MC12.19

User’s Guide

For

Utility Industry Metering Communication Protocol
Application Layer (End Device Data Tables)

October 29, 2013
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Abstract: The technical content of this User’s Guide is nearly identical to IEEE Std 1377™-2012 and ANSI C12.19-2012, using IEEE Std 1377-2012 as the baseline for the MC12.22 User’s Guide. The protocol describes common structures that are provided for encoding data in communication between End Devices (meters, home appliances, C12.22/IEEE 1703/MC12.22 Nodes) and Utility enterprise collection and control systems using both binary codes and the Extensible Markup Language (XML) content. The Advanced Metering Infrastructure (AMI) and Smart Grid requirements are addressed as identified by the Office of Electricity Delivery and Energy Reliability of the U.S. Department of Energy and by the Smart Metering Initiative of the Ontario Ministry of Energy (Canada) and of Measurement Canada. Sets of tables are exposed that are grouped together into sections that pertain to a particular feature-set and related function such as Time-of-use, Load Profile, Security, Power Quality, and more. Each standard Table Set (Data Model) can be expanded or restricted by the Manufacturer of the C12.19/IEEE 1377/MC12.19 Device or home appliance using a descriptive registered syntax that is XML-based Table Definition Language (XML/TDL) and enterprise data-value management using Exchange Data Language (EDL) in a manner that is machine readable. The Tables support implementation of Gas, Water, and Electric devices, sensors and related appliances. Tables are also provided for network node configuration and management by referencing the companion standards IEEE Std 1703™-2012, ANSI C12.22-2012 and MC12.22 User’s Guide-2013.

Keywords: IEEE 1377, ANSI C12.19, MC12.19, Utility Tables, End Device, TDL, EDL
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Introduction

This introduction is not part of the MC12.19 User’s Guide. For consistency with IEEE Std 1377 and ANSI C12.19 the word “standard” was retained throughout this User’s Guide in reference to this document. Also in reference to MC12.18, MC12.19, MC12.21 and MC12.22, the term “standard” means “User’s Guide”.

The ANSI C12.19 and IEEE Std 1377 standard and the MC12.19 User’s Guide an open-platform and common data structure and descriptors for use in transferring data to and from utility End Devices, typically meters and Head-end systems. It has been developed with consideration of input from utilities, meter vendors, automated meter reading service companies, ANSI, Measurement Canada Task Force (for Industry Canada), NEMA, IEEE, Utilimetrics, NIST, SGIP, AEIC, and other interested parties nationally and internationally. This version of the User’s Guide covers the concept of an advanced metering infrastructure (AMI) such as that identified by the Office of Electricity Delivery and Energy Reliability of the U.S. Department of Energy; the Smart Metering Initiative of the Ontario Ministry of Energy (Canada) and the stated requirements of Measurement Canada for the approval of a metering device for use in Canada.

The ANSI C12.19/IEEE Std 1377/MC12.19 Tables are organized into functional groups known as decades (nominally ten Tables per decade). ANSI C12.19/IEEE Std 1377/MC12.19 contain up to 2040 “Standard Tables” that are fully described in the Standard. In addition, provisions were made for an additional 2040 “Manufacturers’ Tables” so that future innovations can be implemented utilizing the extension framework and mechanisms specified by the semantic model defined within. These mechanisms facilitate the possibility of future inclusion of Manufacturer-defined Tables into future publications of the Standard. The Standard provides the means for the inclusion of Manufacturer-defined Tables into End Devices through designation of new Device Classes.

Another set of 2040 “Extended User-defined Tables” is available for End Devices that have a need for extremely low communications overhead and a high need for compaction of data. The User Defined Tables and the Extended User-defined Tables aggregate elements of information from other Tables (Standard Tables Elements or Manufacturer Table Elements). These “Formal Elements” can be bundled into “virtual” Tables for transmission.

Also provided are “Pending” attributes for the Standard Tables, Manufacturer Tables, Standard Procedures, Manufacturer Procedures and Extended User-defined Tables; for use in applications such as End Device deferred programming, and End Device firmware upgrades with activation and roll-back capabilities. The Pending Tables also facilitate event driven and synchronized actionable communication for use by enterprise systems (such as head-end system) that communicate with a multitude of MC12.19 devices in an AMI network of a Smart Grid.

The Standards’ flexibility presents a challenge to system developers, to equipment vendors, and to utilities and customers alike. System developers must continue to provide the capability of processing multiple data formats from the End Devices. The obvious advantage of ANSI C12.19/IEEE Std 1377/MC12.19 is that the semantic rules and semantic model of the Table structures can be published using machine-readable TDL/XML (structure) and EDL/XML (enterprise exchange data) Forms, in addition to the human readable (Standard Document) Forms. TDL/XML and EDL/XML together with their derivative products (such as the human readable forms) are expected to be accessible through accredited registries via the Internet or other readily available means.

All registration authorities that recognize registrars are governed by ANSI C12 and IEEE SCC31. To be recognized, any registration authority is expected to adhere to the requirements specified in this standard. See Annex J, “(normative) Universal Identifier”.

The Standards also provides mechanisms and identifies means to access the Table data. For this reason, it is expected that data acquisition AMI products should be capable of processing data from any End Device that follows the access rules defined by ANSI C12.19/IEEE Std 1377/MC12.19 and associated communication protocols (such as ANSI C12.18/IEEE Std 1701™/MC12.18, ANSI C12.21/IEEE Std 1702™/MC12.21 and ANSI C12.22/IEEE Std 1703™/MC12.22). The End Device’s table of contents is provisioned by Table 0, the “General Configuration Table”. Access to Standard Table 0, function limiting Tables (of the Decades), and information found in device control Tables can be combined with ANSI C12.19/IEEE Std 1377/MC12.19 Device
Class information to gain the necessary information about “End Devices” for improved efficiency and interoperability.

Although this User’s Guide covers a broad range of functionality, it does not follow that implementations need to be large or complex. Implementers and users are encouraged to choose an appropriate functionality subset that is suitable for their needs. Therefore, it is very unlikely for any one End Device to embed all tables or even the majority of the tables described herein. Implementers and users are encouraged to deploy their desired functionalities using complete and consistent suites of Standard Tables from Standard Decades to the largest extent practical for the desired functionality of the device.

This release of the User’s guide establishes a new baseline that includes all of the corrections that were applied in Annex N, “Listing of editorial errors and errors of omission in ANSI C12.19-2008” of IEEE Std 1377-2012 and augmented with those correction applied in ANSI C12.19-2012.

The 2013 version of the MC12.19 User’s Guide was considered in the context of the so-called “protocol suite” of standards:

a. ANSI C12.18 / MC12.18 / IEEE Std 1701™,
b. ANSI C12.19 / MC12.19 / IEEE Std 1377™,
c. ANSI C12.21 / MC12.21 / IEEE Std 1702™,
d. ANSI C12.22 / MC12.22 / IEEE Std 1703™, and

The ANSI and IEEE published changes were included only after assuring that existing devices implementing ANSI C12.19-1997, ANSI C12.19-2008, IEEE Std 1377-1998 and MC12.19-2005 continue to remain compatible with this version of the document.

Note that, in this User’s Guide, the terms “C12.19 XXXX” (e.g., C12.19 Device) may interchangeably be replaced with the terms “IEEE 1377 XXXX” or “MC12.19 XXXX”; i.e., the IEEE 1377 End Device is the same as the ANSI C12.19 End Device and MC12.19 End Device. However, since this document jointly developed under the auspice of ANSI C12 SC17 WG2, the document terminology is based on C12.19 terms. Therefore references to ANSI or IEEE devices or standards are equivalent to references to the corresponding MC12.xx devices or User’s Guides.

Otherwise, this document is identical to the published ANSI C12.19-2012 / IEEE Std 1377-2012 Standards.
Notice to users

The body of this User’s Guide was developed jointly with ANSI C12.19 and IEEE Std 1377. The joint agreement calls for the standards and regulatory organizations IEEE, ANSI and MC to maintain the body of this standard in step as they publish versions and revisions of the standard. A number of editorial corrections were made in the preparation of the MC12.19 User’s Guide after the publication of IEEE Std 1377-2012. These corrections were incorporated into this User’s Guide and highlighted in the body of the document to indicate that the text was corrected. The detailed list of corrections is also shown in Annex N, “Listing of Editorial Corrections to IEEE Std 1377 2012”.

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Users of this User’s Guide should consult all applicable laws and regulations. Conformance with the provisions of this document does not imply compliance or conformance to any applicable regulatory requirements. Implementers of the User’s Guide are responsible for observing or referring to the applicable regulatory requirements. Measurement Canada does not, by the publication of its documents, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

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Errata

Errata, if any, for this User’s Guide can be accessed at the following URL: http://www.ecmx.org. Users are encouraged to check this URL for errata periodically.

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User’s Guide For Utility Industry Metering Communication Protocol Application Layer (End Device Data Tables)

Utility Industry End Device Data Tables

1  Overview

1.1  Scope

This standard defines a Table structure for utility application data to be passed between an End Device and any other device. It neither defines device design criteria nor specifies the language or protocol used to transport that data. The Tables defined in this standard represent a data structure that shall be used to transport the data, not necessarily the data storage format used inside the End Device.

1.2  Purpose

The Utility Industry has a need for a standard that provides an interoperable “plug-and-play” environment for field metering devices. The purpose of this standard is to define the framework and data structures for transporting Utility End Device data to and from End Devices and for use by enterprise systems.

This standard is intended to accommodate the concept of an advanced metering infrastructure such as that identified by the Office of Electricity Delivery and Energy Reliability of the U.S. Department of Energy; the Smart Metering Initiative of the Ontario Ministry of Energy (Canada); and the stated requirements of Measurement Canada for the approval of a metering device for use in Canada.

This standard is to provide a uniform, structured, and adaptive data model, such that Utility End Devices and ancillary devices (e.g., home appliances and communication technology) can operate in a “plug-and-play” and multisource enterprise Advanced Metering Infrastructure (AMI) environment.

This standard extends the definitions provided by IEEE Std 1377-1998 to include provisions for enterprise-level asset management, data management, and uniform data exchange capability, through the use of common and managed Extensible Markup Language (XML)/Table Definition Language (TDL) and XML/Exchange Data Language (EDL) End Device Class models.