

BSR/ASHRAE Addendum *r*
to ANSI/ASHRAE Standard 135-2004

Public Review Draft

ASHRAE® Standard

Proposed Addendum *r* to Standard 135-2004, *BACnet*®—A *Data Communication Protocol for Building Automation and Control Networks*

First Public Review (March 2008)
(Draft Shows Proposed Changes
to Current Standard)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed addendum, use the comment form and instructions provided with this draft. The draft is subject to modification until it is approved for publication by the responsible project committee, the ASHRAE Standards Committee, and the Board of Directors. Then it will be submitted to the American National Standards Institute Board of Standards Review (BSR) for approval. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE web site) remains in effect. The current edition of any standard may be purchased from the ASHRAE Bookstore @ <http://www.ashrae.org> or by calling 404-636-8400 or 1-800-527-4723 (for orders in the U.S. or Canada).

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[This foreword 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 purpose of this addendum is to present a proposed change for public review. These modifications are the result of change proposals made pursuant to the ASHRAE continuous maintenance procedures and of deliberations within Standing Standard Project Committee 135. The proposed changes are summarized below.

- 135-2004r-1. Clarify transitions in `FLOATING_LIMIT` and `OUT_OF_RANGE` events, p. 1.**
- 135-2004r-2. Clarify router action when a network is marked as temporarily unreachable, p. 4.**
- 135-2004r-3. Clarify the destination MAC used when replying to a broadcast DER frame, p. 5.**
- 135-2004r-4. Clarify the handling of write priorities greater than 16, p. 6.**
- 135-2004r-5. Clarify LogDatum presentation, p. 9.**

In the following document, language to be added to existing clauses of ANSI/ASHRAE 135-2004 and Addenda is indicated through the use of *italics*, while deletions are indicated by ~~strike through~~. Where entirely new subclauses are proposed to be added, plain type is used throughout. Only this new and deleted text is open to comment as this time. All other material in this addendum is provided for context only and is not open for public review comment except as it relates to the proposed changes.

135-2004r-1. Clarify transitions in FLOATING_LIMIT and OUT_OF_RANGE events.

Rationale

Interpretation IC 135-2004-8 (approved by SSPC 135 on June 25, 2005) states "An object that reports FLOATING_LIMIT or OUT_OF_RANGE events shall not generate TO-OFFNORMAL transitions from an OFFNORMAL (LOW_LIMIT or HIGH_LIMIT) state." This clarification needs to be embodied in the language in the standard.

Addendum 135-2004r-1

[Change 12.2.19.1, p. 140]

12.2.19.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must exceed the High_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the HighLimitEnable flag must be set in the Limit_Enable property, ~~and~~
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property, property, and~~
- (d) *the Event_State is not equal to LOW_LIMIT.*

The Analog Input object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from LOW_LIMIT to HIGH_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.2.20.1, p. 141]

12.2.20.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must fall below the Low_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the LowLimitEnable flag must be set in the Limit_Enable property, ~~and~~
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property, property, and~~
- (d) *the Event_State is not equal to HIGH_LIMIT.*

The Analog Input object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from HIGH_LIMIT to LOW_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.3.20.1, pp. 145]

12.3.20.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must exceed the High_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the HighLimitEnable flag must be set in the Limit_Enable property, ~~and~~
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property, property, and~~
- (d) *the Event_State is not equal to LOW_LIMIT.*

The Analog Output object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from LOW_LIMIT to HIGH_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.3.21.1, p. 146]

12.3.21.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must fall below the Low_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the LowLimitEnable flag must be set in the Limit_Enable property, ~~and~~
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property, property, and~~
- (d) *the Event_State is not equal to HIGH_LIMIT.*

The Analog Output object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from HIGH_LIMIT to LOW_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.4.26.1, p. 150]

12.4.16.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must exceed the High_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the HighLimitEnable flag must be set in the Limit_Enable property, ~~and~~
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property, property, and~~
- (d) *the Event_State is not equal to LOW_LIMIT.*

The Analog Value object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from LOW_LIMIT to HIGH_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.4.17.1, pp. 150-151]

12.4.17.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must fall below the Low_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the LowLimitEnable flag must be set in the Limit_Enable property, ~~and~~
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property, property, and~~
- (d) *the Event_State is not equal to HIGH_LIMIT.*

The Analog Value object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from HIGH_LIMIT to LOW_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.17.32, p 211]

12.17.32 Error_Limit

This property, of type REAL, shall convey the absolute magnitude that the difference between the Setpoint and Controlled_Variable_Value (the Error) must exceed before a TO-OFFNORMAL event is generated. This property is required if intrinsic reporting is supported by this object.

The Loop object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from LOW_LIMIT to HIGH_LIMIT, or HIGH_LIMIT to LOW_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.23.22.1, p. 238 - Pulse Converter]

12.23.22.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must exceed the High_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the HighLimitEnable flag must be set in the Limit_Enable property, and
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property~~, *property, and*
- (d) *the Event_State is not equal to LOW_LIMIT.*

The Pulse Converter object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from LOW_LIMIT to HIGH_LIMIT, the object shall first transition to the NORMAL state.

[Change 12.23.23.1, p. 239 - Pulse Converter]

12.23.23.1 Conditions for Generating a TO-OFFNORMAL Event

A TO-OFFNORMAL event is generated under these conditions:

- (a) the Present_Value must fall below the Low_Limit for a minimum period of time, specified in the Time_Delay property, and
- (b) the LowLimitEnable flag must be set in the Limit_Enable property, and
- (c) the TO-OFFNORMAL flag must be set in the Event_Enable ~~property~~, *property, and*
- (d) *the Event_State is not equal to HIGH_LIMIT.*

The Pulse Converter object shall not generate a TO-OFFNORMAL transition from the LOW_LIMIT or HIGH_LIMIT state. When transitioning from HIGH_LIMIT to LOW_LIMIT, the object shall first transition to the NORMAL state.

135-2004r-2. Clarify router action when a network is marked as temporarily unreachable.

Rationale

Interpretation IC 135-2004-10 (approved by SSPC 135 on June 25, 2005) states "If a router receives a message that is destined for a particular network that is marked as temporarily unreachable in the routing table, then the router must respond by transmitting a Reject-Message-To-Network message with reject reason 2." This clarification needs to be embodied in the language in the standard.

Addendum 135-2004r-2

[Change 6.6.3.6, p. 62]

6.6.3.6 Router-Busy-To-Network

If a router wishes to curtail the receipt of messages for specific DNETs or all DNETs, it shall generate a Router-Busy-To-Network message.

If a router temporarily wishes to receive no more traffic for one or more specific DNETs, it shall broadcast a Router-Busy-To-Network message with a list of the 2-octet network numbers corresponding to these DNETs. If the 2-octet network numbers are omitted, it means the router wishes to stop the flow of messages to all the networks it normally serves.

Each router receiving a Router-Busy-To-Network message shall update its routing table to indicate that the specified DNETs are not reachable, set or reset a 30-second timer for this status, and broadcast a Router-Busy-To-Network message out each port other than the one on which it was received so that all routers may learn of the congestion control restriction. *The congestion control indication shall be cleared on expiration of the 30 second timer. Upon receiving a message whose destination is on one of the temporarily unreachable DNETs, a router shall send a Reject-Message-To-Network message with a reject reason of 2 to the originating node.*

Normally, a Router-Busy-To-Network message should be followed in a short time by a Router-Available-To-Network message indicating that the congestion control restriction has been lifted. ~~In the event that this does not happen within a timeout period of 30 seconds or if a node that has recently joined the network did not receive a previous Router-Busy-To-Network message, it may attempt a transmission to the "busy" router.~~ *In the event that a router receives a message while it is still requiring congestion control, and* If the router is able to accept the message, it shall do so and, at its discretion, again broadcast a Router-Busy-To-Network message for the benefit of this node and any others that may not have received the previous transmission. If the router is unable to accept the message, it shall immediately return a Reject-Message-To-Network to the sender. It may then also broadcast another Router-Busy-To-Network message for the reasons cited above.

135-2004r-3. Clarify the destination MAC used when replying to a broadcast DER frame.

Rationale

Interpretation IC 135-2004-22 (approved by SSPC 135 on April 25, 2007) states "In Clause 6.5.3 of 135 the 4th method for establishing the address of a router was never intended to be used for replies as the request indicates the router address. When replying to a DER frame from a remote network, if the responding device does not already know a route to the remote network, it shall use the source MAC address from the DER frame as the address through which to route the response frame" (with additional comments). This clarification needs to be embodied in the language in the standard.

Addendum 135-2004r-3

[Change **6.5.3**, p. 57]

Note that ~~four~~ five methods exist for establishing the address of a BACnet router for a particular DNET: 1) the address may be established manually at the time a device is configured, 2) the address may be learned by issuing a Who-Is request and noting the SA associated with the subsequent I-Am message (assuming the device specified in the Who-Is is located on a remote DNET and the I-Am message was handled by a router on the local network), 3) by using the network layer message Who-Is-Router-To-Network, ~~and~~ 4) by using the local broadcast MAC address in the initial transmission to a device on a remote DNET and noting the SA associated with any subsequent responses from the remote ~~device~~. device, and 5) by noting the SA associated with any requests received from the remote DNET. Which method is used shall be a local matter.

The local broadcast MAC address may be used in response messages, although it is discouraged. It is preferable that a device note the SA associated with the original request and reuse that SA in the response. For MS/TP networks, in order for MS/TP master devices to use the local broadcast MAC address in a response, a Reply Postponed MAC frame shall be sent in response to the BACnet Data Expecting Reply frame and the response may then be sent when the MS/TP master device receives the token. MS/TP slave devices are unable to use the local broadcast MAC address for responses because they never receive the token.

135-2004r-4. Clarify the handling of write priorities greater than 16.

Rationale
 Interpretation request IC135-2004-19 deals with the handling of write requests with a priority parameter greater than 16. This proposed changed codifies the answer.

Addendum 135-2004r-4

[Change 15.9.1.3.1, p. 321.]

15.9.1.3.1 Error Type

This parameter consists of two component parameters: (1) an 'Error Class' and (2) an 'Error Code'. See Clause 18. The 'Error Class' and 'Error Code' to be returned for specific situations are as follows:

<u>Situation</u>	<u>Error Class</u>	<u>Error Code</u>
Specified object does not exist.	OBJECT	UNKNOWN_OBJECT
Specified property does not exist.	PROPERTY	UNKNOWN_PROPERTY
An array index is provided but the property is not an array.	PROPERTY	PROPERTY_IS_NOT_AN_ARRAY
An array index is provided that is outside the range existing in the property.	PROPERTY	INVALID_ARRAY_INDEX
The specified property is currently not writable by the requestor.	PROPERTY	WRITE_ACCESS_DENIED
The datatype of the value provided is incorrect for the specified property.	PROPERTY	INVALID_DATATYPE
The property is Object_Name and the name is already in use in the device.	PROPERTY	DUPLICATE_NAME
The property is Object Identifier and the identifier is already in use in the device.	PROPERTY	DUPLICATE_OBJECT_ID
The value provided is outside the range of values that the property can take on.	PROPERTY	VALUE_OUT_OF_RANGE
There is not enough space to store the new value.	RESOURCES	NO_SPACE_TO_WRITE_PROPERTY
<i>The Priority parameter is not within the defined range of 1..16. This condition may be ignored if the property is not commandable.</i>	SERVICES	PARAMETER_OUT_OF_RANGE

[Change 15.10.1.3.1, pp. 322-323.]

15.10.1.3.1 Error Type

This parameter consists of two component parameters: (1) an 'Error Class' and (2) an 'Error Code'. See Clause 18. The 'Error Class' and 'Error Code' to be returned in a 'Result(-)' for specific situations are as follows:

<u>Situation</u>	<u>Error Class</u>	<u>Error Code</u>
Specified object does not exist.	OBJECT	UNKNOWN_OBJECT
Specified property does not exist.	PROPERTY	UNKNOWN_PROPERTY
An array index is provided but the property is not an array.	PROPERTY	PROPERTY_IS_NOT_AN_ARRAY
An array index is provided that is outside the range existing in the property.	PROPERTY	INVALID_ARRAY_INDEX
The specified property is currently read-only.	PROPERTY	WRITE_ACCESS_DENIED
The datatype of the value provided is incorrect for the specified property.	PROPERTY	INVALID_DATATYPE
The property is Object_Name and the name is already in use in the device.	PROPERTY	DUPLICATE_NAME
The property is Object Identifier and the identifier is already in use in the device.	PROPERTY	DUPLICATE_OBJECT_ID
The value provided is outside the range of values that the property can take on.	PROPERTY	VALUE_OUT_OF_RANGE
There is not enough space to store the new value.	RESOURCES	NO_SPACE_TO_WRITE_PROPERTY
<i>The Priority parameter is not within the defined range of 1..16. This condition may be ignored if the property is not commandable.</i>	SERVICES	PARAMETER_OUT_OF_RANGE

[Change 15.10.2, WritePropertyMultiple service procedure, p. 323]

15.10.2 Service Procedure

For each 'Write Access Specification' contained in the 'List of Write Access Specifications', the value of each specified property shall be replaced by the property value provided in the 'Write Access Specification' and a 'Result(+)' primitive shall be issued, indicating that the service request was carried out in its entirety. Interpretation of the conditional Priority parameter shall be as specified in Clause 19.

If, in the process of carrying out the modification of the indicated properties in the order specified in the 'List of Write Access Specifications', a property is encountered that cannot be modified, the responding BACnet-user shall issue a 'Result(-)' response primitive indicating the reason for the failure. The result of this service shall be either that all of the specified properties or only the properties up to, but not including, the property specified in the 'First Failed Write Attempt' parameter were successfully modified.

A BACnet-Reject-PDU shall only be issued if no write operations have been successfully executed, indicating that the service request was rejected in its entirety. If any of the write operations contained in the 'List of Write Access Specifications' have been successfully executed, a Result(-) response indicating the reason for the failure shall be issued as described above.

[Insert new clause 18.6.14 and renumber subsequent clauses, p. 357.]

18.6.14 PARAMETER_OUT_OF_RANGE - Generated in response to a confirmed request APDU that conveys a parameter whose value is outside the range defined for this service.

[Change 20.1.8, p. 375.]

20.1.8 BACnet-Reject-PDU

The BACnet-Reject-PDU is used to reject a received confirmed request PDU that contains syntactical flaws or other protocol errors which would prevent the PDU from being interpreted or the requested service from being provided. Only confirmed request PDUs may be rejected (see 18.8).

There are error conditions where a valid reject-reason and an equally valid error code exist that can be used to describe the condition. In such cases it is a local matter whether or not a BACnet-Reject-PDU is used to convey the error, with the exception that a BACnet-Reject-PDU shall not be returned if service execution has commenced and the execution has resulted in a standard network visible change in the device’s state. For example, a WritePropertyMultiple-Request shall not be rejected if at least one of the write operations has already been applied. In such cases an error code shall be used.

```
BACnet-Reject-PDU ::= SEQUENCE {
  pdu-type          [0] Unsigned (0..15), -- 6 for this PDU type
  reserved          [1] Unsigned (0..15), -- must be set to zero
  original-invokeID [2] Unsigned (0..255),
  reject reason     [3] BACnetRejectReason
-- Context specific tags 0..3 are NOT used in header encoding
}
```

[Change Clause 21, Error production, pp. 406-407]

```
Error ::= SEQUENCE {
  ...
  error-code    ENUMERATED {
    operational-problem          (25),
    optional-functionality-not-supported (45),
    parameter-out-of-range      (80),
    ...
    -- see parameter--out-of-range (80)
    ...
  }
-- Enumerated values 0-255 are reserved for definition by ASHRAE. Enumerated values
-- 256-65535 may be used by others subject to the procedures and constraints described
-- in Clause 23. The last enumeration used in this version is 47.
}
```

135-2004r-5. Clarify LogDatum presentation.

Rationale

Interpretation request IC135-2004-17 noted that the language in the Trend Log's Log_Buffer property element LogDatum, "These choices represent data values read from the monitored object and property," was ambiguous in terms of whether the Trend Log was allowed to present data values in different datatypes from those read, such as reading (INTEGER) 2 and presenting it as (REAL) 2.0. This proposed change codifies the answer.

Addendum 135-2004r-5

[Change 12.25.14, p. 249.]

12.15.24 Log_Buffer

...

The choices available for the LogDatum are listed below:

log-status	This choice represents a change in the status or operation of the Trend Log object. Whenever one of the events represented by the flags listed below occurs, except as noted, a record shall be appended to the buffer.
log-disabled	This flag is set whenever the Trend Log object is disabled, such as when Log_Enable is set to FALSE. Whenever the Trend Log object begins operation, this flag shall be presumed to have changed from TRUE to FALSE and a log entry shall be made.
buffer-purged	This flag shall be set to TRUE whenever the buffer is deleted by a write of the value zero to the Record_Count property. After this value is recorded in the buffer, the subsequent immediate change to FALSE shall not be recorded.
boolean-value real-value enum-value unsigned-value signed-value bitstring-value null-value ...	These choices represent <i>the</i> data values <i>and datatypes</i> read from the monitored object and property.
failure	This choice represents an error encountered in an attempt to read a data value from the monitored object. If the error is conveyed by an error response from a remote device the Error Class and Error Code in the response shall be recorded.
time-change	This choice represents a change in the clock setting in the device, it records the number of seconds by which the clock changed. If the number is not known, such as when the clock is initialized for the first time, the value recorded shall be zero.
any-value	This choice represents <i>the</i> data values <i>and datatypes</i> read from the monitored object and property.