



DPC: 24 / 30491089 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 09 April 2024

Origin: International

Latest date for receipt of comments: 1 May 2024

Project No. 2022/00722

Responsible committee: IST/6/-/12 Home Electronic Systems

Interested committees:

Title: BS ISO/IEC 18012-3 Information Technology # Home Electronic System #Guidelines for product interoperability
Part 3: Lexicon

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 1 May 2024**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



JTC1-SC25/3236/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

ISO/IEC 18012-3 ED1

DATE OF CIRCULATION:

2024-04-05

CLOSING DATE FOR COMMENTS:

2024-05-31

SUPERSEDES DOCUMENTS:

JTC1-SC25/3149/CD, JTC1-SC25/3230/CC

IEC ISO/IEC JTC 1/SC 25 : INTERCONNECTION OF INFORMATION TECHNOLOGY EQUIPMENT

SECRETARIAT:

Germany

SECRETARY:

Mr Marco Peter

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 23, SyC AAL, SEG 9, ISO/IEC JTC 1/SC 41

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☒ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE AC/22/2007 OR NEW GUIDANCE DOC).

TITLE:

Information Technology–Home Electronic System–Guidelines for product interoperability–Part 3: Lexicon

NOTE FROM TC/SC OFFICERS:

This CD has been reviewed by the SC 25 WG 1 working party.

Copyright © 2024 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

1		
2		
3	FOREWORD.....	6
4	INTRODUCTION.....	8
5	1 Scope.....	11
6	2 Normative references	11
7	3 Terms, definitions, abbreviated terms and conventions	11
8	3.1 Terms and definitions.....	11
9	3.2 Abbreviated terms.....	13
10	3.3 Conventions - Defined Data Formats	14
11	3.3.1 countrySubdivision.....	15
12	3.3.2 dateTime Format	15
13	3.3.3 nanosecondsSinceEpoch	16
14	3.3.4 secondsSinceEpoch.....	16
15	3.3.5 latitudeLongitude Format	16
16	3.3.6 timeDuration Format	17
17	3.3.7 timeInterval Format.....	17
18	3.4 Memory storage/access types	17
19	3.4.1 RAM	18
20	3.4.2 ROM	18
21	3.4.3 Operational.....	18
22	3.4.4 Database	18
23	3.4.5 Secret.....	18
24	3.4.6 General	18
25	3.4.7 Summary	18
26	3.5 Address/data types	19
27	4 Conformance requirements.....	20
28	5 Lexicon concepts, principles.....	20
29	5.1 Communicating “lexicon” on media	20
30	6 Object concepts.....	20
31	6.1 Overview of object concepts	20
32	6.2 User object concepts	22
33	6.3 Binding map object concepts	22
34	6.4 Service object concepts	22
35	6.5 Interface object concepts	22
36	6.6 Remote object concepts.....	22
37	7 Action concepts	23
38	7.1 Overview	23
39	7.2 Communicating “functional actions” on media	23
40	8 Objects - Detailed Lexicon	23
41	9 User Objects - Detailed Lexicon	24
42	9.1 User Objects short form	24
43	9.2 User Objects; introduction to components	24
44	9.3 Common Objects and Structures.....	24
45	9.3.1 currentValue	24
46	9.3.2 previousValue	28

47	9.3.3	compareValue.....	29
48	9.3.4	Other Properties	29
49	9.4	Application Domains	29
50	9.4.1	Current application domains	29
51	9.4.2	Energy management domain.....	31
52	9.4.3	Lighting domain	31
53	9.4.4	Utility domain	32
54	9.4.5	HVAC domain	33
55	9.4.6	Convenience Domain	35
56	9.4.7	User interface domain	35
57	9.4.8	Audio/Video domain	36
58	9.4.9	Telecommunications domain	36
59	9.4.10	Security domain	37
60	9.4.11	Appliance domain	37
61	9.4.12	Common user interface domain	38
62	9.4.13	Safety cluster domain	38
63	9.4.14	Electric Vehicle domain.....	39
64	9.4.15	General domain	40
65	10	Binding map objects – Detailed Lexicon.....	41
66	10.1	Binding map introduction.....	41
67	10.2	Mathematical/logical operations	41
68	10.3	Conditioning.....	42
69	10.4	Adjustment.....	42
70	10.5	Operation table	42
71	10.6	Addressing Table	44
72	11	Service Objects – Detailed Lexicon	49
73	11.1	Service Module	49
74	11.2	Services.....	49
75	11.2.1	Identification Service (Foundational)	50
76	11.2.2	Time Service (Foundational)	54
77	11.2.3	Authorization and Authentication Service (Foundational)	62
78	11.2.4	Cryptographic Service (Foundational)	70
79	11.2.5	Common User Interface Service	73
80	11.2.6	Cluster To Cluster Service	73
81	11.2.7	Artificial Intelligence Service	73
82	11.2.8	Energy Management Service	73
83	11.2.9	Electrical Energy Measuring System Service	73
84	11.2.10	Web-based Energy Service.....	73
85	11.2.11	Audio Gateway Service.....	73
86	11.2.12	IGRS RA Agent Service	73
87	12	Interface Objects - Detailed Lexicon	74
88	12.1	General interface objects	74
89	12.2	HAN interface objects	74
90	12.2.1	Overview	74
91	12.2.2	HAN interface module general Characteristics	74
92	12.2.3	HAN interface module application characteristics	83
93	12.2.4	HAN interface module examples	84
94	12.3	WAN Interface Objects and Actions	87

95	12.3.1	WAN discovery of HES gateway modules	87
96	12.3.2	WAN Central Operations	88
97	12.3.3	WAN Attached Network	89
98	12.3.4	Privacy/Security/Safety/Traffic for WAN interface module	90
99	12.3.5	Overall WAN channel services	92
100	12.3.6	Channel service table for WAN channel	93
101	12.3.7	Privacy/Security/Safety/Traffic for WAN channel	95
102	13	Remote Objects - Detailed Lexicon	99
103	13.1	Remote Objects; introduction	99
104	13.2	Common Objects and Structures	99
105	13.2.1	currentValue	99
106	13.2.3	previousValue	101
107	13.2.4	compareValue	101
108	13.2.5	Other properties	102
109	13.3	Remote Object Domains	102
110	13.3.1	Environmental Domain	103
111	13.3.2	Common Area Domain	104
112	13.3.3	Indirect GHG Domain	105
113	14	Actions - Detailed Lexicon	106
114	15	XML	106
115	Annex A	Binding Map Service	107
116	A.1	Binding Map Introduction	107
117	A.2	Value Operation	110
118	A.2.1	Mathematical/logical Operations	111
119	A.2.2	Table of operations	112
120	A.2.3	Conditioning	113
121	A.2.4	Adjustment	113
122	A.2.5	Examples of using the "Value Operation"	113
123	A.2.6	Address redirection	114
124	A.2.7	Operation table	116
125	Annex B	Example of Operation Group	121
126	Annex C	WAN Interface Module	124
127	C.1	WAN Interface Objects and Actions	124
128	C.2	WAN Interface Module Objects	124
129	C.3	WAN Interface Channel Objects	125
130	C.4	WAN communication with other HES gateway systems	128
131	Annex D	Authorization Service Examples	130
132	D.1	Parent/kid authorization example	130
133	D.2	Limit incoming packets example	134
134	Annex E	Semantic meaning	138
135	E.1	Semantic meaning	138
136	E.2	HAN message meaning conveyed by HAN Lexicon specification	138
137	E.3	HAN message meaning conveyed by generic HAN specification	139
138	E.4	All interface modules and all network messages	139
139	Annex F	Detailed lexicon for User Objects	140
140	F.1	Detailed lexicon	140
141	F.2	Energy management domain	140

142 F.3 Lighting domain 145

143 F.4 Utility domain 156

144 F.5 User interface domain 212

145

146

147

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INFORMATION TECHNOLOGY –
HOME ELECTRONIC SYSTEM (HES) –
GUIDELINES FOR PRODUCT INTEROPERABILITY –****Part 3: Lexicon**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 15045-3-1 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information Technology.

This edition includes the following significant technical changes with respect to the previous edition:

- a) ...;

199 The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

200

201 Full information on the voting for the approval of this International Standard can be found in
202 the report on voting indicated in the above table.

203 This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

204 The committee has decided that the contents of this document will remain unchanged until the
205 stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to
206 the specific document. At this date, the document will be

- 207 ☐ reconfirmed,
208 ☐ withdrawn,
209 ☐ replaced by a revised edition, or
210 ☐ amended.

211

212 The National Committees are requested to note that for this document the stability date
213 is 20XX..

214 This text is included for the information of the national committees and will be deleted at the
215 publication stage.

216

217

218

INTRODUCTION

219 The *Home Electronic System* (HES) is a set of standards that supports communication, control,
220 and monitoring applications for homes and buildings. However, homes and buildings present a
221 heterogeneous and evolving networked environment, where many of these networks and
222 applications (including some that are based on HES standards) are not directly interoperable
223 with each other. HES standards achieve interoperability through the ISO/IEC 15045 *HES*
224 *gateway* series, which relies on ISO/IEC 18012 *Guidelines for product interoperability* series to
225 support functional interworking among the dissimilar home devices, applications, protocols,
226 and networks found in this environment. The ISO/IEC 15045 series and ISO/IEC 18012 series
227 were created to render all protocols interoperable.

228 The HES gateway enables an open and adaptable market for incompatible products by
229 specifying a standardized modular system intended to provide interoperability among the
230 diversity of networks found in homes and buildings. The HES interoperability process does not
231 require modification of the various networks, applications, or protocols that use it. Appropriate
232 interworking functions translate network messages through interface modules to a common
233 lexicon expression, which is then exchanged using a private internal network bus protocol. A
234 protected application platform using a bus protocol supports an expanding array of services for
235 both the applications and the network.

236 In summary, the HES gateway series specifies a standardized modular dedicated private
237 internal network system that includes:

- 238 • interfaces (i.e., interface modules) for communications and semantic translation among
239 dissimilar home or building area networks (HANs), and between a HAN and external wide
240 area networks (WANs),
- 241 • a platform for supporting a variety of application services (i.e., service modules), and
- 242 • a secure communication path among these modular elements with access restricted to the
243 appropriate elements in order to protect data, safety and privacy.

244 Interworking is achieved with a translation process by which a message between devices on
245 two networks that use different protocols (including different application languages) are first
246 converted into a common HES (internal) linguistic expression and then back into an equivalent
247 message for the other network. The semantic meaning of messages within these network
248 protocols are either specified by a HAN lexicon specification or by a generic HAN specification.
249 More details are included in Annex E. This conversion is accomplished by an *interworking*
250 *function* (IWF) residing in interface modules for each network. These messages are initiated
251 by changes-of-state relating to objects associated with devices connected to the networks, and
252 are known as *events*. The HES *common language message exchange* (HES-CLME) event
253 messages employ a standardized syntax and semantic expressions defined by the HES
254 *Lexicon* specified in this Part 3 *Lexicon*. The format of the messages, (i.e., the message
255 protocol data unit (PDU) is defined in a subsequent Part 4 *Event encoding*.

256 Relation to existing work

257 The HES gateway is described in ISO/IEC 15045-1 *Home Electronic System (HES) gateway –*
258 *Part 1: A residential gateway model for HES*. Several structural configurations of the HES
259 gateway are described in ISO/IEC 15045-4-1 *HES gateway – Part 1: Physical structural classes*.
260 All classes use the HES interoperability system described above, however in some that use
261 physically separated HES gateway modules, communications among modular elements is
262 provided by a dedicated private internet serial bus (based on Ethernet, see RFC 1918) and
263 utilizes a set of protocols described in ISO/IEC 15045-2 *HES gateway – Part 2: Modularity and*
264 *protocol*, which is now known as common language messaging exchange (HES-CLME).

265 The ISO/IEC 18012-1 *Guidelines for product interoperability – Part 1: Introduction* introduces
266 the necessity for an interoperability standard among home system applications to ensure that
267 applications can interoperate in a safe, reliable, predictable and consistent manner. The
268 interworking function (IWF) is described in ISO/IEC 18012-2 *Guidelines for product*
269 *Interoperability – Part 2: Taxonomy and application interoperability model*. The message
270 content (protocol data unit or PDU) is defined in ISO/IEC 18012-3 *Guidelines for product*

271 *Interoperability – Part 3: Lexicon* and in ISO/IEC 18012-4 *Guidelines for product*
272 *Interoperability – Part 4: Event encoding*. All HES gateway structural class configurations use
273 the same interworking functions, including lexicon, and event encoding.

274 **Lexicon and event encoding**

275 This Part 3 *Lexicon* specifies the standardized HES application objects, functions (actions),
276 and variables, as well as their expression (symbolic encoding), their semantic meaning, and
277 their syntactic usage. These are the elements needed to construct IWFs for each specific
278 network. Because of the dynamic heterogeneous nature of the home and building networking
279 environment, it is intended that these elements, including the IWFs for each network be
280 maintained in a standardized online metadata registry to allow for future expansion while
281 maintaining semantic interoperability. As the Lexicon is expanded, there will be coordination
282 with the appropriate trade or standards organizations to ensure the semantic meanings cover
283 the range of applications and systems of those industries.

284 In addition, standardized test procedures, plugfests, and technical guidance reports are
285 anticipated in the future to prove completeness and ensure interoperability among the range of
286 applications and systems.

287 Part 4 *Event encoding* defines the specific format of the PDUs for various events to be utilized
288 in data packets (e.g., HES-CLIP) or direct API exchanges (e.g., HES-CLPDE) within a gateway.

289 Figure 1 shows the core interoperability and HES gateway series of standards and where this
290 ISO/IEC 18012-3 standard fits into series.

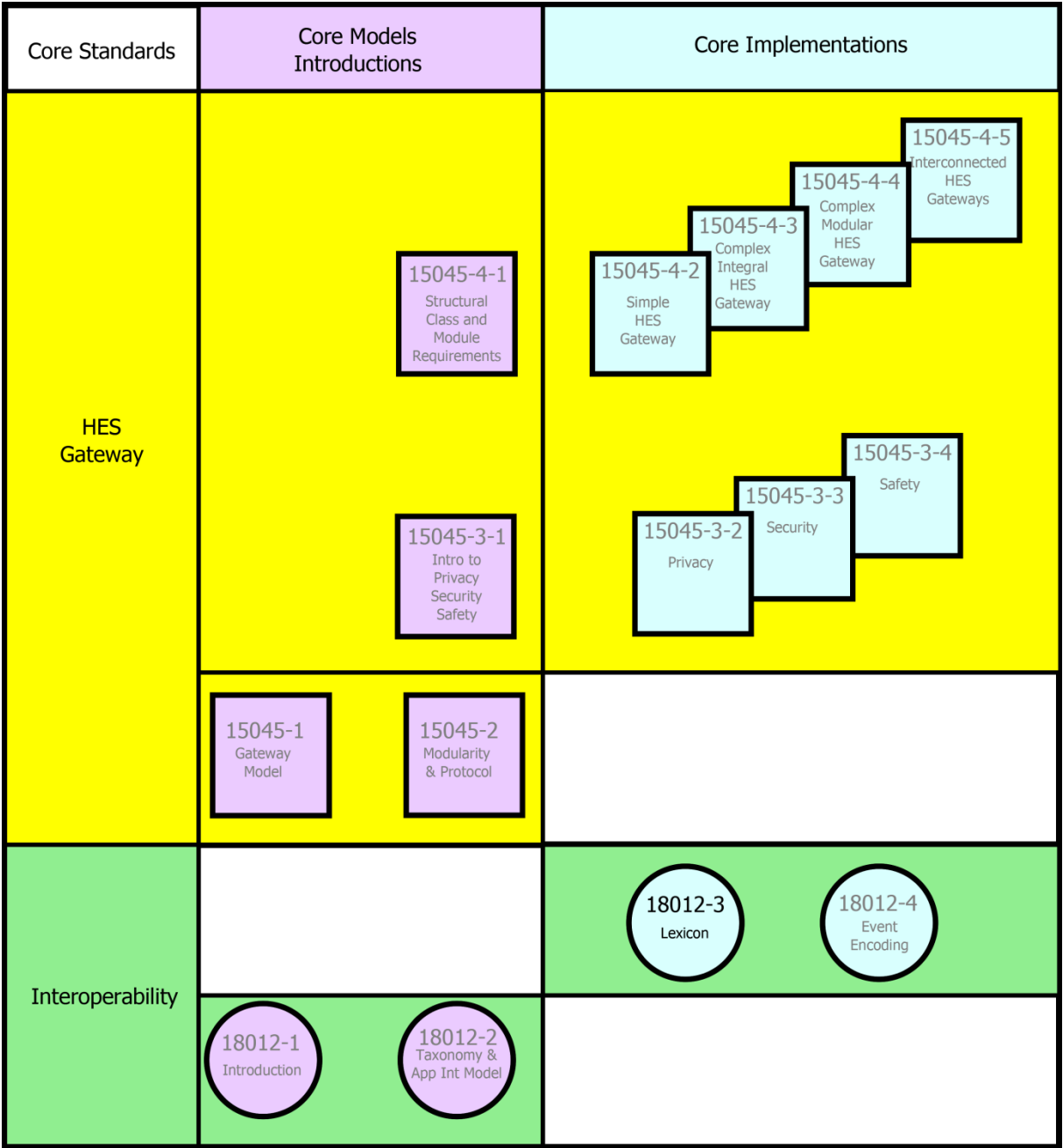


Figure 1 – ISO/IEC18012-3 Standard within the Core Interoperability and HES Gateway Standards

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) – GUIDELINES FOR PRODUCT INTEROPERABILITY –

Part 3: Lexicon

1 Scope

This Part 3 of ISO/IEC 18012, *Home Electronic System System – Guidelines for product interoperability* specifies a lexicon of objects for the Interoperability Domain (ID). This document specifies ID base objects and their associated properties and input/output event types (i.e., in the form of a list of ID sensor, actuator, and control objects), and object state actions, which can be used to define interoperable application models.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15045-1:2004, *Information technology – Home Electronic System (HES) gateway – Part 1: A residential gateway model for HES*

ISO/IEC 15045-2:2012, *Information technology – Home Electronic System (HES) gateway – Part 2: Modularity and protocol*

ISO/IEC 15045-3-1, *Information technology – Home Electronic System (HES) gateway – Part 3-1: Introduction to privacy, security, and safety [In progress]*

ISO/IEC 15045-3-2, *Information technology – Home Electronic System (HES) gateway – Part 3-2: Privacy framework [In progress]*

ISO/IEC 15045-4-1, *Information technology – Home Electronic System (HES) gateway – Part 4-1: HES gateway structural class and module requirements [In progress]*

ISO/IEC 18012-1:2004, *Information technology – Home Electronic System (HES) – Guidelines for product interoperability – Part 1: Introduction*

ISO/IEC 18012-2:2012, *Information technology – Home Electronic System (HES) – Guidelines for product interoperability – Part 2: Taxonomy and application interoperability model*

ISO/IEC 18012-4, *Information technology – Home Electronic System (HES) – Guidelines for product interoperability – Part 4: Event encoding [In progress]*

3 Terms, definitions, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

atomic data

data at the lowest level of detail that cannot be further divided

3.1.2

binding

specification of the source-end and the destination-end of an event connection between application objects

[SOURCE: ISO/IEC 18012-2:2012, definition 3.1.6]

3.1.3**binding map**

table that links inputs to outputs

3.1.4**bus**

common or shared path for communications or power

3.1.5**channel**

subdivision of WAN connection

3.1.6**configuration data**

data that is setup for the controller service in anticipation of real-time operations

Note 1 to entry: see ISO/IEC 15045-3-2.

3.1.7**event**

change of state relating to an object

Note 1 to entry: including user, remote, binding map, interface, and service objects

3.1.8**field**

(field name, data type) pair

Note 1 to entry: A value of a field is a value of its data type

[SOURCE: ISO/IEC 9075]¹

3.1.9**HES lexicon**

list of known HES application objects and actions, and structured information about them

Note 1 to entry: Lexicon in linguistics is an inventory of words and information about them. The term lexicon here is used to represent listing of known HES application objects and structured information about them. This part of the standard provides the structure to be used for the full compilation of the lexicon.

3.1.10**home area network**

network serving nodes, devices, components and functions within a premises

Note 1 to entry: For an HES gateway system, a HAN is a network within the protected area.

3.1.11**interactive data**

data that is typically transferred between objects for the processor service for real-time operation

Note 1 to entry: see ISO/IEC 15045-3-2.

3.1.12**lexicon**

vocabulary, i.e., the words and their definitions, of a language

3.1.13**metadata**

data that defines and describes other data

[SOURCE: ISO/IEC 11179-1]

¹ Terminology of SQL from ISO/IEC 9075 is used for convenience only, any underlying data management system may be used

3.1.14**null value**

special value that is used to indicate the absence of any data value

[SOURCE: ISO/IEC 9075]²

3.1.15**object**

program or unit of software that includes code and data

3.1.16**object address**

address uniquely identifying an object

3.1.17**object reference code**

code that references the specific name within an object

3.1.18**post-market**

product after being shipped to market

3.1.19**pre-market**

product before being shipped to market

3.1.20**row**

value of a row type, i.e., a sequence of field values; for rows in a table, a sequence of column values

[SOURCE: ISO/IEC 9075]³

3.1.21**service module**

HES gateway module that provides a service inside the HES gateway system via HES-CLME communications on a bus

3.1.22**table**

collection of zero or more rows

[SOURCE: ISO/IEC 9075]⁴

3.1.23**wide area network**

network that connects communication devices in the environment external to the premises

Note 1 to entry: For an HES gateway system, a WAN is a network outside the protected area.

3.2 Abbreviated terms

For the purposes of this document, the following abbreviations and definitions apply.

HAN	home area network
HES	home electronic system
HES-CLIP	HES common language internal protocol

² Terminology of SQL from ISO/IEC 9075 is used for convenience only, any underlying data management system may be used

³ Terminology of SQL from ISO/IEC 9075 is used for convenience only, any underlying data management system may be used

⁴ Terminology of SQL from ISO/IEC 9075 is used for convenience only, any underlying data management system may be used

424	HES-CLME	HES common language message exchange
425	IWF	interworking function
426	UTC	universal coordinated time
427	WAN	wide area network

428 3.3 Conventions - Defined Data Formats

429 The following data formats are defined in this section using EBNF format (ISO/IEC 14977) as
 430 is generally used within the XML standard (W3C Nov 26, 2008, see Section 6, Notation). These
 431 data formats are used throughout this document for data related specifications and will be
 432 formatted with ***bold italics***.

433 The short forms, as listed in the table below, Table 1, are the data that are sent in a
 434 communications packet. They are used to maximize efficiency in communications and in the
 435 use of memory.

436 Summary of symbols used below:

- 437 ? - optional; zero or one
 438 * - zero or more
 439 + - one or more

440 Table 1 – Defined types of dataFormat

dataFormat Name	Definition	Short Form	Example #1	Example #2	Example #3
<i>arrayDecimals</i>	decimal (' decimal)*	ad	3	2.5,-4	2,5,2
<i>arrayIntegers</i>	integer (' integer)*	ai	-42	-56,89	-20,55,25
<i>arrayIPAddresses</i>	ipaddress (' ipaddress)*	aa	192.168.0.3,198.27.76.102		
<i>arrayKeyValue Pairs</i>	keyValuePair (' (keyValuePair))*	ak	ne	nw, sm=size	ag=23, ld, um=test
<i>arrayNonNeg Integers</i>	nonNegInteger (' nonNegInteger)*	an	3	0,4	2,5,7
<i>arrayPosIntegers</i>	posInteger (' posInteger)*	ap	3	2,4	2,5,6
<i>arrayShortLetters</i>	shortLetters (' shortLetters)*	al	no	ma,ea	ir,ic,ma
<i>arrayStrings</i>	string (' string)*	as	alarm	Lt,bbe,gi	Ti3\$,6t
<i>arrayTime Intervals</i>	timeInterval (' timeInterval)*	at	2023/ P1Y	20220813 /P2W, 2023/ P1Y	20240108 /P2Y, 2025/ P2Y
<i>arrayZeroOne</i>	zeroOne (' zeroOne)*	az	0	0,1,0	1,0
<i>coordinateInfo</i>	posInteger (' posInteger (' shortLetters)?)?)	co	2	2,4	2,4,lo
<i>country Subdivision</i>	[A-Z] [A-Z] '-' [A-Z] [A-Z] [A-Z]?	cs	US-CA	KR-11	GB-LND
<i>dateTime</i>	{according to ISO 8601-1:2019}; see "dateTime format" in Section 0	dt	20210304	20210609 T122104	T15212 .234
<i>decimal</i>	'-'? [0-9]+ (' [0-9]+)?	de	2.5	-32.19	729
<i>integer</i>	'-'? [0-9]+	in	25	-321	0
<i>ipaddress</i>	[0-255].[0-255].[0-255].[0-255]	ip	192.168.0.3		
<i>keyValuePair</i>	shortLetters ('= string)?	vp	nx	nt=3	mr=abs
<i>latitudeLongitude General</i>	{according to ISO 6709:2008}; see "latitudeLongitude format" in Section 3.3.5	ll	"-39.345 +120.546	" +46 -105	-2.0123 +14.2347
<i>listCoordinateInfo</i>	coordinateInfo (' coordinateInfo)*	lc	3	3,7\n 5,9	4,8,do\n 6,9\n 7,21,si
<i>lowerCaseString</i>	[a-z]+	ls	a	temp	light
<i>posInteger</i>	[1-9] [0-9]*	pi	1	5	327
<i>nonNegDecimal</i>	[0-9]+ (' [0-9]+)?	nd	34	32.6	0.46

dataFormat Name	Definition	Short Form	Example #1	Example #2	Example #3
nonNegInteger	[0-9]+	nn	0	3	231
nanoseconds Since Epoch	nonNegDecimal {up to 4294967295 (unsigned 32 bits) units; fractional of nanoseconds} {see Section 3.3.3}	ns	17012 28967. 453	32563 32953. 32567 2145	
secondsSince Epoch	nonNegDecimal {up to 4294967295 (unsigned 32 bits) units} {see Section 3.3.3}	ss	17012 28967	32563 52933	41023 84561
shortLetters	[a-z] [a-Z] nonNegInteger?	sl	va	mx	in32
string	[ascii]* {comma ',', not allowed}	st	light	dfj344*&	/L9(P{
stringLetterDec	[a-zA-Z] [a-zA-Z0-9]*	sn	door	Lock4	low2dim
stringLetters	[a-zA-Z]+	se	cool	Heat	power
stringLexicon	'/' shortLetters ('/' shortLetters)*	sx	/lx	/lx/ob	/lx/ob/uo
timeDuration	{according to ISO 8601-1:2019}; see "timeDuration format" in Section 3.3.6	td	P2Y	P6DT3H	P1Y3D
timeInterval	{according to ISO 8601-1:2019}; see "timeInterval format" in Section 3.3.7	ti	20210923 T1400/ PT1H	20211123 /P1W1D	2021/ P1Y
versionType	[0-9]+ '.' [0-9]+ '+' '.' [0-9]+	vt	0.9.1	1.0.1	2.3.12
zeroOne	'0' '1'	zo	0	1	

Note: The metadata of "valueSize" ('sz') for any type of integer value indicates the maximum size of the format in bits. For example, "valueSize" of 24 for "integer" limits the value to a size of 24 bits (i.e., -2^{23} to $2^{23} - 1$). A "valueSize" of "16" for "nonNegInteger" limits the value to a size of 16 bits (i.e., 0 to $2^{16} - 1$).

Note: The metadata of "valueScale" ('sc') for any value scales the value by a power of 10. For example, "valueScale" of "3" translates to a multiplier factor of 1000 (10^3). A "valueScale" of "-2" translates to a multiplier factor of 0.01 (10^{-2}). A "valueScale" of "0" translates to a multiplier factor of 1 (10^0).

Note: "\n" refers to line feed as in the standard practise for indicating rows in SQL data streams⁵.

Note: the word "array" is used throughout the document to denote a number of columns, using SQL terms⁶.

Note: the word "list" is used throughout the document to denote a number of rows (or arrays), using SQL terms⁷ (i.e., all values in a list will have the same format).

3.3.1 countrySubdivision

Country code uses Alpha-2 code and subdivision codes defined in ISO 3166.

3.3.2 dateTime Format

The "dateTime" format is used to express instantaneous point in time, durations, and time intervals useful for human-related activities. The "dateTime" format is based upon the ISO 8601-1:2019 standard. In certain cases, the ISO 8601 standard provides options, such as extended and basic formats. This ISO/IEC 18012-3 standard specifies the necessary detail beyond ISO 8601 standard to clarify usage, ensure interoperability and simplify

⁵ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used

⁶ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used

⁷ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used

implementations.

A key aspect of ISO 8601 is that the order is from largest to smallest, allowing for predictable and consistent sorting. The order is year (4 digits), month (2 digits), date (2 digits), hour (2 digits), minutes (2 digits) and seconds (2 digits). The basic format of ISO 8601 is used. In other words, the “-” and “:” are not used for delimiters for dates and times. For example, “20210304” refers to March 4, 2021.

“T” must be used with times. For example, “T0323” refers to the time of 3:23 am.

Dates and times are zero padded. For example, “20210102” represents Jan 2, 2021.

24 hour time is used, so no “am” or “pm” is used. For example, “T2134” means the time of 9:34 pm.

The time zone follows the time with a ‘+’ or ‘-’. For example, “T130912-04” means 12 seconds after 1:09 pm using a time zone that is – 4 hours from UTC. A time zone should be used (i.e., after the time with a positive or negative hour/minutes. If a time zone is not included, it shall be interpreted as the UTC time zone. For UTC time, “+00” or “+0000” shall be used, and not “Z” or “-00” or “-0000”. Therefore, “T1121” and “T1121+00” both represent 11:21 UTC.

Imprecise values are allowed where appropriate. For example, “2021” refers to any event within the year 2021. Of special note, 6 digits are interpreted as the first 4 digits representing the year and are allowed for consistency purposes, with a caution to programmers that YYMMDD or other formats are not being used. For example, “201104” is April in the year 2011.

Skipped date values are marked with a ‘-’. For example, “2021-02” (skipping month) means 2nd day of any month in 2021. “- - 08” means the 8th day in any month.

Skipped time values are marked with a ‘:’. For example, “T0205” means 2:05 am, and “T:06” means 6 minutes after any hour. Decimal places are only allowed after seconds and refer to decimal fractions of seconds. For example, “T210802.45” means 2.45 seconds after 9:08 PM.

3.3.3 nanosecondsSinceEpoch

The nanosecondsSinceEpoch format is appropriate for timestamping messages being transferred on the event bus, HES-CLME. This format uses the Precision Time Protocol (PTP) truncated timestamp format (IEEE 1588v1, also see RFC 8877 Section 4.3) which is 32 unsigned bits for seconds that rolls over in 2106. Many older embedded systems use signed 32 bits for unix time (which starts Jan 1, 1970) that rolls over in 2038 (maximum value of 2147483647) and do not meet this standard. The PTP format also has fractional nanoseconds, which is based on 32 bits ($10^9 - 1$). PTP enables Ethernet devices to be precisely synchronized with very accurate timestamping. The event bus for the HES gateway does not normally require the same level of accuracy or precision, but using the PTP timestamp format allows for higher precision if needed.

ASCII decimal is used to express this format. The number of decimal places should be consistent with the resolution of the timestamps and should not include extra zeros, which also conserves communications time. For example, if a device is capable of measuring timestamps in milliseconds, it should output 3 decimals such as “.325” and not “.325000000”.

3.3.4 secondsSinceEpoch

This format is appropriate for the majority of human-related activities such as schedules and meetings. This format uses the Precision Time Protocol (PTP) truncated timestamp format for seconds (IEEE 1588v1, also see RFC 8877 Section 4.3), which is 32 unsigned bits that rolls over in 2106. Many older embedded systems use signed 32 bits for unix time (which starts Jan 1, 1970) that rolls over in 2038 (maximum value of 2147483647) and does not meet this standard.

3.3.5 latitudeLongitude Format

The “latitudeLongitudeGeneral” format is used for identifying locations anywhere on earth. The “latitudeLongitudeGeneral” format is based upon the ISO 6709:2008 standard. In certain cases,

the ISO 6709 standard provides options, such as using decimal degrees or minutes. While the range of formats in ISO 6709 is uniquely represented, allowing multiple formats for transmitting increases the complexity. Therefore, this ISO/IEC 18012-3 standard specifies the necessary detail beyond ISO 6709 standard to clarify usage, ensure interoperability and simplify implementations.

The degrees and decimal degrees format of ISO 6709 will only be used (H.2.2 and H3.2)). The height or depth may be included, but cannot be expected to be interpreted and used (H.4).

The most common map projection including for GPS systems and on the Internet is CRSWGS_84, which is used in most GPS systems. Therefore the Coordinate Reference Identification of CRSWGS_84 shall be used. In other words, an example of a valid expression of coordinates is “-39.345+120.546CRSWGS_84” (H.5).

The number of digits for latitude, longitude and height (depth) shall indicate the precision of available data (H.6.2).

No terminator characters shall be used (H.6.4).

3.3.6 timeDuration Format

The “timeDuration” format is used to express to human users the amount of time in a time interval. The “timeDuration” format is based on ISO 8601-1:2019. In certain cases, ISO 8601 provides options, such as extended and basic formats. This ISO/IEC 18012-3 standard specifies the necessary detail beyond ISO 8601 standard to clarify usage, ensure interoperability and simplify implementations.

The basic format of ISO 8601 shall be used. In other words, the “-” and “:” shall not be used for delimiters for dates and times.

A prefix of ‘P’ is used with date designators for year (‘Y’), month (‘M’), week (‘W’), day (‘D’). For example, “P2Y3M” refers to a duration of 2 years and 3 months.

A prefix of ‘T’ is used with time designators for hour (‘H’), minute (‘M’) and second (‘S’). For example, “PT4H3M” refers to a duration of 4 hours and 3 minutes.

Designators may be omitted if their value is zero. For example, “P3DT4M” refers to a duration of 3 days and 4 minutes.

Decimal fraction values may be used on the smallest element only using a ‘.’. Therefore, it is not appropriate to use 2.5 hours and 10 minutes (“PT2.5H10M”. Instead “PT2H40M”) should be used (2 hours and 40 minutes).

Date and time values may not exceed their moduli. Therefore, it is not appropriate to use 25 hours (“PT25H”). Instead “P1DT1H” should be used (1 day and 1 hour).

3.3.7 timeInterval Format

The “timeInterval” format is used to express to human users the amount of time in a time interval. The “timeInterval” format is based upon the ISO 8601-1:2019 standard. In certain cases, the ISO 8601 standard provides options, such as extended and basic formats. This ISO/IEC 18012-3 standard specifies the necessary detail beyond ISO 8601 standard to clarify usage, ensure interoperability and simplify implementations.

The basic format of ISO 8601 shall be used. In other words, the “-” and “:” shall not be used for delimiters for dates and times. The interval designator will be delimiter character ‘/’ will be used with a start time and duration. For example, “20211002T1100/PT1H” refers to a start time of Oct 2, 2021 at 11:00 running for 1 hour in duration (finishing at 12:00).

3.4 Memory storage/access types

There is a range of ways in which data is stored and accessed for objects throughout the HES gateway system. The types below specify the characteristics of each type. These memory types (memoryType) are allocated to data definitions throughout this standard and are to be followed

as stated in this standard to ensure predictable and reliable HES gateway operations (i.e., defining expectations of variables).

For example, the interactiveData of currentValue may change after power cycling (Table 5) whereas the pre-market information should remain (Table 3).

3.4.1 RAM

“RAM” is volatile memory that can be changed and modified.

3.4.2 ROM

“ROM” is hard-coded preset data that does not change.

3.4.3 Operational

“Operational” is data that is modified via the system operations.

3.4.4 Database

“Database” is data that can be changed and modified from HES-CLME messaging, but remains after a power cycle (e.g., flash memory).

3.4.5 Secret

“Secret” is information that is to be kept secret.

3.4.6 General

“General” is memory in which the specifics are not important.

3.4.7 Summary

Error! Reference source not found. summarizes each memory storage/access type (memoryType) and specifies their characteristics.

Table 2 – Memory Storage/Access Types (memoryType)

Memory Types	Trans Code	Initialized	Power Cycle	Changeable	Readability
RAM	‘ra’	-	lost	HES-CLME changeable	viewable
ROM	‘ro’	-	remains	preset	viewable
ROM-pre	‘pr’	pre-market	remains	preset	viewable
ROM-post	‘po’	post-market	remains	preset	viewable
Operational	‘op’	-	-	operational changeable	viewable
Database	‘db’	-	remains	HES-CLME changeable	viewable
Secret Programmed	‘sp’	pre-market	remains	preset	obscured
Secret Real Time	‘sr’	-	lost	changeable	obscured
Secret Database	‘sd’	-	remains	changeable	obscured
General	‘ge’	-	-	-	-

Initialized: how the information is initialized

- pre-market (e.g., manufacturer/developer at the time of manufacture of product)
- post-market (e.g., system integrator/installer configuring parameters as product is installed),

Power Cycle: what happens to the data upon a power cycle; loss of power, and return of power

- lost: information is lost after a power cycle
- remains: information remains after a power cycle

Changeable: how the information is changed

- HES-CLME changeable: information may be changed via HES-CLME
 - operation changeable: information may be changed via system operations (it cannot be changed directly via HES-CLME)
 - preset: information is pre-set and cannot be changed via HES-CLME or due to operations
- Readability:** can information be read correctly or is it prevented from being viewed without proper keys via HES-CLME
- viewable
 - obscured

3.5 Address/data types

To ensure communication links deal with messages reliably, predictably and consistently, three parameters are specified, dataPurpose, addrPoint and storageType, are specified. Other standards, such as the ISO/IEC 18012-4 event encoding standard, use these parameters to affect messaging.

The purpose for data used throughout this standard is identified in the “dataPurpose” parameter as shown below:

dataPurpose ('dp'):

Type	Trans Code	Description
configurationData	'cd'	Data to configure the HES gateway modules or system, or to provide information about the HES gateway modules or system (note: these data are initiated at time of manufacturing or through the HES gateway app)
interactiveData	'id'	Real time interactive data that is subsequently used by the binding map for conversions
metaData	'md'	Data about interactiveData
serviceData	'sd'	Data transferred between service modules

The “addrPoint” parameter specifies whether noted addresses in this standard point to addressing information or point to data:

addrPoint ('ap'):

Type	Trans Code	Description
addrPoint ToAddr	'pa'	Address points to address only (not data)
addrPoint ToData	'pd'	Address points to data (configurationData, interactiveData, metaData or serviceData)

The type of data storage, whether atomic data or table, is specified in the “storageType” parameter. All data is atomicData unless otherwise specified.

storageType ('st'):

Type	Trans Code	Description
atomicData	'ad'	Atomic data
generalTable ⁸	'gt'	General table consisting of a number of rows

⁸ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used

indexedTable ⁹	‘it’	Table consisting of a number of rows with an unique key used to identify each row in table
---------------------------	------	--

608

609 **4 Conformance requirements**

610 A module, device, product or system that claims conformance to this HES gateway document
611 shall implement appropriate objects (including the associated metadata or configurationData)
612 as specified in this document.

613 **5 Lexicon concepts, principles**

614 In the field of linguistics, a lexicon is an inventory of words of a language and information about
615 them. The term lexicon here is used to represent a listing of known HES application objects
616 and actions, and structured information about them. This standard applies the structure
617 specified in ISO/IEC 18012-2 *Taxonomy and application interoperability model* to establish a
618 full compilation of the HES lexicon, including HES objects and actions (i.e., the nouns and
619 verbs of the HES language) as well as their attributes.

620 The HES gateway relies on this lexicon to implement its internal translation processes
621 (interworking function), operations, and management to achieve interoperability among
622 networks and related application services. HES-CLME provides a complete linguistic construct
623 (i.e., lexicon, syntax, and semantics) needed to express any function found in home and
624 building electronic systems (for internal use within the HES gateway). It establishes an
625 inclusive set of all relevant electronic systems and products used in practice to achieve
626 interoperability among them.

627 **5.1 Communicating “lexicon” on media**

628 When data are exchanged on communications media, short forms of the information (see
629 **shortLetters** format defined above) are used as much as possible. To reference the overall
630 lexicon, the short form ‘Ix’ is used.

631 **6 Object concepts**

632 **6.1 Overview of object concepts**

633 An object is a software model of a well-defined device for sensing or control, or a system
634 operating task. The HES lexicon specifies five types of objects:

- 635 1)user objects,
636 2)remote objects,
637 3)binding map objects,
638 4)interface objects, and
639 5)service objects.

640 These objects include associated properties or attributes such as state variables or
641 parameters and associated data-types, properties, units, and ranges, depending on usage or
642 functionality.

643 The diagram in Figure 2 shows the types of objects in relation to the HES gateway.

⁹ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used



AVA Documents
Document Sharing Hub

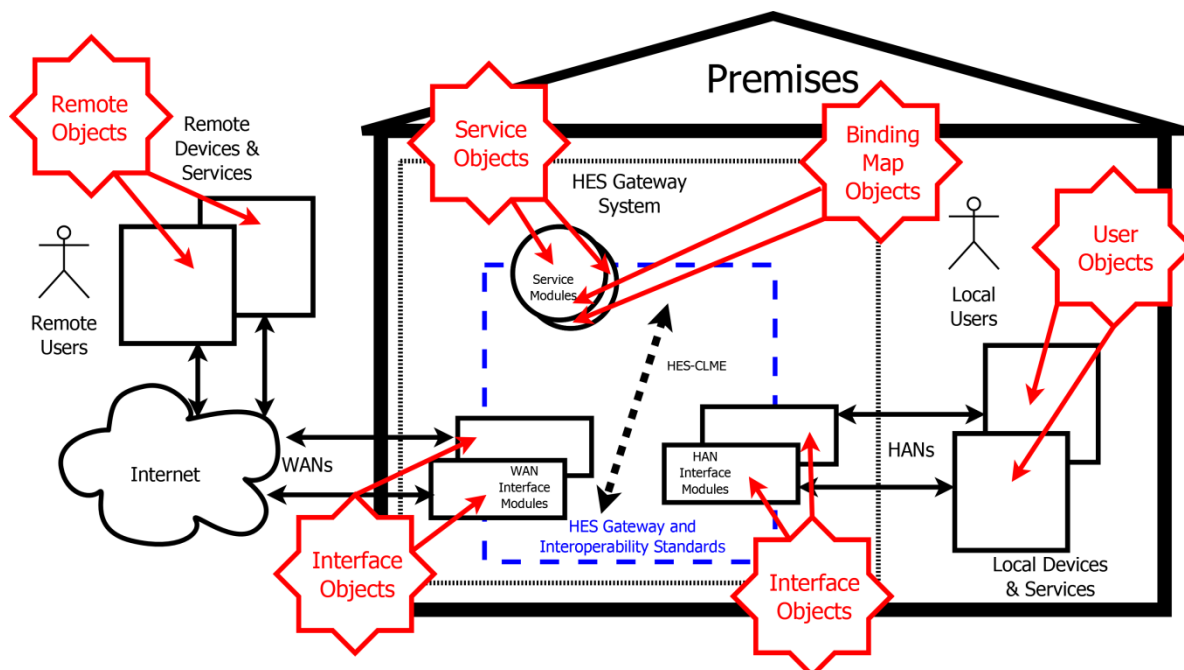


Figure 2 – Types of Objects in the HES Gateway

To reference an “object” in communications through HES-CLME on which primitive actions are to be done (i.e., retrieve and update values), the short form ‘**ob**’ is used. As shown in Figure 3, the short form for “user objects” is ‘**uo**’, “remote objects” is ‘**ro**’, “binding map” is “**bm**”, “interface objects” is ‘**io**’ and “service objects” is ‘**so**’. See ISO/IEC 18012-4. In the future, other types of objects may be added.

More complex actions, called functional actions, are described in 7 and use the short form of ‘**ac**’.

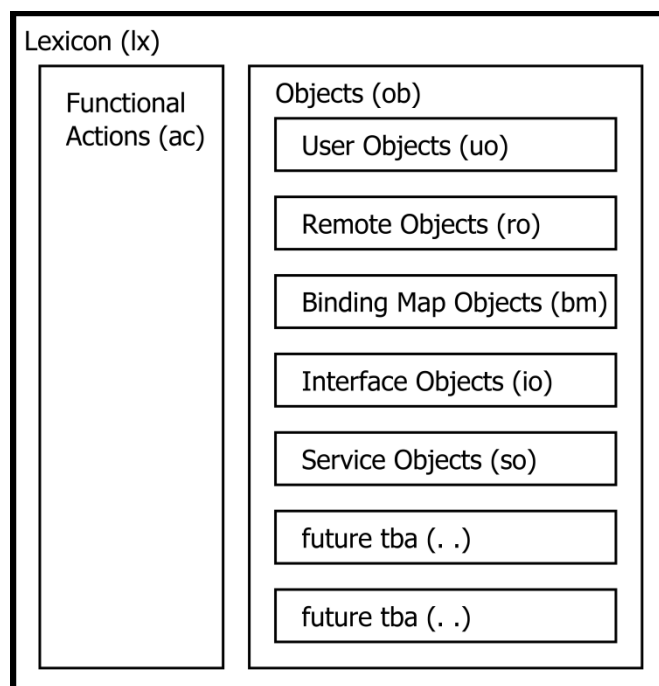


Figure 3 – Short form formats for objects in Lexicon

The hierarchical structure is communicated using a format similar to a file structure with a separator delineating the levels. As discussed in ISO/IEC 18012-4, Annex A, the separator used depends on the communications technique. Annex A specifies for HES-CLME that the

separator used is the character '/'. This results, for example, that the string “/lx/ob/uo” is used to convey user objects. This '/' separator will be used throughout this ISO/IEC 18012-3 standard to make the documentation of the lexicon easier to understand.

For example, the string “/lx/ob/uo” shown within the Lighting Domain in this ISO/IEC 18012-3 document is the actual string for the HES-CLIP communications technique. For other communications techniques the string “/lx/ob/ou” means “**separator** lx **separator** ob **separator** ou” in which the separator is defined in ISO/IEC 18012-4.

For cases in which lexicon information is actually stored in the HES gateway module as data, the '/' separator will be used for all communication techniques to ensure interoperability. For example, valid data to be stored in the lexiconToDiscover parameter in the Binding Map might be “/lx/ob/uo/”, in which case this data would be stored regardless of the communications technique (whether HES-CLIP or not).

ISO/IEC 18012-4, Annex A.1, specifies how lists, arrays and lists of arrays are addressed, resulting in strings addresses such as “/lx/ob/bm/ot1” and “/lx/ob/bm/ot2”.

6.2 User object concepts

User objects ('uo') relate to local user devices and services within the premises.

As described in the ISO/IEC 18012-2 Standard (Section 7) and shown in Figure 5, the user objects are classified in a hierarchical structure using:

- Application Domains
- Functional Objects
- Application Objects

Application Domains group together functions that are closely aligned in the residential and small office environment. Typical Application Domains include lighting, heating and appliances.

A functional object may be composed of a logical grouping of objects to implement a higher level device or set of tasks. An example of a functional object might be a thermostat.

Application objects are objects associated with an end device application in a specific HAN or WAN network. An example of an application object might be a temperature sensor.

A common lexicon is defined in this standard to ensure that products from different networks can interoperate with a consistent and expected operation.

6.3 Binding map object concepts

Binding map objects ('bm') are associated with the binding map tables relating to applications. The tables provide the addressing connections and translations between objects.

6.4 Service object concepts

Service objects ('so') reside within the gateway but are associated with managing or servicing a network application residing on a HAN or WAN. Such application service functions include controller functions, processor functions, and other application-specific functions. Some service objects are not application-specific, but rather may be dedicated to gateway system management functions (e.g., system ID service, system clock, encryption key generation and management, etc.).

6.5 Interface object concepts

Interface objects ('io') are associated with an interface (module) between the gateway and a specific network (HAN or WAN). The interface modules carry out the transfer between the HES-CLME and a specific HAN or WAN protocol, including management of the interworking function (IWF), protocol, addressing, local memory, and other network management functions.

6.6 Remote object concepts

Remote objects ('ro') relate to remote user devices and services external to the premises.

7 Action concepts

7.1 Overview

The HES lexicon also includes a set of actions that may be carried out on or by application objects. Actions are composed of atomic action primitives (i.e., get, set, event-report, subscribe, etc.), see ISO/IEC 18012-2. A “primitive action” applies an atomic action primitive to a specific object property.

A “functional action” combines primitive actions devoted to some high-level task or functionality. In other words, a functional action is a composite of one or more primitive actions from or to one or more application objects contained in a single functional object.

An example of a primitive action might be to get a temperature reading from a sensor. Likewise, an example of a functional action might be the discovery of the list of binding maps for an interface module.

7.2 Communicating “functional actions” on media

The description of communicating primitive actions over HES-CLME is contained in 6.1, “Overview of objects concepts”,

To communicate functional actions over the HES-CLME the short form ‘**ac**’ is used.

Functional actions performed in reference to the objects defined in 6.1 use the same hierarchical structure as the objects (other than using ‘**ac**’ instead of ‘**ob**’), and the detailed tables are included in the “Detailed object” section (9) to simplify the presentation. See Figure 4.

In the future, there may be additional functional actions (e.g., see “*future abc*” in Figure 4) that are not related to any particular object, or are related to multiple objects.

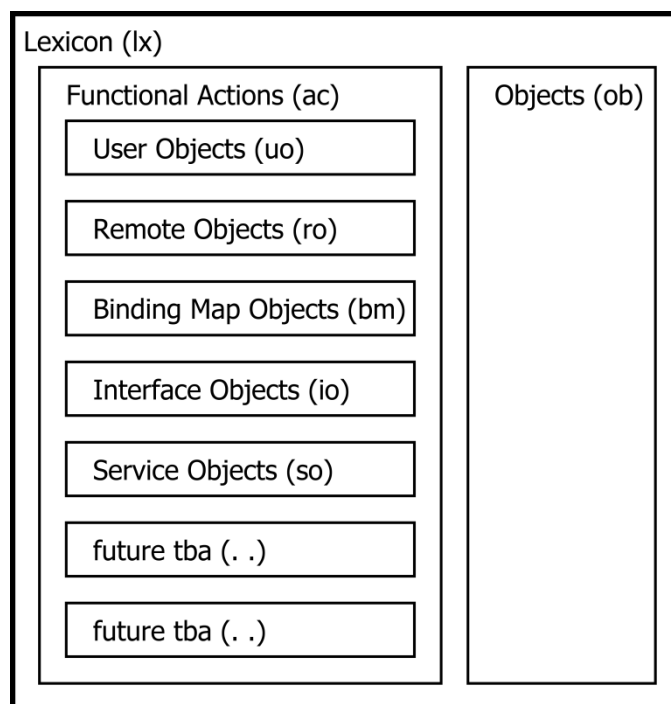


Figure 4 - Short form formats for functional actions in the Lexicon

8 Objects - Detailed Lexicon

As mentioned above, to reference Object in communications, the short form ‘**ob**’ is used.

9 User Objects - Detailed Lexicon

9.1 User Objects short form

As mentioned above, to reference a “User Object” in communications, the short form ‘**uo**’ is used.

9.2 User Objects; introduction to components

User Objects are structured in a hierarchical structure, as shown below in Figure 5, consisting of:

- Application Domain
- Functional Object
- Application Object
- Property

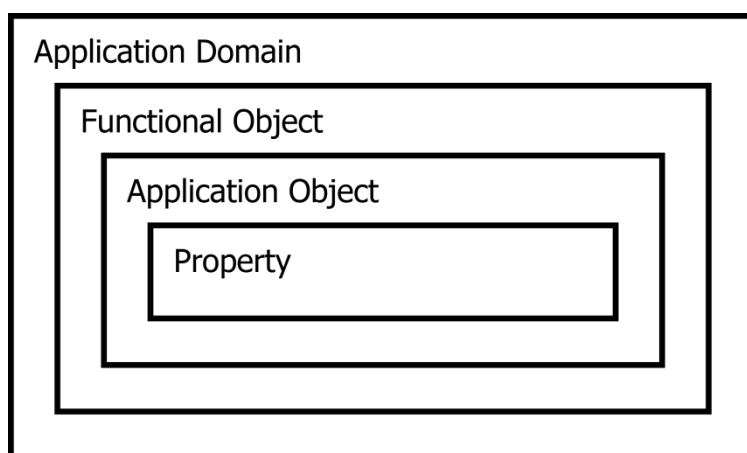


Figure 5 – Overview of User Objects

9.3 Common Objects and Structures

9.3.1 currentValue

“currentValue” is used for instantaneous information of properties.

The tables below show the DescriptiveNames and “Transmitted Codes” (TransCode) for the currentValue (‘cv’) metadata (data relating to the objects).

The TransCodes are unique within each table to ensure that there is only one way to signify each metadata expression. Default or initial values shown are applicable for all instances of currentValue, except where indicated within individual objects.

Table 3 – Pre-Market currentValue metaData

Pre-Market currentValue metaData (memoryType = ‘pr’)			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
version Number	‘vr’	versionType: ‘0.9.3’	Version number of object
data Type	‘dt’	arrayShortLetters	Data type for value
valueSize	‘sz’	nonNegInteger	Maximum size of value

Pre-Market currentValue metaData (memoryType = 'pr')			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
numberOfElements	'ne'	posInteger 1: single variable (default) >1: arrays	Total number of elements in array (e.g., number of variables, number of columns ¹⁰ , etc.)
numberOfRows	'nr'	nonNegInteger 0: unknown length of list 1: (default) >1: length of array or list	Total number of rows ¹¹ in array or list
momentary	'mm'	zeroOne ": not applicable (default) 0: persistent 1: momentary	Indicates whether switch is persistent or momentary
radio	'rd'	zeroOne ": not applicable (default) 0: non-radio 1: radio	Indicates whether buttons are radio type
unitsOfMeasure	'um'	shortLetters 'no': none (default) 'aa': AC amperes 'ah': volt-amp-hours 'av': AC volts 'aw': AC watts 'da': DC amperes 'dv': DC volts 'dw': DC watts 'hp': percent humidity 'hz': hertz 'mi': minutes 'pf': power factor 'se': seconds 'tp': temperature Celsius 'va': volt-amps 'vh': var-hours 'vr': vars 'wh': watt-hours	The units of measure used for "Value"
valueScale	'sc'	integer	Scale multiplier for value in powers of 10
measuredPreset	'mp'	shortLetters ": not applicable (default) 'me': measured 'ca': calculated 'pr': preset 'fc': forecast	Indicates whether value is measured, calculated, preset (expected or nominal) or forecast
accuracy	'ar'	nonNegDecimal ": not applicable (default)	percentage accuracy of measurement (closeness to true value)
precision	'pr'	nonNegDecimal ": not applicable (default)	percentage precision of measurement (closeness to each other)
requirement	'rq'	shortLetters 'co': conditional 'ma': mandatory 'op': optional	Requirement for property within the Application Object

¹⁰ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used

¹¹ Terminology of SQL from ISO/IEC 9075 developed by JTC 1 SC32 is used for convenience only, any underlying data management system may be used

Pre-Market currentValue metaData (memoryType = 'pr')			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
property Type	'pt'	shortLetters 'ep': electricpower 'hu': humidity 'li': light 'ms': mass 'no': none (default) 'pr': barometric pressure 'tm': time 'tp': temperature 'ui': userinteface	Property Unit type
access	'ac'	shortLetters 'in': In 'io': In/Out 'ou': Out	Access direction of property in regards to the application service (e.g., "In" for sensors, "Out" for actuators)
collected DataType	'cd'	shortLetters 'ni': not initialized (default) 'no': no collection of data 'pu': erased after intended purpose 'ti': timed erasing of data	Indicates the type of collection of data to support "privacy best practice" and "privacy next best practice" in ISO/IEC 15045-3-1, and to support the "Use, retention and disclosure limitation" privacy principle in ISO/IEC 15045-3-2
collected Data Parameter	'cp'	nonNegInteger 0: not applicable or not initialized (default) >0: seconds before erasing	Parameter related to CollectedDataType to support "privacy next best practice" in ISO/IEC 15045-3-1, and to support the "Use, retention and disclosure limitation" privacy principle in ISO/IEC 15045-3-2

Explanatory notes:

access:

The direction of "access", in or out, is related to the direction of the property in regard to the application service inside the HES gateway.

As shown in Figure 6, access of "In" is used for a sensor and access of "Out" (Figure 7) is used for an actuator.

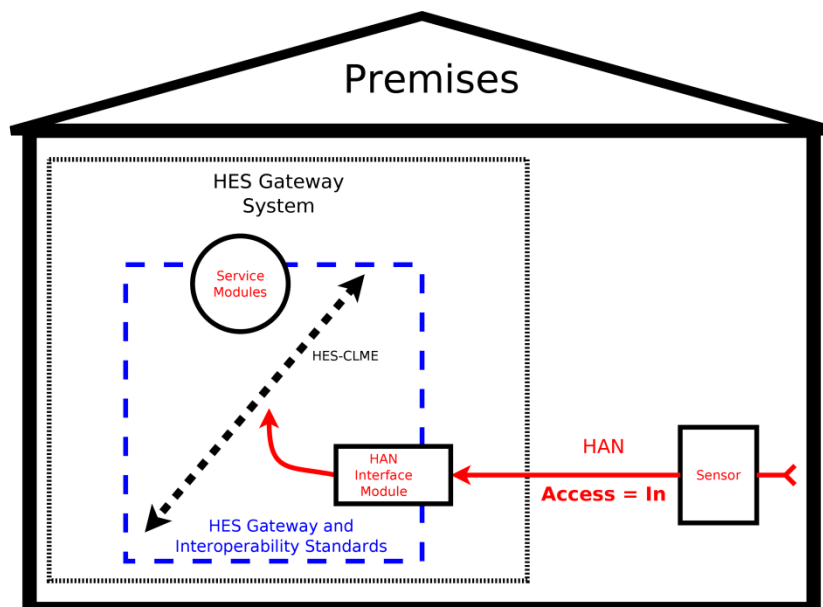


Figure 6 – Access direction of “In” (Sensor)

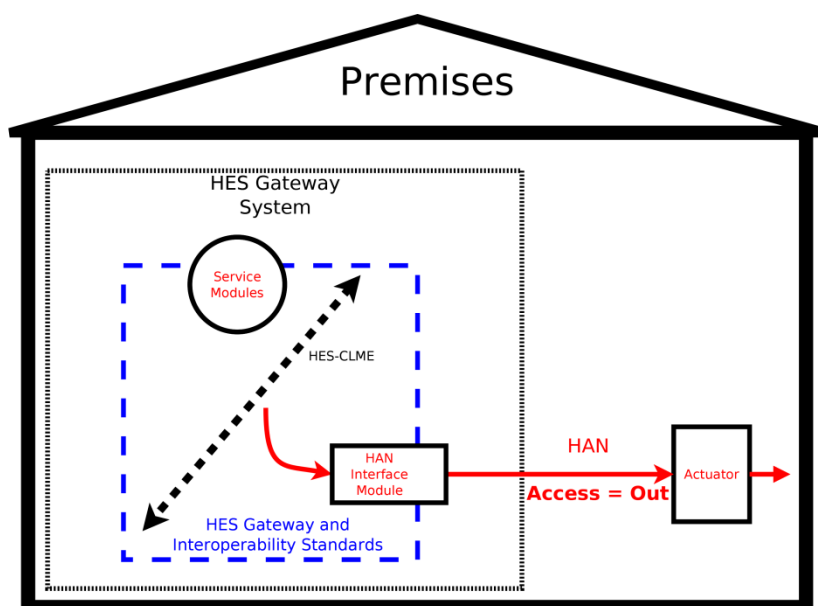


Figure 7 – Access direction of “Out” (Actuator)

Table 4 – Post-Market currentValue metaData

Post-Market currentValue metaData (memoryType = 'po')			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
default	'df'	type same as value ": not applicable(default)	Default value of the property (also known as “rated” or “nominal” especially for sensors)
minimum	'mn'	type same as value ": not applicable(default)	Minimum that value can obtain

Post-Market currentValue metaData (memoryType = 'po')			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
maximum	'mx'	type same as value ": not applicable(default)	Maximum that value can obtain
vulnerability	'vl'	nonNegInteger 0: not initialized (default) >0: vulnerability weakness (higher numbers are more vulnerable)	Vulnerability or weakness that could be exploited or triggered by a threat source to support risk assessment in ISO/IEC 15045-3-1
adverse ImpactLevel	'il'	nonNegInteger 0: not initialized (default) >0: impact level (higher values are higher impacts)	Adverse impact level of using attached HAN network and devices
likelihood Level	'll'	nonNegInteger 0: not initialized (default) >0: likelihood level (higher values are more likely to occur)	Likelihood of adverse impact occurring on the attached HAN network and devices
riskLevel	'rl'	nonNegInteger 0: not initialized (default) >0: risk level (higher values are higher risk)	Calculated risk level of using attached HAN network and devices based upon a formula
privacy Purpose	'pp'	arrayShortLetters	Purpose in regards to privacy to support the "User, retention and disclosure" privacy principle in ISO/IEC 15045-3-2
privacy Audience	'pa'	arrayShortLetters	Intended Audience in regards to privacy to support the "Data minimization" privacy principle in ISO/IEC 15045-3-2

764

765

Table 5 – currentValue interactiveData

currentValue interactiveData (memoryType = 'ra')			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
value	'va'	any data type; dependent on application	Value of the property at the current time; <i>Note: if numberOfRows is greater than one, then data types consisting of one element are extended to arrays, and data types consisting of two or more elements are extended to list of arrays</i>
cursor Coordinate Info	'cc'	listCoordinateInfo ": not applicable	Cursor coordinates (column, row) corresponding to position of reference values

766

767 **9.3.2 previousValue**

768 This clause will be developed in an amendment, if necessary.

9.3.3 compareValue

“compareValue” is used for information of properties over a period of time, such as the watt-hours over the last day.

The tables below show the DescriptiveNames and “Transmitted Codes” (TransCode) for the compareValue (‘cp’) metaData.

All properties of currentValue (see Section 10.3.1) are included in compareValue with the following additions:

Table 6 – Pre-Market compareValue metaData

Pre-Market compareValue Metadata (memoryType = ‘pr’)			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
compare Type	‘ct’	shortLetters ‘li’: last interval ‘no’: now (default) ‘ti’: this interval	how to measure consumption by comparing values (final value) compared to last complete time interval (if 3:15; hour is from 2:00 to 3:00) compared to now (if 3:15; hour is from 2:15 to 3:15) compared to this complete time interval (if 3:15; hour is from 3:00 to 3:15)

Table 7 – Post-Market compareValue metaData

Post-Market compareValue metaData (memoryType = ‘po’)			
Descriptive Name	Trans Code	dataFormat and Preassigned Values	Description
second	‘sc’		compared to 1 second ago
minute	‘mi’		compared to 1 minute ago
hour	‘ho’		compared to 1 hour ago
day	‘dy’		compared to 1 day ago
week	‘wk’		compared to 1 week ago
month	‘mo’		compared to 1 month ago
year	‘ye’		compared to 1 year ago

9.3.4 Other Properties

9.4 Application Domains

9.4.1 Current application domains

Below is a table of the application domains (which originates in the ISO/IEC 18012-2 standard), which may expand in the future. Entries in the “Descriptive Name” column are meaningful words to aid programmers in their development and transmitted codes used in reference to these application domains.

Application Domains:

List of Application Domains		
Descriptive Name	Transmitted Code	Description
energy Management	‘em’	Energy Management: premises energy management and measurement (EMMA)
lighting	‘li’	Lighting: controlling and sensing of lights

List of Application Domains		
Descriptive Name	Transmitted Code	Description
utility	'ut'	Utility: ancillary service such as electricity, gas or water
hvac	'hv'	HVAC (Heating, Ventilation, Air Conditioning), often including heat pump technology: controlling and sensing of indoor environment, using products such as thermostats and temperature/humidity sensors
userInterface	'ui'	User interface: basic user interface functions such as button pushes etc.
audioVideo	'av'	Audio/Video: applications involving audio and video equipment, such as amplifiers, stereos, TVs, and acoustic/sound sensors
telecommunications	'tc'	Telecommunications: tba
security	'se'	Security: applications involving the maintaining of premises security, such as intrusion detection systems, alarms, and motion/accelerometer sensors
appliance	'ap'	Appliance: tba
convenience	'cn'	Convenience: applications involving windows, doors, garage, pool, pump etc.
commonUser Interface	'cu'	Common user interface: enables one local human user interface to be used for multiple clusters
safetyCluster	'sc'	Safety cluster: deals with overall safety concerns with the premises, such as sensing fire, water etc. and providing advisory and critical warnings
electricVehicle	'ev'	Electric Vehicle: supports mobile/stationary operations such as electric vehicle charging, reverse flow (V2G)
general	'ge'	General: not supported by other application domains

787

788 The application domain tables below are listed with the standardized lexicon of each
 789 application domain which ensures interoperability among different manufacturers. Each
 790 application domain included in this section include summary tables with detailed object tables
 791 located in Annex F.

792 The “preamble” shows the top level addressing that precedes the subsequent portions
 793 described in the tables. For example, the Lighting Domain section shows a preamble of
 794 “/lx/ob/uo”. The summary table specifies the “lighting” application domain as ‘li’. Therefore,
 795 the string “/lx/ob/uo/li” would be used to reference lighting.

796 In the summary tables, the unshaded areas relate to the addressing of the objects (addrData
 797 of “address”) and are called “object reference codes”, no matter what level there are at. The
 798 codes for the names of the characteristics are also object reference codes. For example, in
 799 the Lighting Domain, object reference codes include ‘li’, ‘ll’, ‘da’, ‘ds’, ‘aa’, ‘as’, and ‘cv’.

800 The light orange shaded areas labelled “related to interactiveData” contain the data that is
 801 transferred in real-time during the operation of the system (see “processor service” in the
 802 ISO/IEC 15045-3-2 standard) and the metaData that is related.

803 The detailed object tables in Annex F contain the full list of detailed information for each
 804 object including “metadata”. If a characteristic is not shown, the default value as noted (such
 805 as noted in the currentValue table, Section 11.2.1) is to be used. “metadata” are
 806 characteristics of data that are programmed either in the pre-market (e.g., by the
 807 manufacturer before shipping to customer) or post-market (e.g., by a dealer or integrator).

before or during installation at a customer site). (In some cases, a manufacturer may decide to implement characteristics listed as post-market before shipping to the customer.) These configuration data are not changed during the real-time operation (processing), and are of “data” type (described in addrData above) and constitute “metaData” (described in dataPurpose above).

9.4.2 Energy management domain

The energy management domain is used to support applications relating to energy management. Energy in relation to homes and buildings most often takes the form of electricity, but management may apply to any form of energy applied on the premises. The detailed lexicon is specified in F.2.

Top level object address preamble: “/lx/ob/uo”

Summary – Energy management domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports applications relating to energy management						
energy Management ‘em’	Structure of energy management					
	structure ‘st’	element Table ‘et’	current Value ‘cv’	‘nn,sl,sl’		powerbus, consume Generate, comm Controllable

9.4.3 Lighting domain

ISO/IEC TR 15067-2 describes the HES lighting model. The detailed lexicon is specified in F.3.

Top level object address preamble: “/lx/ob/uo”

Summary - Lighting domain

Object Address				Related to interactive Data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports applications relating to lighting						
Lighting ‘li’	On/off Light Controller					
	Light Lamp ‘ll’	digital Actuator ‘da’	current Value ‘cv’	zeroOne		0 or 1
		digital Sensor ‘ds’	current Value ‘cv’	zeroOne		0 or 1
		analog Actuator ‘aa’	current Value ‘cv’	nonNeg Integer (8) [10 ⁰]	percent	0 to 100%
		analog Sensor ‘as’	current Value ‘cv’	nonNeg Integer (8) [10 ⁰]	percent	0 to 100%

9.4.4 Utility domain

The detailed lexicon is specified in F.4.

Top level object address preamble: “/lx/ob/uo”

Summary - Utility domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Ancillary service such as electricity, gas or water						
utility ‘ut’	Sensor for amount of AC power being consumed or generated					
	acPower Sensor ‘ap’	analog Sensor ‘as’	current Value ‘cv’	integer (24 bits) [10 ⁰]	AC watts	>0: consuming; <0: generating
	Sensor for amount of DC power being consumed or generated					
	dcPower Sensor ‘dp’	analog Sensor ‘as’	current Value ‘cv’	integer (24 bits) [10 ⁰]	DC watts	>0: consuming; <0: generating
	Sensor of AC current flowing into or out					
	acElec Current Sensor ‘ac’	analog Sensor ‘as’	current Value ‘cv’	integer (24 bits) [10 ⁻³]	AC amperes	>0: consuming; <0: generating
	Sensor of DC current flowing into or out					
	dcElec Current Sensor ‘dc’	analog Sensor ‘as’	current Value ‘cv’	integer (24 bits) [10 ⁻³]	DC amperes	
	Sensor of DC voltage					
	dcVoltage Sensor ‘dv’	analog Sensor ‘as’	current Value ‘cv’	integer (24 bits) [10 ⁻³]	DC volts	
	Sensor of AC voltage					
	acVoltage Sensor ‘av’	analog Sensor ‘as’	current Value ‘cv’	nonNeg Integer (24 bits) [10 ⁻³]	AC volts	
	Sensor of cumulative electrical energy consumed or generated at this time					
	energy Sensor ‘es’	analog Sensor ‘as’	current Value ‘cv’	‘nn,nn,in’ (32,32,32) [10 ⁰]	watt-hours	consuming, generating, overall
	Sensor of electrical energy consumed or generated over a time period					
	energy Sensor ‘es’	analog Sensor ‘as’	compare Value ‘cp’	‘nn,nn,in’ (32,32,32) [10 ⁰]	watt-hours	consuming, generating, overall
	Sensor of frequency of a power bus					

	freq Sensor 'fs'	analog Sensor 'as'	current Value 'cv'	nonNeg Integer (16) [10 ⁻³]	hertz	0: DC; >0.000: AC
	Sensor of power factor of a power bus					
	powerFactor Sensor 'pf'	analog Sensor 'as'	current Value 'cv'	integer (16) [10 ⁻³]	power factor	-0.9999 to 1.0000
	Mode of energy storage operation (e.g., consuming, generating)					
	energy StorageMode 'em'	digital Actuator 'da'	current Value 'cv'	shortLetters		automatic/ consuming/ generating/ standby
	Energy storage remaining					
	energy StorageMode 'em'	analog Sensor 'as'	current Value 'cv'	'nn,nn' (24,24) [10 ⁰]	watt- hours	charge, discharge
	Sensor for amount of reactive power being consumed or generated					
	reactive Power Sensor 'rp'	analog Sensor 'as'	current Value 'cv'	integer (24 bits) [10 ⁰]	vars	>0: consuming; <0: generating
	Sensor for amount of apparent power being consumed or generated					
	apparent Power Sensor 'pp'	analog Sensor 'as'	current Value 'cv'	integer (24 bits) [10 ⁰]	volt-amps	>0: consuming; <0: generating
	Sensor for amount of reactive energy being consumed or generated					
	reactive Energy Sensor 're'	analog Sensor 'as'	current Value 'cv'	'nn,nn,in' (32,32,32) [10 ⁰]	var-hours	consuming, generating, overall
	Sensor for amount of apparent energy being consumed or generated					
	apparent Energy Sensor 'ae'	analog Sensor 'as'	current Value 'cv'	'nn,nn,in' (32,32,32) [10 ⁰]	volt-amp- hours	consuming, generating, overall
	Harmonic distortion of a power bus					
	harmonic Distortion Sensor 'hd'	analog Sensor 'as'	current Value 'cv'	nonNeg Integer (16) [10 ⁻²]	percent	0.00 to 100.00%

825

826 **9.4.5 HVAC domain**

827 Top level object address preamble: "//lx/ob/uo"

Summary - HVAC domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes



Documents

Document Sharing Hub

Heating, Ventilation and Air Conditioning					
hvac 'hv'	Sensor to measure temperature of air space				
	temp Sensor 'ts'	analog Sensor 'as'	current Value 'cv'	integer (16 bits) [10 ⁻²]	C degrees -273.15 to 327.67°C
	Sensor to measure humidity of air space				
	humidity Sensor 'hs'	analog Sensor 'as'	current Value 'cv'	nonNeg Integer (16 bits) [10 ⁻²]	percent 0.00 to 100.00%
	Setpoint for heating control system to increase air temperature				
	heating Room Controller 'hc'	analog Actuator 'aa'	current Value 'cv'	integer (16 bits) [10 ⁻²]	C degrees -273.15 to 327.67°C
	Setpoint for cooling control system to decrease air temperature				
	cooling Room Controller 'cc'	analog Actuator 'aa'	current Value 'cv'	integer (16 bits) [10 ⁻²]	C degrees -273.15 to 327.67°C
	Setpoint for automatic control system to increase or decrease air temperature				
	auto Room Controller 'ac'	analog Actuator 'aa'	current Value 'cv'	integer (16 bits) [10 ⁻²]	C degrees -273.15 to 327.67°C
HVAC Mode Control					
	HVAC Mode Controller 'mc'	digital Actuator 'da'	current Value 'cv'	shortLetters	off/ auto/ heat/ cool/ fan
Fan Control					
	Fan Controller 'fc'	digital Actuator 'da'	current Value 'cv'	nonNeg Integer (8) [10 ⁰]	0: off; >0: fan speed

9.4.6 Convenience Domain

Top level object address preamble: “/lx/ob/uo”

Summary – Convenience Domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Support Convenience applications; such as window, door, garage, pool, pump etc.						
convenience ‘cn’	On/Off Appliance Controller					
	appliance Controller ‘ac’	digital Actuator ‘da’	current Value ‘cv’	zeroOne		0 or 1
	Sense Appliance Status					
	appliance Sensor ‘as’	digital Sensor ‘ds’	current Value ‘cv’	zeroOne		0 or 1

9.4.7 User interface domain

The detailed lexicon is specified in F.5.

Top level object address preamble: “/lx/ob/uo”

Summary – User interface domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports applications relating to basic user interface such as button pushes etc.						
user Interface ‘ui’	User input: e.g., button, touch screen					
	Ui Status ‘us’	digital Sensor ‘ds’	current Value ‘cv’	nonNeg Integer		
		string Sensor ‘ss’	current Value ‘cv’	string		
	Display: e.g., indicator, screen					
	Ui Display ‘ud’	digital Actuator ‘da’	current Value ‘cv’	nonNeg Integer		
		string Actuator ‘sa’	current Value ‘cv’	string		

9.4.8 Audio/Video domain

Top level object address preamble: “/lx/ob/uo”

Summary – Audio/Video interface domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Audio/Video applications						
audio Video ‘av’	Tba					
	tba	tba	tba	tba	tba	tba
	Tba					
	tba	tba	tba	tba	tba	tba

9.4.9 Telecommunications domain

The telecommunications domain is used to support applications whereby the main function of the end user devices are for person to person communication purposes that may or may not use the HANs for communications. For example, the main purpose of telephones, cell phones, intercoms and video conferencing systems are to enable voice or video communications with other devices, which may be local or remote, and that may use other communication systems.

Top level object address preamble: “/lx/ob/uo”

Summary – Telecommunications domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Telecommunications applications						
telecommunications ‘tc’	Tba					
	tba	tba	tba	tba	tba	tba
	Tba					
	tba	tba	tba	tba	tba	tba

9.4.10 Security domain

ISO/IEC TR 15067-4 describes the HES security model.

Top level object address preamble: “/lx/ob/uo”

Summary – Security domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Security applications						
security 'se'	Tba					
	tba	tba	tba	tba	tba	tba
	Tba					
	tba	tba	tba	tba	tba	tba

9.4.11 Appliance domain

Top level object address preamble: “/lx/ob/uo”

Summary – Appliance domain

Object Address				Related to interactive Data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Appliance applications						
appliance 'ap'	Tba					
	tba	tba	tba	tba	tba	tba
	tba					
	tba	tba	tba	tba	tba	tba

9.4.12 Common user interface domain

Top level object address preamble: “/Ix/ob/uo”

Further development to follow in future versions. **Summary – Common user interface domain**

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Common User Interface applications which enables one local human user interface to be used for multiple clusters						
common User Interface ‘cu’	Tba					
	tba	tba	tba	tba	tba	tba
	Tba					
	tba	tba	tba	tba	tba	tba

9.4.13 Safety cluster domain

Top level object address preamble: “/Ix/ob/uo”

Summary – Safety cluster domain

Object Address				Related to interactive Data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Safety Cluster applications which deals with overall safety concerns with the premises, such as sensing fire, water etc. and providing advisory and critical warnings						
safety Cluster ‘sc’	Tba					
	tba	tba	tba	tba	tba	tba
	tba					
	tba	tba	tba	tba	tba	tba

9.4.14 Electric Vehicle domain

Top level object address preamble: “/lx/ob/uo”

Summary – Electric Vehicle domain

Object Address				Related to interactive Data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports Electric Vehicle applications which deals with mobile/stationary operations such as electric vehicle charging, reverse flow (V2G)						
electric Vehicle 'ev'	Tba					
	tba	tba	tba	tba	tba	tba
	Tba					
	tba	tba	tba	tba	tba	tba

9.4.15 General domain

Top level object address preamble: “/lx/ob/uo”

Summary – General domain

Object Address				Related to interactive data		
Application Domain	Functional Object	Appl Object	Property	dataType (valueSize) [valueScale]	unitsOf Measure	Restricted range and notes
Supports General applications not supported by other application domains						
general ‘ge’	Tba					
	tba	tba	tba	tba	tba	tba
	tba					
	tba	tba	tba	tba	tba	tba

10 Binding map objects – Detailed Lexicon

10.1 Binding map introduction

Binding map functionality is a core function of every HES gateway. All HES gateway modules use binding maps to exchange HES-CLME messages with other HES gateway modules. This service specifies the source-end and the destination-end of an event connection between application objects.

A full description of the binding map is included in Annex A.

The core information to implement the binding map is contained in this section.

In summary, as shown in Figure 8, the binding map matches and reflects a source address to a destination address. The binding map also converts the interactive data of a source lexicon object to a new interactive data of a destination lexicon object.

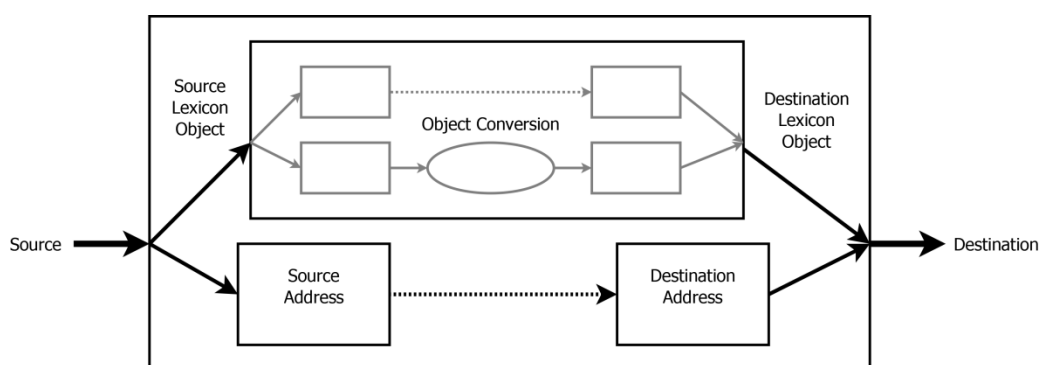


Figure 8 – Functionality of Binding Maps

The object conversion is achieved through mathematical/logical operations, conditioning of inputs, and adjustments of outputs.

10.2 Mathematical/logical operations

The table below lists the key operations and their parameters:

Descriptive Name	Trans Code	input Para1	input Para2	outPara True	outPara False
add	'ad'	'va' or #	'va' or #		
subtract	'su'	'va' or #	'va' or #		
multiple	'mu'	'va' or #	'va' or #		
divide	'dv'	'va' or #	'va' or #		
ifEqual	'eq'	'va' or #	'va' or #	'va' or #	'va' or #
ifGreaterThan	'gt'	'va' or #	'va' or #	'va' or #	'va' or #
ifLessThan	'lt'	'va' or #	'va' or #	'va' or #	'va' or #
noOperation	'no'	'va' or #			

Notes:

- TransCode: Transmitted Code
- inputPara1: inputParameter #1
- inputPara2: inputParameter #2
- outParaTrue: outputParameter if true
- outParaFalse: outputParameter if false
- 'va': value of currentValue . . .
- #: internal preset value

10.3 Conditioning

Basic conditioning for the inputs before processing include the following:

Descriptive Name	Trans Code	Description
passThrough	'pt'	straight pass through without changes
block	'bk'	block, not pass through
absoluteValue	'av'	negative numbers converted to positive
negate	'ng'	invert value

10.4 Adjustment

Basic adjustment for the outputs include the following:

Descriptive Name	Trans Code	Description
passThrough	'pt'	straight pass through without changes
block	'bk'	Block, not pass through
absoluteValue	'av'	negative numbers converted to positive
negate	'ng'	Invert value

10.5 Operation table

operationTable (short form is 'ot') is the full list of operations for a binding map consisting of a "row" entry for each "operation group". An operation group defines a complete input and output expected scenario as shown in Figure 9.

refid (ri)	enable (en)	inputs (ip)	operation (op)	input Parameters (pi)	output Parameters (po)	outputs (ou)
---------------	----------------	----------------	-------------------	-----------------------------	------------------------------	-----------------

Figure 9 – Components within an Operation Group of a Binding Map

"inputs" table (ip) is shown below:

Descriptive Name	Description	Trans Code	dataFormat	Preassigned Values or Enumerated Values or Valid Range
deviceIndex	Index of source service or device	'di'	nonNeg Integer	0: not initialized >0: reference id of specific device
sourceObject	Lexicon of source object	'so'	stringLexicon	any Lexicon string
sourceValue	Value of currentValue	'sv'	any	value of currentValue
condition	Conditioning on inputs	'co'	shortLetters	'pt': straight pass through without changes 'bk': block, not pass through 'av': negative numbers converted to positive 'ng': invert value
authorType	Type of authorization	'at'	shortLetters	'bk': block 'fl': flow 'pa': partial

Descriptive Name	Description	Trans Code	dataFormat	Preassigned Values or Enumerated Values or Valid Range
method	Type of method for input message	'me'	shortLetters	're': retrieve 'up': update 'de': delete (not used at this time) 'cr': create (not used at this time)
credInfo	Information of credential (such as certificates, access tokens, passwords etc.)	'ci'	string	any string
userName	User name	'un'	string	any string
accompany Operation	Operation to be performed on accompanied information (such as 'ci' and 'un')	'ap'	shortLetters	'pt': straight pass through without changes 'bk': block, not pass through 'au': authorize

"outputs" table (op) is shown below:

Descriptive Name	Description	Trans Code	dataFormat	Preassigned Values or Enumerated Values or Valid Range
deviceList	List of indexes of destination services and devices	'dl'	arrayNonNeg Integer	0: not initialized >0: reference id of specific device
destObject	Lexicon of destination object	'do'	stringLexicon	any Lexicon string
destValue	Value of currentValue	'dv'	any	value of currentValue
adjustment	Adjustment for output	'ad'	shortLetters	'pt': straight pass through without changes 'bk': block, not pass through 'av': negative numbers converted to positive 'ng': invert value
authorType	Type of authorization	'at'	shortLetters	'bk': block 'fl': flow 'pa': partial
optInOut	Opt in/out mechanisms	'op'	shortLetters	'oi': opt in 'ou': opt out 'fi': forced in 'fo': forced out

Descriptive Name	Description	Trans Code	dataFormat	Preassigned Values or Enumerated Values or Valid Range
method	Type of method for output message	'me'	shortLetters	're': retrieve (response passed back to originator) 'up': update (status passed back to originator) 'de': delete (not used at this time) 'cr': create (not used at this time)

10.6 Addressing Table

addressingTable (short form is 'at') is the full list of interface modules, devices and services using the binding map as shown in Figure 10. This allows easy and consistent reference to interface modules, devices and services within the binding map (e.g., within the inputs and outputs table).

device Index (di)	module Type (mt)	module RefIndex (mi)	net RefIndex (ni)	address (ad)
-------------------	------------------	----------------------	-------------------	--------------

Figure 10 - Components within the addressingTable

The components within the addressingTable are described below:

Descriptive Name	Description	Trans Code	dataFormat	Preassigned Values or Enumerated Values or Valid Range
deviceIndex	Index to device or service	'di'	nonNegInteger	0: not initialized >0: reference id of specific device
moduleType	Type of source module	'mt'	shortLetters	'hi': HAN interface module 'wi': WAN interface module 'sm': Service module 'it': Internal process
moduleRef Index	Index reference to source module	'mi'	nonNegInteger	0: not applicable or not initialized >0: reference id of module; 1 or 2 for a simple gateway; potentially higher for other gateway classes
netRefIndex	Index to device or service on the attached network	'ni'	nonNegInteger	0: general reference (e.g., index of Interface module itself) >0: index to device or service on attached network Note: this value originates from a translation table of indexes to attached network addressing contained within interface module
address	IP address of interface modules	'ad'	ipAddress	

overall; Binding Map**Description:** Overall aspects of the binding map**Object Address:**

Type	Trans Code	Descriptive Name
overallProcess	'lx'	lexicon
lexiconType	'ob'	object
objectType	'bm'	bindingMap

Post-Market bindingMap configurationData (memoryType = 'pr'):

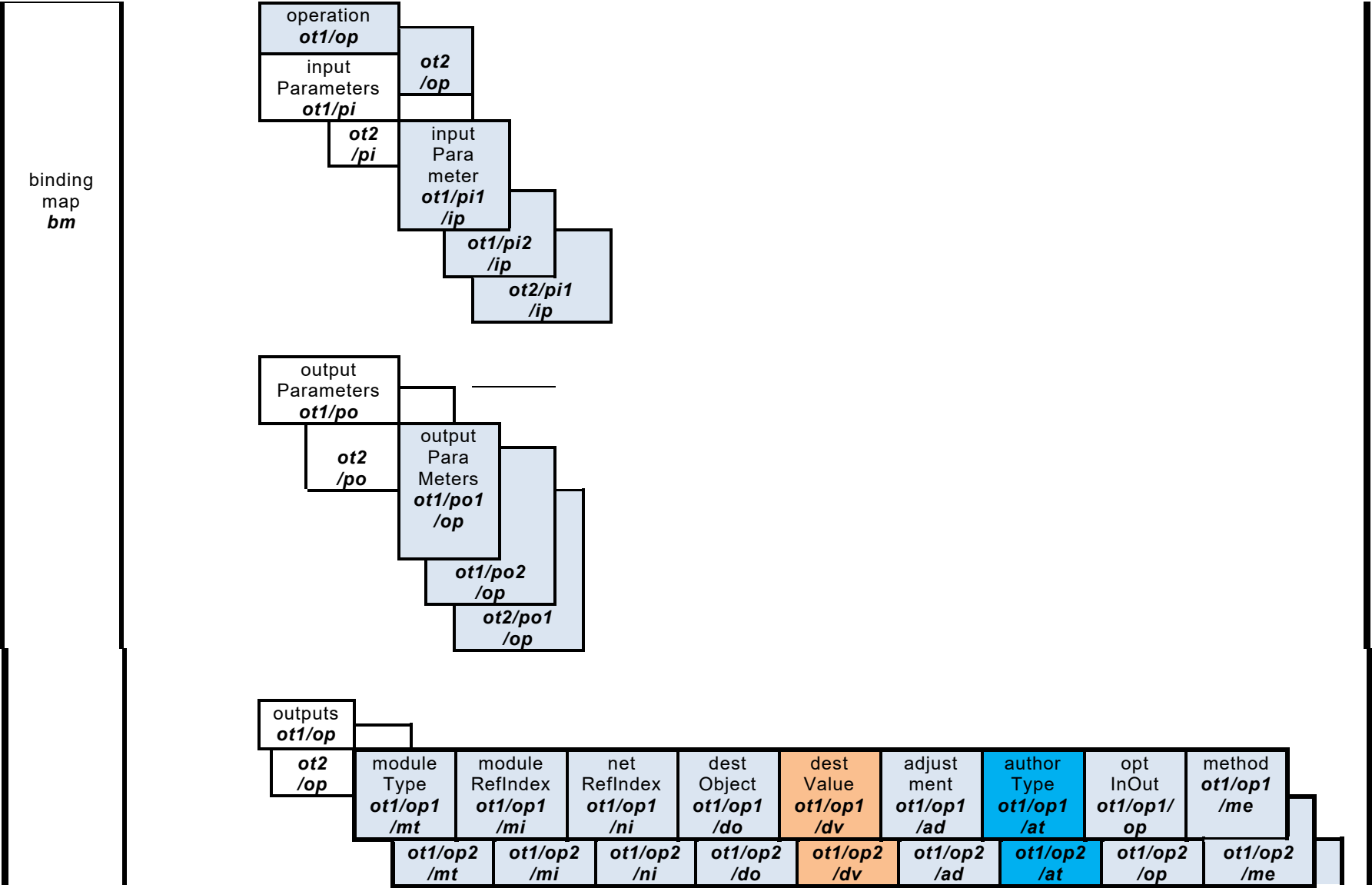
Descriptive Name	Description	Trans Code	dataFormat	Preassigned Values or Enumerated Values or Valid Range
requirement	The requirement to have Binding Map within the HES gateway system.	'rq'	smallLetters	'ma': mandatory
single	Does this service require only a single instance (not allowing multiple cases)?	'fn'	smallLetters	'no': no

Table 8 shows the complete operation table and addressing table for the binding map service shown all together.

Top Level Object Address preamble: “/Ix/ob”

Table 8 – Binding Map Operation Table

Binding Map									
Object Address		configurationData (memoryType='po')			interactiveData (memoryType='ra')			serviceData	
Binding Map service									
binding map bm	requirement: mandatory (rq: 'ma')								
	single: no (si: 'no')								
	Table containing operations								
	operation Table ot								



		<table><tr><td>ot2/op1 /mt</td><td>ot2/op1 /mi</td><td>ot2/op1 /ni</td><td>ot2/op1 /do</td><td>ot2/op1 /dv</td><td>ot2/op1 /ad</td><td>ot2/op1 /at</td><td>ot2/op1 /op</td><td>ot2/op1 /me</td></tr></table>									ot2/op1 /mt	ot2/op1 /mi	ot2/op1 /ni	ot2/op1 /do	ot2/op1 /dv	ot2/op1 /ad	ot2/op1 /at	ot2/op1 /op	ot2/op1 /me
ot2/op1 /mt	ot2/op1 /mi	ot2/op1 /ni	ot2/op1 /do	ot2/op1 /dv	ot2/op1 /ad	ot2/op1 /at	ot2/op1 /op	ot2/op1 /me											
Table containing addressing information																			
addressing Table <i>at</i>																			
		module Type <i>at1/mt</i>	module RefIndex <i>at1/mi</i>	address <i>at1/ad</i>															
		<i>at2/mt</i>	<i>at2/mi</i>	<i>at2/ad</i>															

913
914