

**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<sup>TM</sup>/MC12.18, ANSI C12.21/IEEE Std 1702<sup>TM</sup>/MC12.21 and ANSI C12.22/IEEE Std 1703<sup>TM</sup>/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
- e. Draft ANSI C12.23 / Draft MC12.23 / IEEE P1705™.

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".

## Laws and regulations

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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## Table of Contents

	Page
1 Overview .....	1
1.1 Scope .....	1
1.2 Purpose .....	1
2 Normative references.....	2
3 Definitions .....	4
4 General .....	12
4.1 Standard Tables .....	12
4.1.1 Standard Tables grouping .....	12
4.1.2 Standard Tables properties.....	12
4.1.3 Standard Procedure properties .....	13
4.2 Manufacturer Tables.....	14
4.2.1 Manufacturer Tables grouping.....	14
4.2.2 Manufacturer Tables properties .....	14
4.2.3 Manufacturer Procedure properties.....	15
4.3 Packed Record, Bit Field, and Element properties .....	16
4.4 Extended User-defined Tables properties .....	16
5 Syntax.....	17
5.1 Descriptive syntax .....	17
6 Special data types .....	18
6.1 Character set selection .....	18
6.2 Noninteger formats .....	18
6.2.1 STRING Numbers .....	19
6.3 Date and time formats.....	20
6.3.1 HTIME_DATE, LTIME_DATE, STIME_DATE, TIME, STIME, HTIME types .....	20
6.3.2 RDATE type .....	25
6.3.3 DATE Type .....	27
6.4 Common table or procedure identifier formats.....	28
6.4.1 TABLE_IDA_BFLD bit field.....	28
6.4.2 TABLE_IDB_BFLD bit field.....	29
6.4.3 TABLE_IDC_BFLD bit field.....	30
6.4.4 SOURCE_SELECT_RCD.....	30
7 Compliance and compatibility .....	32
7.1 Compliance .....	32
7.2 Backward and forward compatibility.....	33
8 Table transportation issues .....	34
8.1 Minimum services and parameters .....	34
8.1.1 Read Service .....	34
8.1.2 Write Service .....	35
8.1.3 Partial table access using the Index/Element-count method .....	36
8.1.4 Partial table access using the Offset/Octet-count method.....	38
8.1.5 Index count access method examples .....	39
8.2 Pending Event description .....	39

8.3	List management description .....	42
9	Tables .....	45
9.1	Decade 0: General Configuration Tables .....	45
9.1.1	Table 00 General Configuration Table .....	45
9.1.2	Table 01 General Manufacturer Identification Table.....	51
9.1.3	Table 02 Device Nameplate Table.....	52
9.1.4	Table 03 End Device Mode Status Table.....	60
9.1.5	Table 04 Pending Status Table .....	63
9.1.6	Table 05 Device Identification Table.....	65
9.1.7	Table 06 Utility Information Table.....	66
9.1.8	Table 07 Procedure Initiate Table.....	69
9.1.9	Table 08 Procedure Response Table.....	74
9.1.10	Standard Procedures .....	79
9.1.10.1	Procedure 00 Cold Start.....	79
9.1.10.2	Procedure 01 Warm Start.....	79
9.1.10.3	Procedure 02 Save Configuration .....	79
9.1.10.4	Procedure 03 Clear Data .....	79
9.1.10.5	Procedure 04 Reset List Pointers .....	79
9.1.10.6	Procedure 05 Update Last Read Entry .....	80
9.1.10.7	Procedure 06 Change End Device Mode .....	81
9.1.10.8	Procedure 07 Clear Standard Status Flags .....	82
9.1.10.9	Procedure 08 Clear Manufacturer Status Flags.....	82
9.1.10.10	Procedure 09 Remote Reset.....	83
9.1.10.11	Procedure 10 Set Date and/or Time .....	84
9.1.10.12	Procedure 11 Execute Diagnostics Procedure.....	87
9.1.10.13	Procedure 12 Activate All Pending Tables .....	87
9.1.10.14	Procedure 13 Activate Specific Pending Table(s).....	87
9.1.10.15	Procedure 14 Clear All Pending Tables .....	87
9.1.10.16	Procedure 15 Clear Specific Pending Table(s) .....	87
9.1.10.17	Procedure 16 Start Load Profile.....	88
9.1.10.18	Procedure 17 Stop Load Profile.....	88
9.1.10.19	Procedure 18 Log In .....	88
9.1.10.20	Procedure 19 Log Out.....	89
9.1.10.21	Procedure 20 Initiate an Immediate Call.....	89
9.1.10.22	Procedure 21 Direct Load Control .....	90
9.1.10.23	Procedure 22 Modify Credit .....	91
9.1.10.24	Procedure 23 Reserved .....	91
9.1.10.25	Procedure 24 Reserved .....	91
9.1.10.26	Procedure 25 Reserved .....	92
9.1.10.27	Procedure 26 Reserved .....	92
9.1.10.28	Procedure 27 Clear Pending Call Status .....	92
9.1.10.29	Procedure 28 Start Quality-of-service Monitors .....	92
9.1.10.30	Procedure 29 Stop Quality-of-service Monitors .....	92
9.1.10.31	Procedure 30 Start Secured Register.....	92
9.1.10.32	Procedure 31 Stop Secured Register .....	94
9.1.10.33	Procedure 32 Set Precision Date and/or Time .....	95
9.2	Decade 1: Data Source Tables .....	97
9.2.1	Table 10 Data Source Dimension Limits Table .....	98
9.2.2	Table 11 Actual Data Sources Limiting Table.....	101
9.2.3	Table 12 Units of Measure Entry Table.....	103
9.2.4	Table 13 Demand Control Table.....	112
9.2.5	Table 14 Data Control Table.....	114
9.2.6	Table 15 Constants Table .....	115
9.2.7	Table 16 Source Definition Table.....	121
9.2.8	Table 17 Transformer Loss Compensation Table .....	123
9.3	Decade 2: Register Tables .....	125
9.3.1	Table 20 Register Dimension Limits Table .....	125
9.3.2	Table 21 Actual Register Limiting Table .....	128

9.3.3	Table 22 Data Selection Table .....	130
9.3.4	Table 23 Current Register Data Table .....	132
9.3.5	Table 24 Previous Season Data Table .....	134
9.3.6	Table 25 Previous Demand Reset Data Table.....	135
9.3.7	Table 26 Self-read Data Table .....	136
9.3.8	Table 27 Present Register Selection Table .....	138
9.3.9	Table 28 Present Register Data Table.....	139
9.4	Decade 3: Local Display Tables .....	140
9.4.1.1	Table 30 Display Dimension Limits Table.....	140
9.4.2	Table 31 Actual Display Limiting Table .....	142
9.4.3	Table 32 Display Source Table.....	144
9.4.4	Table 33 Primary Display List Table.....	145
9.4.5	Table 34 Secondary Display List Table.....	147
9.5	Decade 4: Security Tables .....	149
9.5.1	Table 40 Security Dimension Limits Table .....	149
9.5.2	Table 41 Actual Security Limiting Table .....	151
9.5.3	Table 42 Security Table.....	152
9.5.4	Table 43 Default Access Control Table.....	154
9.5.5	Table 44 Access Control Table.....	156
9.5.6	Table 45 Key Table.....	158
9.5.7	Table 46 Reserved .....	158
9.5.8	Table 47 Reserved .....	158
9.6	Decade 5: Time and Time-of-Use Tables.....	159
9.6.1	Table 50 Time and TOU Dimension Limits Table .....	161
9.6.2	Table 51 Actual Time and TOU Limiting Table .....	164
9.6.3	Table 52 Clock Table.....	167
9.6.4	Table 53 Time Offset Table.....	169
9.6.5	Table 54 Calendar Table.....	170
9.6.6	Table 55 Clock State Table.....	175
9.6.7	Table 56 Time Remaining Table .....	177
9.6.8	Table 57 Precision Clock State Table.....	178
9.7	Decade 6: Load Profile Tables.....	179
9.7.1	Table 60 Load Profile Dimension Limits Table .....	179
9.7.2	Table 61 Actual Load Profile Limiting Table.....	184
9.7.3	Table 62 Load Profile Control Table .....	188
9.7.4	Table 63 Load Profile Status Table .....	192
9.7.5	Table 64 Load Profile Data Set One Table .....	195
9.7.6	Table 65 Load Profile Data Set Two Table .....	199
9.7.7	Table 66 Load Profile Data Set Three Table .....	202
9.7.8	Table 67 Load Profile Data Set Four Table .....	205
9.8	Decade 7: History Log and Event Log Tables.....	208
9.8.1	Table 70 Log Dimension Limits Table.....	211
9.8.2	Table 71 Actual Log Limiting Table .....	214
9.8.3	Table 72 Events Identification Table.....	217
9.8.4	Table 73 History Log Control Table.....	218
9.8.5	Table 74 History Log Data Table .....	220
9.8.6	Table 75 Event Log Control Table .....	223
9.8.7	Table 76 Event Log Data Table .....	225
9.8.8	Table 77 Event Log and Signatures Enable Table .....	228
9.8.9	Table 78 End Device Program State Table.....	231
9.8.10	Table 79 Event Counters Table.....	235
9.9	Decade 8: User-defined Tables.....	236
9.9.1	Table 80 User-defined Tables Dimension Limits Table .....	236
9.9.2	Table 81 Actual User-defined Tables Limiting Table .....	239
9.9.3	Table 82 User-defined Tables List Table.....	241
9.9.4	Table 83 User-defined Tables Selections Table.....	243

9.9.5	Table 84 User-defined Table Zero .....	244
9.9.6	Table 85 User-defined Table One .....	245
9.9.7	Table 86 User-defined Table Two .....	246
9.9.8	Table 87 User-defined Table Three .....	247
9.9.9	Table 88 User-defined Table Four .....	248
9.9.10	Table 89 User-defined Table Five .....	249
9.10	Decade 9: Telephone Control Tables .....	250
9.10.1	Table 90 Telephone Dimension Limits Table .....	250
9.10.2	Table 91 Actual Telephone Limiting Table .....	253
9.10.3	Table 92 Telephone Global Parameters Table .....	255
9.10.4	Table 93 Telephone Call Originate Parameters Table .....	257
9.10.5	Table 94 Telephone Call Originate Schedule Table .....	260
9.10.6	Table 95 Telephone Call Answer Parameters .....	263
9.10.7	Table 96 Originating Telephone Call Purpose .....	265
9.10.8	Table 97 Last Telephone Call Status .....	267
9.10.9	Table 98 Telephone Call Originate Status .....	269
9.11	Decade 10: Unassigned .....	271
9.12	Decade 11: Load Control and Pricing Tables .....	272
9.12.1	Table 110 Load Control Dimension Limits Table .....	273
9.12.2	Table 111 Actual Load Control Limiting Table .....	276
9.12.3	Table 112 Load Control Status .....	278
9.12.4	Table 113 Load Control Configuration .....	280
9.12.5	Table 114 Load Control Schedule .....	282
9.12.6	Table 115 Load Control Conditions .....	285
9.12.7	Table 116 Prepayment Status .....	288
9.12.8	Table 117 Prepayment Control .....	289
9.12.9	Table 118 Billing Control .....	290
9.13	Decade 12: Reserved .....	292
9.14	Decade 13: Reserved .....	292
9.15	Decade 14: Extended User-defined Tables .....	293
9.15.1	Table 140 Extended User-defined Tables Function Limiting Table .....	294
9.15.2	Table 141 Extended User-defined Tables Actual Limits Table .....	296
9.15.3	Table 142 Extended User-defined Selections Table .....	297
9.15.4	Table 143 Extended User-defined Constants Table .....	304
9.16	Decade 15: Quality-of-service .....	305
9.16.1	Table 150 Quality-of-service Dimension Limits Table .....	308
9.16.2	Table 151 Actual Quality-of-Service Limiting Table .....	316
9.16.3	Table 152 Quality-of-service Control Table .....	323
9.16.4	Table 153 Quality-of-service Incidents Table .....	336
9.16.5	Table 154 Quality-of-service Log Table .....	339
9.16.6	Table 155 Asynchronous Time-Domain Waveforms Table .....	341
9.16.7	Table 156 Asynchronous Frequency-Domain Spectrum Table .....	344
9.16.8	Table 157 Periodic Time Domain Waveforms Table .....	348
9.16.9	Table 158 Periodic Frequency-Domain Spectrum Table .....	351
9.17	Decade 16: One-way Devices .....	354
9.17.1	Table 160 One-way Dimension Limits Table .....	354
9.17.2	Table 161 Actual One-way Table .....	358
9.17.3	Table 162 One-way Control Table .....	361
9.17.4	Table 163 One-way Data Status Table .....	364
9.17.5	Table 164 One-way Commands/Responses/Extended User-defined Tables Table .....	367
Annex A	(informative) Reserved Device Classes for meter equipment manufacturers implementing ANSI C12.19-1997 devices .....	369
Annex B	(normative) History and event log codes .....	370
B.1	Codes .....	370

B.2	Logger arguments implementation details .....	372
B.3	Logger codes interpretation details .....	375
Annex C	(normative) Default Sets for Decade Tables .....	379
Annex D	(normative) Indices for partial table read/write access .....	385
Annex E	(informative) Event Logger implementation .....	387
E.1	Background .....	387
E.2	Signature algorithm .....	388
Annex F	(informative) Transformer losses compensation .....	390
F.1	Transformer losses consideration .....	390
F.1.1	No-load loss and exciting current .....	390
F.1.2	Load loss .....	390
F.1.3	Transformer losses compensation .....	390
F.2	Transformer loss compensation calculations .....	391
F.3	Transformer loss compensation calculation example .....	392
Annex G	(normative) Document-form descriptive syntax .....	393
G.1	General notes on symbols, rules, and their meaning .....	393
G.2	Extended BNF symbols and meaning .....	393
G.3	Flow of information .....	400
G.4	Identifiers .....	400
G.5	Basic data types .....	405
G.5.1	Basic data type definitions .....	407
G.5.2	Data type handling .....	409
G.5.2.1	Signed integers .....	409
G.5.2.2	Characters and strings .....	410
G.5.2.3	Noninteger numbers .....	410
G.5.2.4	Date and time formats .....	410
G.6	References to types, constants, and values .....	410
G.6.1	Scoping rules .....	411
G.6.1.1	Predefined STD and TDL scopes .....	411
G.6.1.2	Container scopes .....	413
G.6.2	References to values .....	414
G.6.3	Value .....	417
G.7	Conditionals .....	419
G.7.1	IF statements .....	419
G.7.2	SWITCH statements .....	420
G.8	BIT FIELD type .....	420
G.9	SET type .....	421
G.10	ARRAY type .....	421
G.11	PACKED RECORD type .....	422
G.12	Constants .....	423
G.13	Tables .....	423
G.14	Procedures .....	423
G.15	Single-Line Math Expressions .....	425
G.16	Properties .....	427
G.17	Document Form Starting Production Rule .....	428
Annex H	(informative) Date-time elements conversion algorithm (TM_FORMAT=3 and TM_FORMAT=4) .....	429
Annex I	(normative) XML file format of TDL and EDL files .....	430
I.1	Overview of the TDL/EDL XML document framework .....	430
I.1.1	TDL/EDL files and terminology .....	430
I.2	TDL XML File Format of the TDL Document .....	435
I.2.1	<tdl> Root Element .....	435

1.2.1.1	<td> DTD.....	435
1.2.1.2	<td> Attributes.....	435
1.2.1.3	<td> Document Form.....	436
I.2.2	<description> element.....	436
1.2.2.1	<description> DTD.....	436
1.2.2.2	<description> Attributes.....	437
1.2.2.3	<description> Child Elements.....	437
1.2.2.4	<description> Child DTDs.....	437
1.2.2.5	<description> Child Elements Summary.....	439
1.2.2.6	<p> Attributes.....	440
1.2.2.7	<blockquote> Attributes.....	440
1.2.2.8	<ol> Attributes.....	440
1.2.2.9	<ul> Attributes.....	440
1.2.2.10	<ol> and <ul> subelement usage.....	440
1.2.2.11	<dt> and <dd> subelement usage of <dl>.....	441
1.2.2.12	<object> Attributes.....	441
1.2.2.13	<table> Attributes.....	441
1.2.2.14	<caption>, <col>, <thead>, <tfoot> and <tbody> sub-element usage of <table>.....	442
1.2.2.15	<description> Document Form.....	443
1.2.2.16	<extension> Element.....	444
1.2.2.17	<extension> DTD.....	444
1.2.2.18	<extension> Attributes.....	444
1.2.2.19	<extension> Document Form.....	444
I.2.3	<assert> Element.....	444
1.2.3.1	<assert> DTD (named).....	445
1.2.3.2	<assert> Attributes.....	445
I.2.4	<enumerator> Element.....	445
1.2.4.1	<enumerator> DTD (named).....	445
1.2.4.2	<enumerator> Attributes (named).....	446
1.2.4.3	<enumerator> Document Form (named).....	448
I.2.5	Constant enumerated values of <enumerator> (named).....	449
1.2.5.1	Constant enumerated values DTD.....	449
1.2.5.2	<enumerator> DTD (un-named).....	449
I.2.6	<enum> Element (Child of <enumerator>).....	449
1.2.6.1	<enum> DTD.....	450
1.2.6.2	<enum> Attributes.....	450
1.2.6.3	<enum> Document Form.....	450
I.2.7	<default> element (Child of <enumerator> element).....	451
1.2.7.1	<default> DTD.....	451
1.2.7.2	<default> Attributes.....	451
1.2.7.3	<default> Document Form.....	451
I.2.8	<packedRecord> Element.....	451
1.2.8.1	<packedRecord> DTD.....	452
1.2.8.2	<packedRecord> Attributes.....	452
1.2.8.3	<packedRecord> Document Form.....	454
I.2.9	<element> Element (Child of <packedRecord>).....	455
1.2.9.1	<element> DTD.....	455
1.2.9.2	<element> Attributes.....	455
1.2.9.3	<element> Document Form.....	456
I.2.10	<array> Element (Child of <packedRecord>).....	457
1.2.10.1	<array> DTD.....	457
1.2.10.2	<array> Attributes.....	457
1.2.10.3	<array> Document Form.....	458
I.2.11	<set> Element (Child of <packedRecord> element).....	459
1.2.11.1	<set> DTD.....	459
1.2.11.2	<set> Attributes.....	459
1.2.11.3	<set> Document Form.....	460
I.2.12	<if> Element (Child of <packedRecord>).....	461
1.2.12.1	<if> DTD (Child of <packedRecord>).....	461
1.2.12.2	<if> Attributes (Child of <packedRecord>).....	461
1.2.12.3	<if> Document Form.....	461

I.2.12.4	<then> Element (Child of <packedRecord>/<if>)	461
I.2.12.5	<then> DTD	462
I.2.12.6	<then> Attributes	462
I.2.12.7	<then> Document Form	462
I.2.13	<else> Element (Child of <packedRecord>/<if>)	462
I.2.13.1	<else> DTD	462
I.2.13.2	<else> Attributes	462
I.2.13.3	<else> Document Form	462
I.2.14	<switch> Element (Child of <packedRecord>)	464
I.2.14.1	<switch> DTD	464
I.2.14.2	<switch> Attributes	464
I.2.14.3	<switch> Document Form	464
I.2.14.4	<case> Element (Child of <packedRecord>/<switch>)	464
I.2.14.5	<case> DTD	464
I.2.14.6	<case> Attributes	464
I.2.14.7	<case> Document Form	464
I.2.14.8	<default> element (Child of <packedRecord>/<switch>)	465
I.2.14.9	<default> DTD	465
I.2.14.10	<default> Attributes	465
I.2.14.11	<default> Document Form	465
I.2.15	<bitField> element	467
I.2.15.1	<bitField> DTD	467
I.2.15.2	<bitField> Attributes	468
I.2.15.3	<bitField> Document Form	470
I.2.16	<subElement> Element (Child of <bitField>)	471
I.2.16.1	<subElement> DTD	471
I.2.16.2	<subElement> Attributes	472
I.2.16.3	<subElement> Document Form Equivalent	473
I.2.17	<if> Element (Child of <bitField>)	473
I.2.17.1	<if> DTD	473
I.2.17.2	<if> Attributes	473
I.2.17.3	<if> Document Form	473
I.2.18	<then> Element (Child of <bitField>/<if>)	474
I.2.18.1	<then> DTD	474
I.2.18.2	Attributes	474
I.2.18.3	<then> Document Form	474
I.2.19	<else> Element (Child of <bitField>/<if>)	474
I.2.19.1	<else> DTD definition	474
I.2.19.2	<else> Attributes	474
I.2.19.3	<else> Document Form	474
I.2.20	<switch> Element (Child of <bitField>)	474
I.2.20.1	<switch> DTD	475
I.2.20.2	<switch> Attributes	475
I.2.20.3	<switch> Document Form	475
I.2.21	<case> Element (Child of <bitField>/<switch>)	475
I.2.21.1	<case> DTD	475
I.2.21.2	<case> Attributes	475
I.2.21.3	<case> Document Form	475
I.2.22	<default> Element (Child of <bitField>/<switch>)	475
I.2.22.1	<default> DTD	476
I.2.22.2	<default> Attributes	476
I.2.22.3	<default> Document Form	476
I.2.23	<decade> Element (Child of <tdl>)	476
I.2.23.1	<decade> DTD	476
I.2.23.2	<decade> Attributes	476
I.2.23.3	<decade> Document Form	477
I.2.24	<table> Element (Child of <tdl> or <decade>)	477
I.2.24.1	<table> DTD	477
I.2.24.2	<table> Attributes	478
I.2.24.3	<table> Document Form	480

1.2.25	<procedure> Element (Child of <tdl> or <decade>)	481
1.2.25.1	<procedure> DTD	482
1.2.25.2	<procedure> Attributes	482
1.2.25.3	<procedure> Document Form	483
1.2.26	<extend> Element (Child of <procedure>)	484
1.2.26.1	<extend> DTD definition	484
1.2.26.2	<extend> Attributes	485
1.2.26.3	<extend> Document Form	485
1.2.27	<qualify> Element (Child of <tdl>)	485
1.2.27.1	<qualify> DTD	485
1.2.27.2	<qualify> Attributes	485
1.2.27.3	<qualify> Document Form	485
1.2.28	<table> element (Child of <qualify> element)	486
1.2.28.1	<table> DTD definition	486
1.2.28.2	<table> Attributes	486
1.2.29	<procedure> Element (Child of <qualify>)	486
1.2.29.1	<procedure> DTD	486
1.2.29.2	<procedure> Attributes	487
1.2.30	<element> Element (Child of <qualify>)	487
1.2.30.1	<element> DTD	487
1.2.30.2	<element> Attributes	488
1.2.31	<packedRecord> Element (Child of <qualify>)	488
1.2.31.1	<packedRecord> DTD	488
1.2.31.2	Attributes	488
1.2.32	<bitField> Element (Child of <qualify>)	488
1.2.32.1	<bitField> DTD	489
1.2.32.2	<bitField> Attributes	489
1.2.33	<assert> Element (Child of <qualify>)	489
1.2.33.1	<assert> DTD	489
1.2.33.2	<assert> Attributes	489
1.3	EDL XML Format	489
1.3.1	Overview	489
1.3.2	<edl> Root Element	490
1.3.2.1	<edl> DTD	490
1.3.2.2	<edl> Attributes	491
1.3.2.3	<edl> Document Form	491
1.3.3	<description> Element (Child of <edl>)	491
1.3.3.1	<description> DTD	492
1.3.3.2	<description> Document Form	492
1.3.4	Pseudo Element Names	492
1.3.5	Resolving Second Edition XML Schema Constraints	493
1.3.5.1	The Schema Constraints Problem	493
1.3.5.2	Resolution of The Schema Constraints Problem	494
1.3.6	<\${if-switch-clause}> Element	494
1.3.6.1	<\${if-switch-clause}> DTD	494
1.3.7	<defaultSet> Element (Child of <edl>)	494
1.3.7.1	<defaultSet> DTD	495
1.3.7.2	<defaultSet> Attributes	495
1.3.7.3	<defaultSet> Document Form	495
1.3.8	<\${limitingTableName}> Element (Child of <defaultSet>)	497
1.3.8.1	<\${limitingTableName}> DTD	497
1.3.8.2	<\${limitingTableName}> Attributes	497
1.3.8.3	<\${limitingTableName}> Document Form	498
1.3.9	<data> Element (Child of <edl>)	498
1.3.9.1	<data> DTD	498
1.3.9.2	<data> Document Form	498
1.3.10	<\${tableName}> Element	498
1.3.10.1	<\${tableName}> DTD	498
1.3.10.2	<\${tableName}> Attributes	498
1.3.10.3	<\${tableName}> Document Form	499



I.3.11	<\${elementName}> Element.....	499
I.3.11.1	<\${elementName}> DTD.....	499
I.3.11.2	<\${elementName}> Attributes.....	499
I.3.11.3	<\${elementName}> Document Form.....	500
I.3.12	<entry> Element.....	500
I.3.12.1	<entry> DTD.....	500
I.3.12.2	<entry> Attributes.....	501
I.3.12.3	<entry> Document Form.....	501
I.3.13	<pendingHeader> element.....	502
I.3.13.1	<pendingHeader> DTD.....	502
I.3.13.2	<pendingHeader> Document Form.....	503
I.4	EDL XML Form Encoding of Final Element Values.....	503
Annex J	(normative) Universal Identifier.....	505
Annex K	(informative) Algorithms for the conversion of Table Element values to engineering units.....	506
K.1	Locating conversion factors from Decade 1.....	506
K.2	De-normalizing interval data elements.....	509
K.3	Converting to engineering units at the point of metering.....	510
K.4	Converting to engineering units at the point of delivery.....	511
K.5	Assigning engineering units.....	512
K.6	Assigning fundamental engineering units.....	512
K.7	Table value to engineering units conversion: An example.....	512
Annex L	(informative) Registering or updating DEVICE CLASS OID.....	515
L.1	Binding a Device Class to End Device operating model.....	515
L.2	End Devices referencing the Standard's Device Class.....	518
L.3	Practical examples and use-cases.....	518
L.3.1	Examples: Initial registration condition—an empty TDL.....	518
L.3.1.1	Case 1: Exposing manufacturer's content.....	518
L.3.1.2	Case 2: Changing End Device behavior.....	522
L.3.2	Examples: Initial registration conditions—nonempty TDL.....	524
L.3.2.1	Case 1: Appending a new element to an existing table.....	525
L.3.2.2	Case 2: Inserting a new element into an existing table.....	527
L.3.2.3	Case 3: Modifying an element of an existing table.....	528
L.3.2.4	Case 4: Modifying a constant element in a table.....	529
L.3.2.5	Case 5: Adding a new Table to an End Device.....	531
Annex M	(informative) Bibliography.....	533
Annex N	Listing of Editorial Corrections to IEEE Std 1377 2012.....	534

## Table of Figures

Figure 4-1—Possible combinations of FLC, FLC+1, and Decade Tables .....	12
Figure 4-2—Default Standard Tables properties .....	13
Figure 4-3—Default Standard Tables 7, 8, and Procedures properties .....	14
Figure 4-4—Default Manufacturer Tables properties .....	15
Figure 4-5—Default Manufacturer Procedures properties .....	15
Figure E-1—Detailed signature computation algorithm.....	389
Figure G-1—Octet bit ordering .....	400
Figure G-2—Multi-byte ordering .....	400
Figure G-3—Subtypes and bit field bit ordering .....	420
Figure G-4—Set Octets and bit ordering .....	421
Figure G-5—Single-dimension array ordering .....	422
Figure I-1—Production of the Document Form (Document Format of Section 9.0, “Tables”) from the TDL XML File .....	431
Figure I-2—Production of Exchange Data Language (EDL) validation schema file from a TDL XML File .....	431
Figure I-3—Production of the Document Form (Document Format of Annex C, “Default Sets for Decade Tables”) from the EDL XML Default Sets file.....	431
Figure I-4—Production of final element indices (Document Format of Annex D, “Indices for partial table read/write access”) from a TDL XML file .....	432
Figure I-5—From XML to AMI application—the pathways for using C12.19 Standard and Manufacturer-defined TDL/XML tables for Documentation, EDL, and AMI application processing .....	433
Figure K-1—A typical electricity meter installation .....	510
Figure L-1—A registered End Device instance .....	516
Figure L-2—Device Class re-registration decision-making process flow .....	517

# 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.