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Application protocol for electrical storage systems and controllers

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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.

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Template for comments and secretariat observations

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



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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, SEG 9	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	

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TITLE:

Information technology – Home Electronic System (HES) architecture - Part-4-302 Application protocol for electrical storage systems and controllers

NOTE FROM TC/SC OFFICERS:

CONTENTS

1		
2	FOREWORD	5
3	INTRODUCTION	7
4	1 Scope	8
5	2 Normative references	8
6	3 Terms, definitions and abbreviated terms	8
7	3.1 Terms and definitions	8
8	3.2 Abbreviations	9
9	4 Conformance	9
10	5 Configuration	10
11	5.1 General	10
12	5.2 Configuration and components	10
13	5.3 Connection configuration	10
14	6 Application layer	11
15	6.1 General	11
16	6.2 NECD objects	11
17	6.3 NECD services	12
18	6.4 Object-specific NECD properties	12
19	6.5 Application operation	14
20	6.5.1 General	14
21	6.5.2 Continuous requests	14
22	6.5.3 Response wait time value for controllers	15
23	6.5.4 Resending a frame	15
24	6.5.5 Processing object property counter	15
25	6.5.6 Property values of write requests	15
26	7 Normal operation	16
27	7.1 General	16
28	7.2 Start-up operation	18
29	7.2.1 General	18
30	7.2.2 Start-up processing of NECD nodes	18
31	7.2.3 Search processing	18
32	7.2.4 Obtaining NECD attribute information	18
33	7.2.5 Obtaining electrical storage system attribute information	19
34	7.3 Occasional operation	22
35	7.3.1 General	22
36	7.3.2 Obtaining electrical storage system status	22
37	7.3.3 Setting and updating “AC charge amount target value” property (or “AC	
38	discharge amount target value” property)	25
39	7.3.4 Setting and updating “Charging electric power setting” property (or	
40	“Discharging electric power setting” property) (optional)	28
41	7.3.5 Setting “Charging method” property (or “Discharging method” property)	
42	(optional)	31
43	7.3.6 Setting “Operation mode setting” property	34
44	7.3.7 Terminating charging (or discharging) operation of the storage battery	
45	based on “AC charging amount target value” property (or “AC	
46	discharging amount target value” property)	37
47	7.4 Fault status notification	41
48	8 Remote control	42

49	8.1	General.....	42
50	8.2	Setting and updating “AC charge amount target value” property (or “AC 51 discharge amount target value” property) on remote control.....	42
52	8.3	Setting “Operation mode setting” property when remotely controlling.....	44
53	9	Considerations on controllers.....	46
54	9.1	General.....	46
55	9.2	Restrictions by electrical storage system implementations.....	46
56	Annex A (informative) <i>Terms and NECD protocol frame format on ISO/IEC 14543-4-3 57 and IEC 62394</i>		48
58	A.1	Terms correspondence between ISO/IEC 14543-4-3 and IEC 62394.....	48
59	A.2	NECD protocol frame format.....	48
60	Annex B (informative) <i>Relationship between ISO/IEC 14543-4 series and the HES 61 gateway, based upon ISO/IEC 15045 and ISO/IEC 18012 series of standards</i>		49
62	B.1	ISO/IEC 14543-4 series and the HES gateway.....	49
63	Bibliography.....		50
64			
65	Figure 1 – Relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543-4- 66 302 7		
67	Figure 2 – Example of electrical storage system configuration and components.....		10
68	Figure 3 – Connection configurations.....		11
69	Figure 4 – Assumed network stack.....		11
70	Figure 6 – Sequence for obtaining NECD attribute information.....		19
71	Figure 7 – Sequence of obtaining electrical storage system attribute information.....		21
72	Figure 8 – Sequence to obtain status of electrical storage systems.....		25
73	Figure 9 – Sequence for setting “AC charge amount target value” property (or “AC 74 discharge amount target value” property).....		28
75	Figure 10 – Sequence for setting “Charging electric power setting” property (or 76 “Discharging electric power setting” property).....		31
77	Figure 11 – Sequence for setting “Charging method” property (or “Discharging method” 78 property).....		33
79	Figure 12 – Sequence for setting “Charging method” property (or “Discharging method” 80 property) when no response is received from the storage battery.....		34
81	Figure 13 – Sequence for setting “Operation mode setting” property.....		36
82	Figure 14 – Sequence for setting “Operation mode setting” property when no response 83 is received from the storage battery.....		37
84	Figure 15 – Sequence of terminating charging (discharging) operation based on “AC 85 charge amount target value” property (“AC discharge amount target value” property).....		40
86	Figure 16 – Sequence of terminating charge (discharge) operation based on “AC 87 charge amount target value” property (“AC discharge amount target value” property) 88 when “Operation mode setting” property is changed.....		41
89	Figure 17 – Remote control.....		42
90	Figure 18 – Example of setting sequence for “AC charge amount target value” property 91 (“AC discharge amount target value” property) when “Remote control setting” property 92 is used.....		43
93	Figure 19 – Example of setting sequence for “Operation mode setting” property when 94 “Remote control setting” property is used.....		45
95	Figure 20 – Example of setting sequence for “Operation mode setting” property when 96 “Remote control setting” property is used, in case that no response is made by 97 electrical storage system.....		46

98	Figure A.1 – NECD protocol frame format	48
99		
100	Table 1 – NECD objects	11
101	Table 2 – NECD services	12
102	Table 3 – NECD properties of device object (super class).....	12
103	Table 4 – NECD properties of device object	13
104	Table 5 – Response wait time values for controllers	15
105	Table 6 – Re-set wait time for the AC charge/discharge amount target value.....	27
106	Table 7 – Wait time for re-setting charging/discharging electric power setting	29
107	Table 8 – Wait time for charging/discharging method for re-setting	32
108	Table 9 – Wait time for re-setting operation mode	35
109	Table A.1 – Terms correspondence table between ISO/IEC 14543-4-3 and IEC 62394	48
110	Table B.1 – Partial list of the translation between 14543-4-302 and HES Gateway	
111	18012-3 Lexicon	49
112		
113		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INFORMATION TECHNOLOGY –

HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 4-302: Application protocols for electrical storage systems and controllers

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International Standard ISO/IEC 14543-4-302 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14543 series, under the general title Information technology – Home electronic system (HES) architecture, can be found on the IEC web site and ISO web site.

The text of this document is based on the following documents:

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

165 Full information on the voting for the approval of this document can be found in the report on
166 voting indicated in the above table.

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

168 The committee has decided that the contents of this document will remain unchanged until the
169 stability date indicated on the IEC website under “<http://webstore.iec.ch>” in the data related to
170 the specific document. At this date, the document will be

- 171 • reconfirmed,
- 172 • withdrawn,
- 173 • replaced by a revised edition, or
- 174 • amended.

INTRODUCTION

This part of the ISO/IEC 14543 specifies the detailed procedures and behaviours of both electrical storage systems and controllers at the application level communication based on ISO/IEC 14543-4-3. This standard specifies the message structure, sequences and protocol of the application layer for networked enhanced control devices used in the Home Electronic System. Some services are targeted for communications between devices. Other services are exclusively reserved for management purposes. Some services can be used for both management and run-time communications. This document is applicable for energy management services, mobile access, remote appliance maintenance services, home healthcare services, home security services and comfort control.

Figure 1 shows the relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543-4-302. ISO/IEC 14543-4-3 specifies the message structure, sequences and protocol for general-purpose communications used in network enhanced control devices of the Home Electronic System (HES) Class 1. ISO/IEC 14543-4-3 provides the common interfaces for the use-level process and the services such as energy management, remote maintenance, and other services for easily building a system consisting of multi-vendor devices and equipment. IEC 62394 specifies the detailed lists of control commands on NECD objects (see ISO/IEC 14543-4-3). Annex A shows terms and NECD protocol frame format on ISO/IEC 14543-4-3 and IEC 62394.

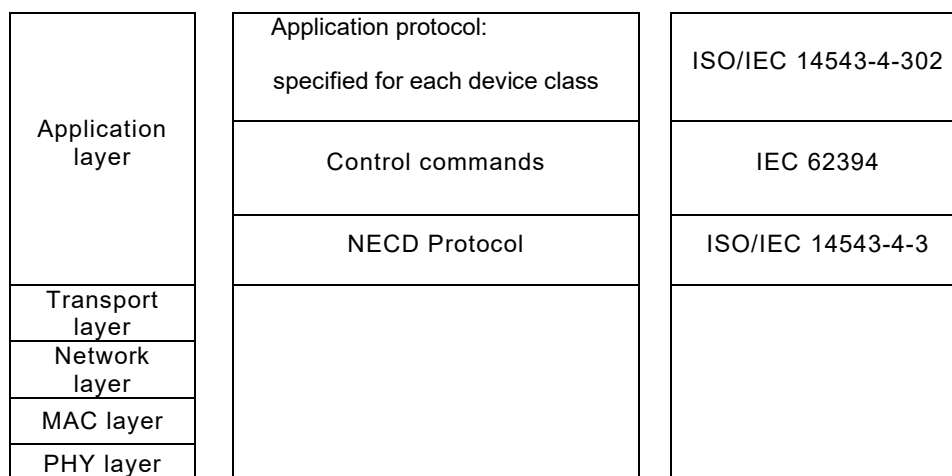


Figure 1 – Relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543-4-302

ISO/IEC 14543-4-3 is a general-purpose communications specification that applies to a variety of devices. This standard is the basis for Part 4-302, which specifies detailed procedures and behaviours for pre-packaged system solutions that include storage batteries, inverters, chargers and related devices. The procedures and behaviours specified in Part 4-302 may be used for energy flow inside a home or energy flow between the grid and a home.

In order to enhance interoperability, it is necessary to specify how to implement ISO/IEC 14543-4-3 for each device / controller at the application level such as command sequences, timeout requirements, required combinations of acceptable commands, etc.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 4-302: Application protocols for electrical storage systems and controllers

1 Scope

This part of ISO/IEC 14543 specifies an application-layer protocol necessary for ensuring interoperability among the products of various manufacturers regarding communications between electrical storage systems and controllers. It uses the network enhanced communications device (NECD) protocol specified in ISO/IEC 14543-4-3. This protocol is based on UDP using IPv4 or IPv6 (TCP is optional).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14543-2-1, *Information technology – Home electronic system (HES) architecture – Part 2-1: Introduction and device modularity*

ISO/IEC 14543-4-3, *Information technology – Home Electronic System (HES) architecture – Part 4-3: Application layer interface to lower communications layers for network enhanced control devices of HES Class 1*

IEC 62394, *Service diagnostic interface for consumer electronics products and networks – Implementation for ECHONET*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

3.1.1

battery management unit

BMU

device that manages packs and cells (monitoring state, calculating, checking environment, balancing, etc.)

3.1.2

cell

device that can be charged and discharged repeatedly

Note: The typical residential device is a lithium ion battery.

3.1.3

device object

network enhanced control device (NECD) object other than a node profile object

Note 1 to entry: In this document, it refers to storage battery object only.

3.1.4

electrical storage system

combination of devices that include single or multiple power conditioning systems (PCSs), battery management units (BMUs), and packs to support primarily residential applications, including a communications interface

3.1.5**NECD protocol**

protocol used in network enhanced control device (NECD) communications

3.1.6**node profile**

description of objects implemented in each node

3.1.7**pack**

combination of cells

3.1.8**power conditioning system****PCS**

device that charges and discharges cells, and translates DC voltage of cells to AC voltage (e.g., inverter), and AC voltage to DC voltage (e.g., charger) of cells

3.1.9**remote control**

control from outside the home

3.1.10**response wait time**

time between a controller request to and the response from an electrical storage system

3.1.11**super class**

properties that are inherited and implemented in all device objects

3.2 Abbreviations

BMU	battery management unit
DNOJ	destination NECD object
IP	internet protocol
NDA	NECD DATA
NDT	NECD property value Data
NECD	network enhanced control device
NHD	NECD header
NPC	NECD property code
NSV	NECD service
OPC	processing object property counter
PCS	power conditioning system
PDC	property data counter
SNOJ	source NECD object
TID	transaction ID
UDP	user datagram protocol

4 Conformance

Electrical storage systems and controllers of HES Class 1 that claim conformance to this document shall:

- send, receive and process sequences and procedures as specified in Clause 7.
- provide application services and properties specified in 6.2, 6.3 and 6.4 as needed by electrical storage systems and controllers for which the application is intended.

5 Configuration

5.1 General

This clause describes configuration and components of electrical storage system and connection configurations between electrical storage system and controller.

5.2 Configuration and components

Figure 2 shows an example of electrical storage system configuration and components. Electrical storage system includes the device or function of power conditioning system (PCS), battery management unit (BMU), and one or several packs basically. Electrical storage system has ISO/IEC 14543-4-302 data communications function on PCS or BMU in many cases.

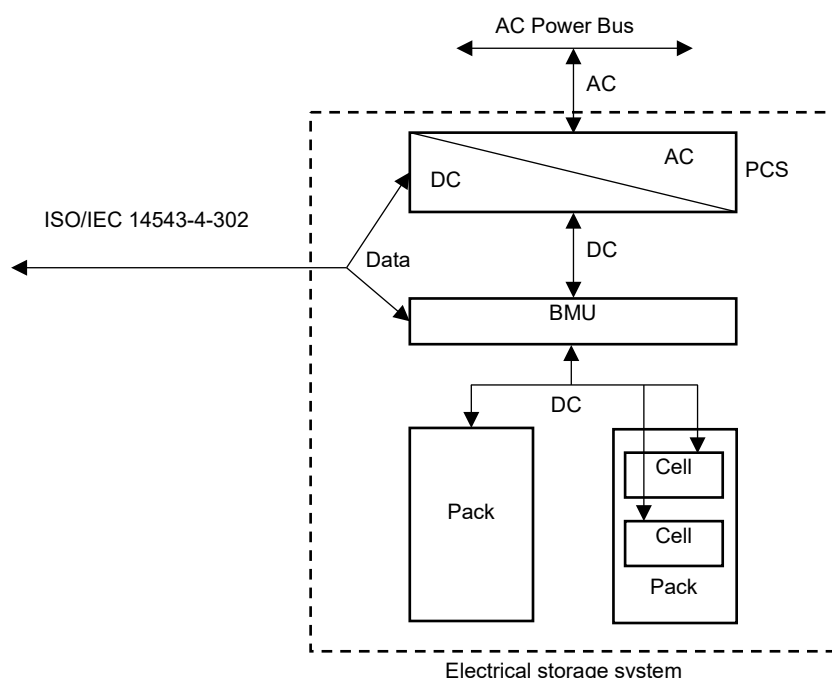
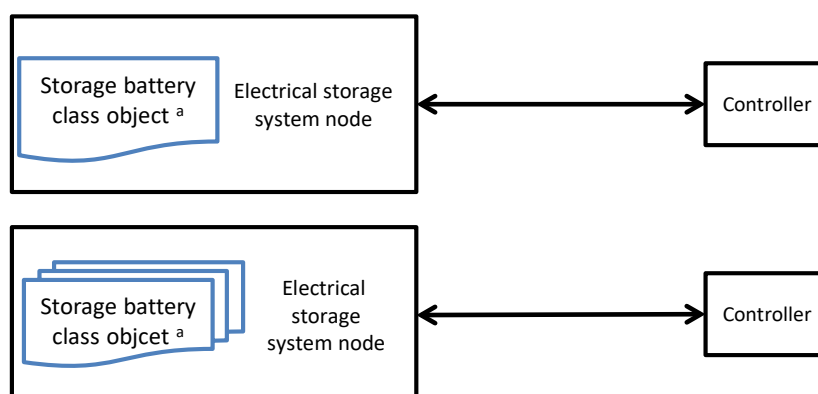


Figure 2 – Example of electrical storage system configuration and components

5.3 Connection configuration

This specification is necessary for ensuring interoperability between the products of different manufacturers in connection with application communication between electrical storage systems and controllers, using NECD protocol as an application protocol via UDP (TCP)/IPv6 communications.

Figure 3 shows the configurations assumed under this specification.



^a "Storage battery class object" is a device object specified in IEC 62394

Figure 3 – Connection configurations

The upper illustration in Figure 3 shows the case where a single device object is installed in a single node. The lower shows the case where multiple device objects are installed in a single node. The latter case occurs when multiple battery units are attached to a single communication unit. In this case, there are multiple storage battery class objects in a single electrical storage system node (i.e., at a single IP address). Controllers shall support nodes that configure multiple device objects in a single node.

Controllers shall be capable of handling multiple nodes and objects. The maximum number of nodes and objects to be handled is implementation-dependent on the controllers. When multiple controllers are connected to a single system, some electrical storage systems cannot accept a request from a controller for a certain period of time after the electrical storage system received a request from another controller.

Figure 4 shows the assumed network stack for operating the NECD protocol in this document. NECD protocol operation is assumed as an application protocol on UDP(TCP)/IPv6. Note that TCP installation is optional. As a rule, the stack uses IPv6, however, IPv4 is allowed depending on the market trends for migration from IPv4 to IPv6.

Application layer	ISO/IEC 14543-4-302 IEC62394 ISO/IEC14543-4-3
Transport layer	UDP(TCP)
Network layer	IPv6 or IPv4
(Adaptation layer)	(6LoWPAN ^a)
MAC layer	(No specific MAC layer assumed)
PHY layer	(No specific PHY layer assumed)

^a Depends on transmission media using IPv6

Figure 4 – Assumed network stack

Connection processing specific to each lower layer communication medium that is necessary in advance of the start of NECD communication is out of the scope of this document. In this document, application communications using NECD protocol is described on the assumption that connection processing specific to those communication media is complete.

6 Application layer

6.1 General

The NECD protocol shall be used at the application layer. All nodes that conform to this document shall support all mandatory functions specified in ISO/IEC 14543-4-3.

6.2 NECD objects

Electrical storage systems and controllers shall have the NECD objects shown in Table 1.

Table 1 – NECD objects

	Class group code	Class code	Class name	Instance code
Electrical storage system	0x02	0x7D	Storage battery	0x01 to 0x7F
	0x0E	0xF0	Node profile	0x01
Controller	0x05	0xFF	Controller	0x01 to 0x7F
	0x0E	0xF0	Node profile	0x01

NOTE Instance code 0x00 is designated to specify all instances of the same class in a node.

6.3 NECD services

Electrical storage systems and controllers shall support the NECD services shown in Table 2.

Table 2 – NECD services

NSV code	NECD service content	Symbol
0x51	Property value write “response-not-possible” response	SetC_SNA
0x52	Property value read “response-not-possible” response	Get_SNA
0x61	Property value write request (response required)	SetC
0x62	Property value read request	Get
0x71	Property value write response	Set_Res
0x72	Property value read response	Get_Res
0x73	Property value notification	INF

NOTE NSV codes which are specified in ISO/IEC 14543-4-3 but are not shown in Table 2 (0x60, 0x63, 0x6E, 0x74, 0x7A, 0x7E, 0x50, 0x53, and 0x5E) are not subject to the certification tests based on this document.

6.4 Object-specific NECD properties

Electrical storage systems shall install the NECD properties of a device object shown in Table 3 and Table 4. NECD properties of a node profile object shall support at least the mandatory properties.

Controllers shall send requests to the device object properties shown in Table 3 and Table 4. If a controller can control electrical storage systems via a public network, the remote control operations that set properties of storage batteries shall include SetC [0x61] to “Remote control setting” property [0x93].

Table 3 – NECD properties of device object (super class)

Property name	NPC	Units	Access rule		Announcement at status change	Remarks
			Get	Set		
Installation location	0x81	—	M	M	M	
Standard version information	0x82	—	M	—	—	
Fault status	0x88	—	M	—	M	
Manufacturer code	0x8A	—	M	—	—	
Remote control setting	0x93	—	O	O	—	
Status change announcement property map	0x9D	—	M	—	—	
Set property map	0x9E	—	M	—	—	

Property name	NPC	Units	Access rule		Announcement at status change	Remarks
			Get	Set		
Get property map	0x9F	—	M	—	—	

M: mandatory, O: optional, —: not supported

Table 4 – NECD properties of device object

Property name	NPC	Units	Access rule		Announcement at status change	Remarks
			Get	Set		
Operation status	0x80	—	M	—	M	
Identification number	0x83	—	M	—	—	
Current time setting	0x97	—	M	—	—	
Current date setting	0x98	—	M	—	—	
AC effective capacity (charging)	0xA0	Wh	M	—	—	AC
AC effective capacity (discharging)	0xA1	Wh	M	—	—	AC
AC chargeable capacity	0xA2	Wh	M	—	—	AC
AC dischargeable capacity	0xA3	Wh	M	—	—	AC
AC chargeable electric energy	0xA4	Wh	M	—	—	AC
AC dischargeable electric energy	0xA5	Wh	M	—	—	AC
AC cumulative charging electric energy	0xA8	0.001 kWh	M	—	—	AC
AC cumulative discharging electric energy	0xA9	0.001 kWh	M	—	—	AC
AC charge amount target value	0xAA	Wh	M	M	M	AC
AC discharge amount target value	0xAB	Wh	M	M	M	AC
Charging method	0xC1	—	M	O	M	
Discharging method	0xC2	—	M	O	M	
Minimum/maximum charging electric power	0xC8	W	M	—	—	AC
Minimum/maximum discharging electric power	0xC9	W	M	—	—	AC
Working operation status	0xCF	—	M	—	M	a, b
Operation mode setting	0xDA	—	M	M	M	a, b
System-interconnected type	0xDB	—	M	—	—	

Property name	NPC	Units	Access rule		Announcement at status change	Remarks
			Get	Set		
Remaining stored electricity 1	0xE2	Wh	M	—	—	DC ^c
Remaining stored electricity 2	0xE3	0.1A h	M	—	—	DC ^c
Remaining stored electricity 3	0xE4	%	M	—	—	^c
Battery type	0xE6	—	M	—	—	
Rated electric energy	0xD0	Wh	O	—	—	DC
Rated capacity	0xD1	0.1A h	O	—	—	DC
Rated voltage	0xD2	V	O	—	—	DC
Instantaneous charging/discharging electric power	0xD3	W	O	—	—	AC
Charging electric power setting	0xEB	W	O	O	—	AC
Discharging electric power setting	0xEC	W	O	O	—	AC

360 M: mandatory, O: optional, —: not supported

361 ^a Property values of “Charging”, “Discharging”, and “Standby” are mandatory

362 ^b When “Operation mode setting” property [0xDA] is set as “Auto”, the property value of “Working
363 operation status” property [0xCF] should be set as “Charging”, “Discharging”, or “Standby”, depending
364 on the actual status of the storage battery

365 ^c One of them is mandatory

366 The details of the properties shown in above Table 3 and Table 4 are specified in IEC 62394 “Storage
367 battery class specifications”. If a discrepancy between IEC 62394 and this document exists, the
368 description in this document applies.

369 Electrical storage systems may not operate as set on “Operation mode setting” property [0xDA]
370 depending on the system status of the electrical storage system. The actual status of the
371 electrical storage system (charging or discharging, etc.) should be set on “Working operation
372 status” property [0xCF] and the value of “Operation mode setting” property [0xDA] should not
373 be changed in this case.

374 Fault status of electrical storage systems shall be shown when using the standardized “Fault status”
375 property [0x88]. Electrical storage systems may describe details of the fault status by using other fault
376 NECD properties (“Manufacturer’s fault code” property [0x86] and “Fault description” property [0x89])
377 as specified in IEC 62394.

378 6.5 Application operation

379 6.5.1 General

380 The following subclauses describe the operations on electrical storage systems and controllers
381 at the application level.

382 6.5.2 Continuous requests

383 A request from a controller and the corresponding response from an electrical storage system
384 is a basic unit of communication, i.e., an electrical storage system returns a single response to
385 a single request. Controllers that issue continuous requests to an electrical storage system
386 shall be designed with a time defined in Table 5. When receiving a response, the time is reset
387 and the controller can send a new request.