A Data Communication Protocol for Building Automation and Control Networks


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. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE® website (www.ashrae.org) or in paper form from the Senior Manager of Standards.

The latest edition of an ASHRAE Standard may be purchased on the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

© 2018 ASHRAE   ISSN 1041-2336
<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bernhard Isler*</td>
<td>Chair</td>
<td>Frank Schubert</td>
<td></td>
</tr>
<tr>
<td>Michael Osborne, Vice-Chair</td>
<td></td>
<td>H. Michael Newman*</td>
<td>Steve Sywak*</td>
</tr>
<tr>
<td>Coleman L. Brumley, Jr.*</td>
<td>Secretary</td>
<td>Frank V. Neher</td>
<td>David B. Thompson</td>
</tr>
<tr>
<td>Michael P. Graham*</td>
<td></td>
<td>Carl Neilson</td>
<td>Klaus Wagner</td>
</tr>
<tr>
<td>David G. Holmberg*</td>
<td></td>
<td>Duffy O’Craven*</td>
<td>Grant N. Wichenko*</td>
</tr>
<tr>
<td>Daniel Kollodge</td>
<td></td>
<td>Narasinha Reddy</td>
<td>Scott Ziegenfus</td>
</tr>
<tr>
<td>Jake Kopocis</td>
<td></td>
<td>Jonathan Rigby</td>
<td>Teresa Zotti*</td>
</tr>
<tr>
<td>Thomas Kurowski</td>
<td></td>
<td>David Ritter*</td>
<td></td>
</tr>
<tr>
<td>Edward J. Macey-MacLeod*</td>
<td></td>
<td>David Robin</td>
<td></td>
</tr>
</tbody>
</table>

* Denotes members of voting status when the document was approved for publication

**ASHRAE STANDARDS COMMITTEE 2017–2018**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steven J. Emmerich, Chair</td>
<td></td>
<td>Roger L. Hedrick</td>
<td>David Robin</td>
</tr>
<tr>
<td>Donald M. Brundage, Vice-Chair</td>
<td></td>
<td>Rick M. Heiden</td>
<td>Peter Simmonds</td>
</tr>
<tr>
<td>Niels Bidstrup</td>
<td></td>
<td>Jonathan Humble</td>
<td>Dennis A. Stanke</td>
</tr>
<tr>
<td>Michael D. Corbat</td>
<td></td>
<td>Srinivas Katipamula</td>
<td>Wayne H. Stoppelmoor, Jr.</td>
</tr>
<tr>
<td>Drury B. Crawley</td>
<td></td>
<td>Kwang Woo Kim</td>
<td>Richard T. Swierczyna</td>
</tr>
<tr>
<td>Julie M. Ferguson</td>
<td></td>
<td>Larry Kouma</td>
<td>Jack H. Zavour</td>
</tr>
<tr>
<td>Michael W. Gallagher</td>
<td></td>
<td>Arsen K. Melikov</td>
<td>Lawrence C. Markel, BOD ExO</td>
</tr>
<tr>
<td>Walter T. Grondzik</td>
<td></td>
<td>R. Lee Millies, Jr.</td>
<td>M. Ginger Scoggins, CO</td>
</tr>
<tr>
<td>Vinod P. Gupta</td>
<td></td>
<td>Karl L. Peterman</td>
<td></td>
</tr>
<tr>
<td>Susanna S. Hanson</td>
<td></td>
<td>Erick A. Phelps</td>
<td></td>
</tr>
</tbody>
</table>

Steven C. Ferguson, Senior Manager of Standards

**SPECIAL NOTE**

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution.” Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
   b. participation in the next review of the Standard,
   c. offering constructive criticism for improving the Standard, or
   d. permission to reprint portions of the Standard.

**DISCLAIMER**

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE’s Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

**ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS**

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

ASHRAE is a registered trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ANSI is a registered trademark of the American National Standards Institute.
[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 changes to ANSI/ASHRAE Standard 135-2016. 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 changes are summarized below.

135-2016 bm-1. Reduce allowed range for Usage Timeout, p. 2
135-2016 bm-2. Specify design choices for M S/TP devices, p. 3
125-2016 bm-3. Handle unwanted M S/TP frames in IDLE state, p. 5

In the following document, language to be added to existing clauses of ANSI/ASHRAE Standard 135-2016 is indicated through the use of italics, while deletions are indicated by strikethrough. Where entirely new subclauses are added, plain type is used throughout.

The use of placeholders like X, Y, Z, X1, X2, etc., should not be interpreted as literal values of the final standard. These placeholders will be assigned actual numbers/letters only with incorporation of this addendum into the standard for republication.
135-2016bm-1. Reduce allowed range for Usage Timeout

Rationale

The MS/TP parameter $T_{usage\_timeout}$ as defined in Clause 9.5.3 has been misinterpreted by some implementers since it allows up to 100ms of delay for nodes to reply to PollForMaster or to begin using a passed token. The current language is unfortunately vague and implies that an implementation may use a value as small as 20ms or as large as 100ms. The intention was always that the definition of $T_{usage\_delay}$ would require that devices always reply within 15ms, but the wide variation in $T_{usage\_timeout}$ was misleading to some implementors. This creates an interoperability issue if a “20ms” device attempts to interoperate with a “100ms” device.

The range of $T_{usage\_timeout}$ is reduced to 35 milliseconds maximum.

[Change Clause 9.5.3, $T_{usage\_timeout}$, p. 99]

$T_{usage\_timeout}$

The minimum time without a DataAvailable or ReceiveError event that a node must wait for a remote node to begin using a token or replying to a Poll For Master frame: 20 milliseconds. (Implementations may use larger values for this timeout, not to exceed 100 35 milliseconds.)
135-2016bm-2. Specify design choices for MS/TP devices.

Rationale

The standard allows for MS/TP devices to make various choices in their implementation. There is no standard method for determining some of the key choices.

Also, the current language limits the number of nodes per segment to 32 due to the EIA-485 standard. However, EIA-485 specifies 32 unit loads, not 32 nodes. Early EIA-485 transceivers were one unit load, but today, 1/2, 1/4, and even 1/8 load transceivers are available, allowing the possibility of up to 8 * 32, or 256 nodes per segment.

The PICS is extended to allow specification of the implementation choices, including unit loads, of the MS/TP product.

[Change Clause 9.2.2, p. 82]

9.2.2 Connections and Terminations

The maximum number of nodes unit loads per segment shall be 32 (as specified by the EIA-485 standard). Additional nodes unit loads may be accommodated by the use of repeaters, as described in Clause 9.9.

...

[Add new Clause 9.X, p. 122]

9.X Documenting MS/TP Device Design Choices

Every MS/TP device includes a collection of design choices that affect the behavior of the device. Among these, the following choices are important in terms of MS/TP interoperability:

(a) master or slave implementation
(b) isolated or non-isolated power source for EIA/TIA-485 transceiver
(c) whether local biasing is built-in to the device
(d) transceiver unit loading
(e) data rates supported by the device

Each MS/TP device shall indicate all of this information in its Protocol Implementation Conformance Statement (PICS). See Annex A.

9.X.1 Master or Slave Implementation

The PICS shall indicate whether the device implements a Master Node State Machine or Slave Node State Machine or either.

9.X.2 EIA/TIA-485 Power Isolation

The PICS shall indicate whether the EIA/TIA-485 transceiver implements an optically and magnetically isolated power source, or not. Designs that implement such a power source shall be called ISOLATED, and designs that do not shall be called NON-ISOLATED.

9.X.3 Local Biasing

The PICS shall indicate whether the device implements local biasing, by way of 47K ohms pull-up/pull-down (see 9.2.2), as having “Local Bias 47K.” Devices without 47K ohms biasing shall indicate “Local Bias none.”

9.X.4 Transceiver Unit Loading

Based on the characteristics of the EIA/TIA-485 transceiver of the device, the PICS shall indicate “Unit Load X” where X is 1, ½, ¼, or [ .

9.X.5 Data Rates

The PICS shall include a list of each data rate supported by the device.
[Change Annex A, p. 937]

Data Link Layer Options:

- Master/Slave (Clause 9), baud rate(s):
  - Master
  - Slave
  - Non-isolated transceiver
  - Isolated transceiver
  - Local 47K ohms bias resistors
  - None
  - Other: ____________________

Transceiver unit loading: 1 ½ ¼

Data rates: 9600 19200 38400 57600 76800 115200

- Master/Slave (Clause 9), baud rate(s): ____________________

- . . .

. . .
135-2016bm-3. Handle additional unwanted MS/TP frames in IDLE state.

Rationale

Some MS/TP frames sent to a master device being in IDLE state are not valid frames in that state, so they are unwanted frames and should be ignored. Except that the ReceivedValidFrame flag should be reset to FALSE to signal the message is processed and to allow a next received message being fed into the state machine.

A new condition is included in the master node's state machine state IDLE, in section ReceivedUnwantedFrame, to handle these unwanted frame types.

[Change Clause 9.5.6.2, p. 106]

9.5.6.2 IDLE

In the IDLE state, the node waits for a frame.

...ReceivedUnwantedFrame

If ReceivedValidFrame is TRUE and either

(a) DestinationAddress is not equal to either TS (this station) or 255 (broadcast) or

(b) DestinationAddress is equal to 255 (broadcast) and FrameType has a value of Token, Test_Request, or a proprietary type known to this node that expects a reply (such frames may not be broadcast) or

(c) FrameType has a value that indicates a standard or proprietary type that is not known to this node or

(d) DestinationAddress is equal to TS and FrameType is equal to Reply To Poll For Master or Reply Postponed,

then an unexpected or unwanted frame was received. Set ReceivedValidFrame to FALSE, and enter the IDLE state to wait for the next frame.

...
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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Addendum bm to ANSI/ASHRAE Standard 135-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>Approved by ASHRAE on June 15, 2018; and by the American National Standards Institute on June 15, 2018.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Reduce allowed range for Usage Timeout.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Specify design choices for MS/TP devices.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Handle unwanted MS/TP frames in IDLE state.</td>
</tr>
</tbody>
</table>
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.
About ASHRAE
ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability. Through research, Standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow’s built environment today.

For more information or to become a member of ASHRAE, visit www.ashrae.org.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards.

Visit the ASHRAE Bookstore
ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, on CD-ROM, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous version. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at www.ashrae.org/bookstore.

IMPORTANT NOTICES ABOUT THIS STANDARD
To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.