a program.

Note that the number of events that are retained, or the number of days or months over which event messages and summaries are retained is a local matter.

AD.2.1.2 DR Program Metadata

DRProgram information includes basic program information (programID, venID, and programDescription) plus a link pointing to some site-specific meter metadata. This link can identify a meter ID or name (using "urn" or "tag" as a non-locating "identifier", for example, "tag:wossamotta.edu,2022:Meter12") or may point to a meter object.

The method for evaluating building performance relative to DR response requirements is specific to each DR program agreement. Understanding DR program requirements and performance evaluation are not in scope. The programDescription URI(s) should provide understanding of the DR program requirements.

AD.2.1.3 DR Event Message Log

DRMessageLog provides a record of all DR messages stored in memory. A client may want to review each message for forensics purposes or other reasons (e.g., to look for some specific event metadata such as Target that is not included in the current BACnet ESI DR data model) for a specific event or for some time interval.

An OpenADR VEN may be configured in PULL or PUSH mode. If in PULL mode, there may be a very large number of repetitive messages that consume storage. A BACnet ESI may be configured to retain only messages with new event information or utilize some other filtering method as a local matter. If the BACnet ESI is configured to not store repetitive messages, it is also a local matter whether the BACnet ESI indicates the number of repetitions of the dropped messages or any other metadata.

AD.3 Data Access

AD.3.1 Demand Response

AD.3.1.1 DR Event Summary

The DREventSummary of OpenADR events can be accessed via a GET request to:

(a) {prefix}/.energy/electric/demandResponse/eventSummaries/events/*eventID*, for a specific event,
(b) {prefix}/.energy/electric/demandResponse/eventSummaries/programs/*venID*, for events of a specific DR program,
(c) {prefix}/.energy/electric/demandResponse/eventSummaries/pending, for pending events,
(d) {prefix}/.energy/electric/demandResponse/eventSummaries/active, for active events,
(e) {prefix}/.energy/electric/demandResponse/eventSummaries/completed, for completed events,
(f) {prefix}/.energy/electric/demandResponse/eventSummaries/all, for all events,

where {prefix} is found per Clause W.2. These events may additionally be filtered by a date range. Event summary data is returned according to the format in Clause AD.4.1.1.

If more than one event summary is returned (multiple instances of DREventSummaryDetails), results for each event shall be returned in order of event start time (start) from newest to oldest.

AD.3.1.2 DR Program Metadata

A GET request to {prefix}/.energy/electric/demandResponse/programs will return program metadata per the DRProgram composition definitions in Clause AD.4.1.2. This metadata includes a list of links that

may be used to point to multiple meters associated with each DR program that has a VEN hosted by the BACnet ESI.

AD.3.1.3 DR Event Message Log

A GET request to {prefix}/.energy/electric/demandResponse/eventMessages will return the DR message log, AD.4.1.3. DRMessageLog returns a record of all DR messages retained in a database. The request may be filtered by a time window, e.g., events in the past 3 months, or a narrow window around a specific event.

If a client wants only the messages associated with a specific DR event, this can be accessed with a GET request to {prefix}/.energy/demandResponse/eventMessages/events/eventID.

If a client wants only the messages associated with a specific DR program, this can be accessed with a GET request to {prefix}/.energy/demandResponse/eventMessages/programs/venID.

AD.4 Data Definitions

The CSML corresponding to the tables in this clause is available at data.ashrae.org.

AD.4.1 Demand Response

AD.4.1.1 DREventSummary

This section provides data model components for event summaries.

Table AD-4.1.1 DREventSummary composition

Components	Type, optionality	Description
drEventSummaryDetails	LIST of DREventSummaryDetails	Each DREventSummaryDetails composition provides a summary of a single OpenADR event

Table AD-4.1.1.1 DREventSummaryDetails composition

Components	Type, optionality	Description
programName	String	facility user-provided name for DR program
venID	String	ven/venID
problem	Problem, OPTIONAL	
event	Event	key information elements from the Event component of the most recent DR event message

Table AD-4.1.1.1.1 Problem composition

Components	Type, optionality	Description
status	Integer, OPTIONAL	http status code in response from VEN back to VTN if there is an error
detail	String, OPTIONAL	provides a human readable explanation specific to this occurrence of the problem, e.g. "Connection to database timed out"
type	Link, OPTIONAL	URI identifies specific problem type
title	String, OPTIONAL	short description of problem type
instance	Link, OPTIONAL	URI identifying specific problem

Table AD-4.1.1.1.2 Event composition

Components	Type, optionality	Description
eventID	String, OPTIONAL	Unique event ID
createdDateTime	BACnetDateTime, OPTIONAL	Server timestamp on event creation
modificationDateTime	String, OPTIONAL	Most recent event modification timestamp (if any)
programID	String	ID attribute of program object this event is associated with
eventName	String, OPTIONAL	User-defined name for event (e.g., for user interface)
priority	Integer, OPTIONAL	Relative priority of event from 0 to 3, 0 being highest priority
start	BACnetDateTime	Start time of the event. BACnet ESI supports multi-interval price events where intervals have the same durations, but not multi-part events with varying durations.
duration	Integer	duration of each interval, seconds. If more than one interval, then each interval is of the same duration.
randomizeStart	Integer, OPTIONAL	indicates a randomization time that may be applied to start, in seconds.
payloadType	String	From OA3 eventPayloadDescriptor/payloadType , e.g., “SIMPLE” or “PRICE”.
values	ARRAY of String	OA3 event level (SIMPLE) is type INT, PRICE is type REAL. OA3 Data values : event/payloads/valuesMap/values Note: Duration provides the length of each interval, and the length of this values array times duration provides the total event duration (if more than one interval).
units	String, OPTIONAL	eventPayloadDescriptor/units
currency	String, OPTIONAL	eventPayloadDescriptor/currency

AD.4.1.2 DR Program type definitions

DR Program provides program metadata with meter metadata for each DR program.

Table AD-4.1.2 DRProgram composition

Components	Type, optionality	Description
programID	String	VTN assigned program ID
programName	String	User provided short name for program, e.g., ComTOU
programLongName	String, OPTIONAL	User provided long name for program, e.g., Commercial TOU-A
retailerName	String, OPTIONAL	Name of energy retailer providing the program.

programType	String, OPTIONAL	user-defined program category (e.g., “Pricing_Tariff”)
venID	String, OPTIONAL	Virtual end node object ID
programDescription	LIST of Link, OPTIONAL	URI(s) pointing to human/machine-readable content. This element was previously called marketContext.
drMeter	LIST of Link, OPTIONAL	Links point to some site-specific meter metadata. A link may point to a meter object, where "http" or “https" points to a BACnet/WS accessible resource, or may identify a meter ID or name using “urn” or “tag” as a non-locating “identifier” (for example, “tag:wossamotta.edu,2022:Meter12”). There may be more than one meter associated with a DR program.

AD.4.1.3 DRMessageLog type definition

Log of DR messages exchanged with facility which may include messages for more than one event and messages associated with more than one DR program. Message log may be constrained by available storage or may not include all messages per policy.

Table AD-4.1.3 DRMessageLog type definition

Components	memberType, optionality	Description
logStartTime	DateTime	start date and time for log record
logEndTime	DateTime	end date and time for log record
logDescription	String OPTIONAL	description of log contents
drLog	LIST of DRLog	message log for each event of each DR program

Table AD-4.1.3.1 DRLog composition

Components	Type, optionality	Description
venID	String	VEN ID with format specified by DR program
programID	String	DR program-specific ID
programDescription	LIST of Link, OPTIONAL	URL(s) pointing to human/machine-readable content
eventID	String	unique ID for each event with format defined by DR Program
drLogMessageText	LIST of DRLogMessageText	flattened text of each DR event-related message

Table AD-4.1.3.1.1 DRLogMessageText composition

Components	Type, optionality	Description
messageTime	DateTime	datetime message was received at or sent from the VEN
messageBody	String	flattened message text

AD.5 Examples

Consider that a building client is not already configured to read DR program information or meter data. In this case, the client may request a summary of all DR events:

{prefix}/.energy/electric/demandResponse/eventSummaries/all

The server will return the DREventSummary composition with a summary of all event information in memory for each event that has been completed or is pending or active. This event summary data will include the programID which may be used to tie a given eventID to a specific meter by using a GET request to:

{prefix}/.energy/electric/demandResponse/programs

This will return the metadata for each DR program and links to meters associated with those DR program(s). The building client will then know about every stored event and know which meter(s) serve for measurement and verification for any specific event.

[Add to BACnet Clause 25: References, p. ?]

after the ISO/IEC 10646-1 entry:
ISO 17800 Facility Smart Grid Information Model (ANSI/ASHRAE/NEMA Standard 201)

after the FIPS 197 (2002) entry:
IEC 62746-10-1 Ed.1, 2018-11 Systems interface between customer energy management system and the power management system - Part 10-1: Open automated demand response (OpenADR)

[Add to Clause 3.3, p. ?]

DR *demand response*
ESI *energy services interface*
ESI-EM *ESI energy manager*
ESP *energy service provider*
VEN *virtual end node*
VTN *virtual top node*

[Add a new entry to **History of Revisions**, p. 1364]

(This History of Revisions is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard.)

HISTORY OF REVISIONS

. . .	. . .	**. . .**
1	30	**Addendum *cm* to ANSI/ASHRAE Standard 135-2020** Approved by ASHRAE on December 31, 2024; and by the American National Standards Institute on December 31, 2024. 1. BACnet Energy Services Interface

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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