

TECHNICAL SPECIFICATION



**Electric vehicles conductive charging system –
Part 3-7: DC EV supply equipment where protection relies on double or
reinforced insulation – Battery system communication**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Single-use IEC Publications System
TPSC WG on EV Charge Cables
No reproduction or translation
IECNORM.COM : Click to view the full PDF
September 2023
6873-1 (WG) 2023

TECHNICAL SPECIFICATION



**Electric vehicles conductive charging system –
Part 3-7: DC EV supply equipment where protection relies on double or
reinforced insulation – Battery system communication**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 43.120

ISBN 978-2-8322-5736-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope.....	11
2 Normative references	11
3 Terms and definitions	11
4 Symbols and abbreviated terms.....	12
5 Operating principles	12
5.1 General.....	12
5.2 Battery system specific FSA.....	12
5.3 State definitions	13
5.4 Transitions in the FSA for battery systems	13
6 Object dictionary.....	14
6.1 General.....	14
6.2 Additional definitions to general application objects	15
6.2.1 General	15
6.2.2 Object 6001 _h : Control word	15
6.2.3 Object 6002 _h : Status word.....	15
6.3 Detailed complex data type specifications.....	15
6.3.1 General	15
6.3.2 Object 0081 _h to 0082 _h : Reserved.....	16
6.3.3 Object 0083 _h : Ni-MH charging rules parameter record.....	16
6.4 Produced application objects	16
6.4.1 General	16
6.4.2 Object 6100 _h : Type of battery cells.....	16
6.4.3 Object 6102 _h : Battery system rated Wh capacity (optional)	20
6.4.4 Object 6105 _h : Battery system temperature	22
6.4.5 Object 6126 _h : Battery system maximum cell voltage (optional, mandatory for rental/swap battery systems).....	25
6.4.6 Object 6127 _h : Battery system minimum cell voltage (optional, mandatory for rental/swap battery systems).....	27
6.4.7 Object 6160 _h : Actual battery system Wh capacity.....	28
6.4.8 Object 6162 _h : Full EMS output battery system Wh capacity (optional, mandatory for rental/swap battery systems).....	30
6.4.9 Object 6164 _h : Relative battery system Wh capacity (SOC) (optional)	32
6.4.10 Object 6192 _h : Reserved	34
6.4.11 Object 6193 _h : Threshold time of the battery system maximum charging time	34
6.5 Produced application objects (optional).....	35
6.5.1 General	35
6.5.2 Object 6101 _h : Battery system connecting status (optional)	35
6.5.3 Object 6103 _h : Battery system rated Ah capacity (optional)	38
6.5.4 Object 6104 _h : Battery system number of cells (optional).....	39
6.5.5 Object 6106 _h : Battery system lifetime (optional)	41

6.5.6	Object 6107 _h : Battery system lifetime in cycles (optional).....	42
6.5.7	Object 6108 _h : Battery system lifetime EMS input capacity (optional)	44
6.5.8	Object 6109 _h : Battery system manufacturer (optional).....	45
6.5.9	Object 610A _h : Battery system cell manufacturer (optional)	47
6.5.10	Object 610B _h : Battery system cell notation (optional)	48
6.5.11	Object 6120 _h : Battery system maximum charge start temperature (optional)	49
6.5.12	Object 6121 _h : Battery system minimum charge start temperature (optional)	51
6.5.13	Object 6122 _h : Battery system maximum discharge temperature (optional)	53
6.5.14	Object 6123 _h : Battery system minimum discharge temperature (optional)	54
6.5.15	Object 6124 _h : Battery system maximum temperature for storage (optional)	56
6.5.16	Object 6125 _h : Battery system minimum temperature for storage (optional)	58
6.5.17	Object 6161 _h : Actual battery system Ah capacity (optional)	59
6.5.18	Object 6163 _h : Full EMS output battery system Ah capacity (optional)	61
6.5.19	Object 6165 _h : Battery system VDN 1 actual cell voltage (optional)	62
6.5.20	Object 6166 _h to 6174 _h : Battery system VDN 2 to 16 actual cell voltage (optional)	64
6.5.21	Object 6175 _h : Battery system balance (optional)	64
6.5.22	Object 6176 _h : Battery system SOH (optional)	65
6.5.23	Object 6177 _h : Battery system EMS output time (optional).....	67
6.5.24	Object 6178 _h : Battery system EMS input time (optional).....	69
6.5.25	Object 6179 _h : Battery system EMS output Ah counter (optional)	70
6.5.26	Object 617A _h : Battery system EMS input Ah counter (optional)	72
6.5.27	Object 617B _h : Battery system EMS output Wh counter (optional)	74
6.5.28	Object 617C _h : Battery system EMS input Wh counter (optional)	75
6.5.29	Object 617D _h : Battery system EMS output counter (optional)	77
6.5.30	Object 617E _h : Battery system EMS input counter (optional)	79
6.5.31	Object 617F _h : Battery system deep discharging counter (optional)	80
6.5.32	Object 6180 _h : Battery system short-circuit counter (optional)	82
6.5.33	Object 6181 _h : Battery system over-temperature counter (optional)	83
6.5.34	Object 6182 _h : Temperature dependent average EMS output current (optional)	85
6.5.35	Object 6183 _h : Temperature dependent peak EMS output current (optional)	86
6.5.36	Object 6184 _h : Temperature dependent average EMS input current (optional)	87
6.5.37	Object 6185 _h : Temperature dependent peak EMS input current (optional)	88
6.5.38	Object 6186 _h : Temperature dependent capacity correction (optional)	89

6.5.39	Object 6187 _h : Battery system capacity dependent current correction (optional)	90
6.5.40	Object 6188 _h : Battery system temperature dependent self-discharge rate (optional)	92
6.5.41	Object 6189 _h : Temperature dependent cell charge maximum voltage (optional)	93
6.5.42	Object 618A _h : Battery system 100 % to 90 % capacity dependent voltage correction (optional)	94
6.5.43	Object 618B _h : Battery system 0 % to 10 % capacity dependent voltage correction (optional)	95
6.5.44	Object 618C _h : Battery system point of cell balancing (optional)	96
6.6	Consumed application objects	98
6.6.1	General	98
6.6.2	Object 618F _h : EMS output rules for Ni-MH battery system (optional)	98
6.6.3	Object 618D _h : Battery system go to deep sleep mode timing (optional)	101
6.6.4	Object 618E _h : Battery system minimal SOC for go to deep sleep mode (optional)	103
6.6.5	Object 6190 _h : Battery system specific controls (optional)	104
Figure 1 – FSA for battery system		13
Figure 2 – Value structure		16
Figure 3 – Object structure		36
Figure 4 – Object structure		39
Table 1 – States behaviour		13
Table 2 – Transitions, events and actions		14
Table 3 – Value definition		15
Table 4 – Value definition for VD specific FSA control		15
Table 5 – Value definition for virtual device FSA state		15
Table 6 – Ni-MH charging rules parameter record		16
Table 7 – Value definition		17
Table 8 – Object description		18
Table 9 – Entry description		19
Table 10 – Object description		20
Table 11 – Entry description		21
Table 12 – Grouping of sub-indices		22
Table 13 – Object description		23
Table 14 – Entry description		23
Table 15 – Object description		25
Table 16 – Entry description		26
Table 17 – Object description		27
Table 18 – Entry description		27
Table 19 – Object description		29
Table 20 – Entry description		29
Table 21 – Object description		30

Table 22 – Entry description	31
Table 23 – Value definition	32
Table 24 – Object description	32
Table 25 – Entry description	33
Table 26 – Entry description	34
Table 27 – Entry description	35
Table 28 – Value definition	36
Table 29 – Object description	36
Table 30 – Entry description	37
Table 31 – Object description	38
Table 32 – Entry description	38
Table 33 – Value definition for the parallel and series cell number fields.....	40
Table 34 – Object description	40
Table 35 – Entry description	40
Table 36 – Object description	41
Table 37 – Entry description	42
Table 38 – Object description	43
Table 39 – Entry description	43
Table 40 – Object description	44
Table 41 – Entry description	44
Table 42 – Object description	46
Table 43 – Entry description	46
Table 44 – Object description	47
Table 45 – Entry description	47
Table 46 – Object description	48
Table 47 – Entry description	49
Table 48 – Object description	50
Table 49 – Entry description	50
Table 50 – Object description	51
Table 51 – Entry description	52
Table 52 – Object description	53
Table 53 – Entry description	53
Table 54 – Object description	55
Table 55 – Entry description	55
Table 56 – Object description	56
Table 57 – Entry description	56
Table 58 – Object description	58
Table 59 – Entry description	58
Table 60 – Object description	59
Table 61 – Entry description	60
Table 62 – Object description	61
Table 63 – Entry description	61
Table 64 – Object description	63

Table 65 – Entry description	63
Table 66 – Index assignments for battery system 2 to 16	64
Table 67 – Value definition	64
Table 68 – Object description	64
Table 69 – Entry description	65
Table 70 – Value definition	66
Table 71 – Object description	66
Table 72 – Entry description	66
Table 73 – Object description	67
Table 74 – Entry description	68
Table 75 – Object description	69
Table 76 – Entry description	69
Table 77 – Object description	71
Table 78 – Entry description	71
Table 79 – Object description	72
Table 80 – Entry description	73
Table 81 – Object description	74
Table 82 – Entry description	74
Table 83 – Object description	76
Table 84 – Entry description	76
Table 85 – Object description	77
Table 86 – Entry description	77
Table 87 – Object description	79
Table 88 – Entry description	79
Table 89 – Object description	80
Table 90 – Entry description	81
Table 91 – Object description	82
Table 92 – Entry description	82
Table 93 – Object description	84
Table 94 – Entry description	84
Table 95 – Object description	85
Table 96 – Entry description	86
Table 97 – Object description	86
Table 98 – Entry description	87
Table 99 – Object description	87
Table 100 – Entry description	88
Table 101 – Object description	88
Table 102 – Entry description	89
Table 103 – Object description	89
Table 104 – Entry description	90
Table 105 – Sub-index relation to capacity range	90
Table 106 – Value definition	91
Table 107 – Object description	91

Table 108 – Entry description	91
Table 109 – Object description.....	92
Table 110 – Entry description	92
Table 111 – Object description.....	93
Table 112 – Entry description	93
Table 113 – Value definition.....	94
Table 114 – Object description.....	94
Table 115 – Entry description	94
Table 116 – Value definition.....	95
Table 117 – Object description.....	95
Table 118 – Entry description	96
Table 119 – Object description.....	96
Table 120 – Entry description	97
Table 121 – Object description.....	99
Table 122 – Entry description	99
Table 123 – Object description.....	102
Table 124 – Entry description	102
Table 125 – Value definition.....	103
Table 126 – Object description.....	103
Table 127 – Entry description	103
Table 128 – Value definition.....	105
Table 129 – Object description.....	105
Table 130 – Entry description	106

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLES CONDUCTIVE CHARGING SYSTEM –

Part 3-7: DC EV supply equipment where protection relies on double or reinforced insulation – Battery system communication

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.

IEC TS 61851-3-7 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
69/653/DTS	69/674/RVDTS
	69/674A/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The following print types are used:

- requirements: in roman type;
- notes: in small roman type;
- **text formatted in bold and using mixed capital and underline are used as state names and are not to be translated.**

A list of all parts in the IEC 61851 series, published under the general title *Electric vehicles conductive charging system*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This document is published in separate parts according to the following structure:

IEC TS 61851-3-1, *Electric vehicles conductive charging system – Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment*

IEC TS 61851-3-2, *Electric vehicles conductive charging – Part 3-2: DC EV supply equipment where protection relies on double or reinforced insulation – Particular requirements for portable and mobile equipment*

IEC TS 61851-3-4, *Electric vehicles conductive charging system – Part 3-4: DC EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*

IEC TS 61851-3-5, *Electric vehicles conductive charging system – Part 3-5: DC EV supply equipment where protection relies on double or reinforced insulation – Pre-defined communication parameters and general application objects*

IEC TS 61851-3-6, *Electric vehicles conductive charging system – Part 3-6: DC EV supply equipment where protection relies on double or reinforced insulation – Voltage converter unit communication*

IEC TS 61851-3-7, *Electric vehicles conductive charging system – Part 3-7: DC EV supply equipment where protection relies on double or reinforced insulation – Battery system communication*

ELECTRIC VEHICLES CONDUCTIVE CHARGING SYSTEM –

Part 3-7: DC EV supply equipment where protection relies on double or reinforced insulation – Battery system communication

1 Scope

This part of IEC 61851, which is a Technical Specification, applies to CANopen communication for the conductive transfer of electric power between the supply network and an electric road vehicle or a removable RESS or traction-battery of an electric road vehicle.

This document specifies application objects provided by the battery system.

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.

IEC TS 61851-3-4:2023 *Electric vehicles conductive charging system – DC EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*

IEC TS 61851-3-5:2023 *Electric vehicles conductive charging system – Part 3-5: DC EV supply equipment where protection relies on double or reinforced insulation – Pre-defined communication parameters and general application objects*

EN 50325-4:2002, *Industrial communications subsystem based on ISO 11898 (CAN) for controller- device interfaces – Part 4: CANopen*

EN 50604-1:2016, *Secondary lithium batteries for light EV (electric vehicle) applications – Part 1: General safety requirements and test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61851-3-4 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in IEC TS 61851-3-4 and the following apply:

Ag	silver
AGM	absorbent glass mat
Al	aluminium
Cd	cadmium
Fe	iron
Li	lithium
MeO	metal oxide
Ni	nickel
Ni-MH	nickel metal hydride
SOC	state of charge
SOH	state of health
TiO	titanium oxide
Zn	zinc

5 Operating principles

5.1 General

In addition to the finite state automaton (FSA) defined by 9.1 of IEC TS 61851-3-4:2023, this document defines an additional battery system specific FSA to operate batteries in a common way. Any battery system supports the mandatory FSA states. State transitions within the FSA are based on device internal events (e.g. occurrence of device errors) or on the reception of the FSA control word.

5.2 Battery system specific FSA

The battery system specific FSA as defined in Figure 1 shall start with the initial entry in the EMS FSA state **Disconnected** and shall exist as long as the EMS FSA is not left.

The FSA defines the application behaviour of the battery system (see also Table 1). The battery system shall ensure safety by providing independent local control according to EN 50604-1:2016 (even when the CAN network is not working properly). The NMT slave FSA as defined in EN 50325-4:2002, the EMS FSA and the battery system FSA are coupled in the following way: a state change in any of the involved FSAs may trigger state changes in the other FSAs.

For state transitions (numbers in Figure 1), see Table 2.

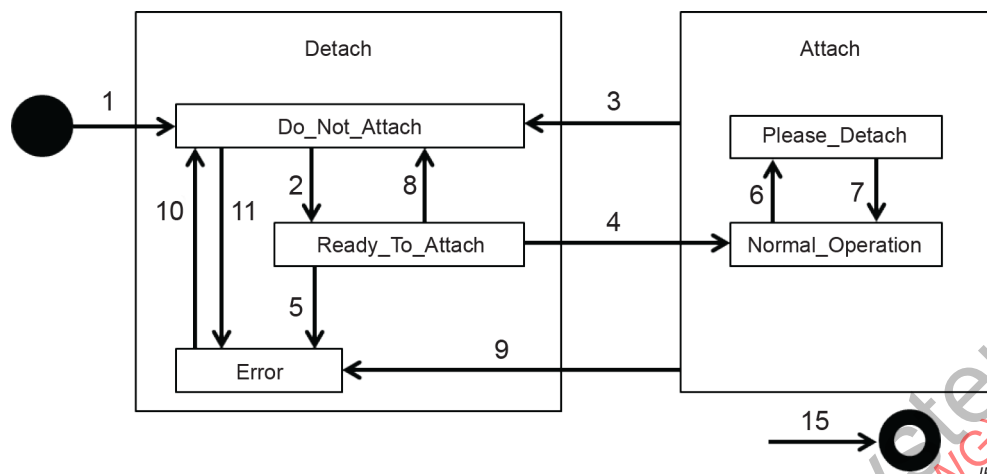


Figure 1 – FSA for battery system

5.3 State definitions

The FSA for battery systems as shown in Figure 1 shall provide the following states with the described state behaviour in Table 1 and state transitions in Table 2.

NOTE 1 States refer to removable and non-removable battery systems.

NOTE 2 "Detached" does not mean "removable".

Table 1 – States behaviour

Name	Behaviour
Initial	Pseudo state indicating the activation of the FSA
Detached	Battery system is not connected to the power circuit
Do_Not_Attach	Battery system may be configured and is not prepared to be connected to the power circuit
Ready_To_Attach	Battery system is prepared and ready to be attached to the power circuit.
Attached	Battery system is connected to the power circuit
Normal_Operations	Battery system is operating on the power circuit
Please_Detach	Battery system indicates itself that it requires to be disconnected from the power circuit (e.g. because the battery system operates no longer within the operating limits).
Error	The battery system is in an error condition. There is no power transferred. See also Clause 7 of IEC TS 61851-3-4:2023.
Final	Pseudo state, indicating the deactivation of the FSA

5.4 Transitions in the FSA for battery systems

The FSA for battery systems shall support the transitions as given in Table 2.

Table 2 – Transitions, events and actions

Transition	Event(s)	Action(s)
1	Automatic transition on initial entry to EMS FSA	Update status word
2	In case the internal conditions of the battery system allow an attachment to the power circuit, the VC FSA shall enter the state Ready_To_Attach .	Update status word
3	In case it is no longer safe to be attached, state Do_Not_Attach shall be reached through this state transition	Update status word
4	This state transition shall be only possible either in EMS FSA state Operating or Masterless_Operating . In EMS FSA state Operating , this state transition shall be triggered via remote command. In EMS FSA state Masterless_Operating , this state transition shall be triggered by means of local events.	Update status word
5, 9, 11	In case of an internal error in the BMS (e.g. BMS internal communication error, high temperature, overvoltage), the battery system may be detached (if attached) from the power circuit and state ERROR shall be reached via these state transitions. These state transitions are triggered by means of local events.	Update status word
6	In case the internal conditions prohibit a continued charge or discharge of the battery system entering, Please_Detach state shall signal this ^a .	Update status word
7	If the internal conditions no longer prohibit a continued charge or discharge of the battery system, the battery system may return to Normal_Operations .	Update status word
3	In EMS FSA state Operating , a remote command via the control word shall trigger this state transition. In EMS FSA state Masterless_Operating , this state transition shall be triggered due to a local request.	Update status word
10	In case all device internal errors are resolved, this state transition is executed.	Update status word
15	This is pseudo state transition when switching off the battery system ^b .	Update status word
Transition numbers are shown in Figure 1.		
^a The EMSC in this state has the chance to take precautions before detaching the battery system.		
^b Prior to this state transition, the battery system should be detached from the power circuit.		

6 Object dictionary

6.1 General

Clause 6 specifies the application objects required by the CANopen device hosting the virtual device battery system.

Some application objects may define temperature dependent values. The values shall be given for the temperatures defined within ranges 1 to 38 as illustrated in Table 3.

Table 3 – Value definition

Value	Description
–50 °C to –46 °C	Temperature range 1
–45 °C to –41 °C	Temperature range 2
to	
145 °C to 149 °C	Temperature range 40

6.2 Additional definitions to general application objects

6.2.1 General

Subclause 6.2 provides additional parameters to those specified in IEC TS 61851-3-5:2023.

6.2.2 Object 6001_h: Control word

The bit field "VD specific FSA control" shall control the virtual device specific FSA for battery systems as specified in Table 4.

Table 4 – Value definition for VD specific FSA control

Value	Description	Transitions
0	No action	None
3	Enter Do_Not_Attach	3,
4	Enter Normal_Operation	4,
All other values shall be reserved.		

6.2.3 Object 6002_h: Status word

The bit field "virtual device FSA state" shall indicate the current state of the virtual device in the virtual device specific FSA for battery systems as specified in Table 5.

Table 5 – Value definition for virtual device FSA state

Value	FSA state
0	VD specific FSA not active
1	Do_Not_Attach
2	Ready_To_Attach
3	Normal_Operation
4	Please_detach
6	Error
All other values shall be reserved.	

6.3 Detailed complex data type specifications

6.3.1 General

The battery systems complex data types for the first logical device are described in the object dictionary in index range 0081_h to 0083_h. If the application profile is implemented in one of the other logical devices, the description is implemented in index ranges as specified in EN 50325-4:2002.

6.3.2 Object 0081_h to 0082_h: Reserved

These objects are reserved for future use.

6.3.3 Object 0083_h: Ni-MH charging rules parameter record

Table 6 specifies the charging rules parameter record for Ni-MH batteries.

Table 6 – Ni-MH charging rules parameter record

Index	Sub-index	Data type
0083 _h	00 _h	UNSIGNED8
	01 _h	UNSIGNED16
	02 _h	INTEGER32
	03 _h	UNSIGNED16
	04 _h	UNSIGNED32
	05 _h	INTEGER16
	06 _h	INTEGER32
	07 _h	UNSIGNED16
	08 _h	UNSIGNED16
	09 _h	INTEGER32
	0A _h	UNSIGNED16

6.4 Produced application objects

6.4.1 General

Subclause 6.4 defines application objects produced by the virtual device battery system.

6.4.2 Object 6100_h: Type of battery cells

This object shall provide the battery cells type. Figure 2 illustrates the object structure. The value definition for the battery's chemistry and the related battery cells sub-type are specified in Table 7. Table 8 specifies the object description and Table 9 specifies the entry description.

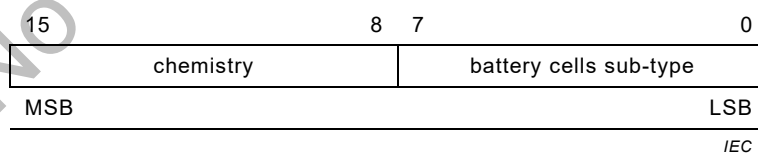


Figure 2 – Value structure

Table 7 – Value definition

Bit field chemistry		Bit field battery cells sub-type	
Value	Description	Value	Description
00 _h	Chemistry not specified	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
01 _h	Lead acid (PbA)	00 _h	For flooded, for normal gravity, for flat plate
		01 _h	For flooded, for normal gravity, for tubular
		02 _h	For flooded, for high gravity, for flat plate
		03 _h	For flooded, for high gravity, for tubular
		04 _h to 07 _h	Reserved
		08 _h	For maintenance free, for AGM
		09 _h	For maintenance free, for gel
		0A _h	For maintenance free, for hybrid
		0B _h to FF _h	Reserved
02 _h	Nickel cadmium	00 _h	For vented, for pocket plate
		01 _h	For vented, for sintered plate
		02 _h to 07 _h	Reserved
		08 _h	For sealed, for pocket plate
		09 _h	For sealed, for sintered plate
		0A _h to FF _h	Reserved
03 _h	Nickel zinc (Ni-Zn)	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
04 _h	Reserved	00 _h to FF _h	Reserved
05 _h	Nickel iron (Ni-Fe)	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
06 _h	Silver oxide	00 _h	For Ag-Zn
		01 _h	For Ag-Cd
		02 _h	For Ag-Fe
		03 _h to FF _h	Reserved
07 _h	Nickel hydrogen (NiH ₂)	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
08 _h	Nickel metal hydride (Ni-MH)	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
09 _h	Zinc/alkaline/manganese dioxide	00 _h	No sub-type information available
		01 _h to FF _h	Reserved

Bit field chemistry		Bit field battery cells sub-type	
Value	Description	Value	Description
0A _h	Lithium Ion (Li-Ion); utilizing carbon anode	00 _h	For Li-Ni-Co-AIO
		01 _h	For Li-CoO
		02 _h	For Li-MnO
		03 _h	For Li-Fe-PO
		04 _h	For Li-TiO
		05 _h	For Li-MeO
		06 _h	For Li-NiCoMnO
		07 _h to FF _h	Reserved
0B _h	Lithium Ion (Li-Ion); utilizing lithium titanate anode	00 _h	For Li-Ni-Co-AIO
		01 _h	For Li-CoO
		02 _h	For Li-MnO
		03 _h	For Li-Fe-PO
		04 _h	For Li-TiO
		05 _h	For Li-MeO
		06 _h	For Li-NiCoMnO
		07 _h to FF _h	Reserved
0C _h	Zinc bromine	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
0D _h	Metal air	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
0E _h	Lithium-Iron-sulphide	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
0F _h	Sodium beta	00 _h	No sub-type information available
		01 _h to FF _h	Reserved
All other values shall be reserved.			

Table 8 – Object description

Attribute	Value
Index	6100 _h
Name	Type of battery cells
Object code	ARRAY
Data type	UNSIGNED16
Category	Mandatory

Table 9 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	to
Sub-index	7E _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	80 _h
Description	Battery external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
to	
Sub-index	FE _h
Description	Battery external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.3 Object 6102_h: Battery system rated Wh capacity (optional)

This object shall provide the battery system rated Wh capacity. The values shall be given in multiples of 1 mWh. This value is set once the battery system is manufactured and will never change in the lifetime of the battery system. Table 28 specifies the object description and Table 29 specifies the entry description.

Table 10 – Object description

Attribute	Value
Index	6102 _h
Name	Battery system rated Wh capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 11 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1 rated Wh capacity
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2 rated Wh capacity
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127 rated Wh capacity
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery rated Wh capacity external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery rated Wh capacity external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.4 Object 6105_h: Battery system temperature

This object shall provide the battery system temperature. As each battery system may support several temperature sensors, this object is arranged as an array, whereby a set of 10_h entries allow administering the measured values of up to 15 temperature sensors. The first entry of such a set of battery system-related sensor values shall provide the highest temperature value, which is currently measured by one of the sensors. The values shall be given in multiples of 0,1 °C. The grouping of sub-indices is specified in Table 30. Table 13 specifies the object description. Table 14 specifies the entry description.

Table 12 – Grouping of sub-indices

Sub-index number [hex]	Description
00	Highest sub-index support (see EN 50325-4:2002)
01 to 10	Battery system VDN 1
11 to 20	Battery system VDN 2
21 to 30	Battery system VDN 3
31 to 40	Battery system VDN 4
41 to 50	Battery system VDN 5
51 to 60	Battery system VDN 6
61 to 70	Battery system VDN 7
71 to 80	Battery system VDN 8
81 to 90	Battery system VDN 9
91 to A0	Battery system VDN 10
A1 to B0	Battery system VDN 11
B1 to C0	Battery system VDN 12
C1 to D0	Battery system VDN 13
D1 to E0	Battery system VDN 14
E1 to F0	Battery system VDN 15
F0 to FE	Battery system VDN 16
FF	See EN 50325-4:2002
NOTE Temperature sensors are supported for VDN 1 to 16 in the index range for CiA device and application profiles. In case battery systems are supported by using higher VDNs (more than 15 temperature sensors), the temperature values are maintained in the manufacturer-specific index range.	

Table 13 – Object description

Attribute	Value
Index	6105 _h
Name	Battery system temperature
Object code	ARRAY
Data type	INTEGER16
Category	Mandatory

Table 14 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1 highest temperature value
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 1 sensor 1 temperature
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	03 _h
Description	Battery system VDN 1 sensor 2 temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

Attribute	Value
to	
Sub-index	10 _h
Description	Battery system VDN 1 sensor 15 temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	11 _h
Description	Battery system VDN 2 highest temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	12 _h
Description	Battery system VDN 2 sensor 1 temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	20 _h
Description	Battery system VDN 2 sensor 15 temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	F1 _h
Description	Battery system VDN 16 highest temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

Attribute	Value
Sub-index	F2 _h
Description	Battery system VDN 16 sensor 1 temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	FE _h
Description	Battery system VDN 16 sensor 13 temperature
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

6.4.5 Object 6126_h: Battery system maximum cell voltage (optional, mandatory for rental/swap battery systems)

This object shall provide the maximum battery cell voltage. The values shall be given in multiples of 1 mV. Table 15 specifies the object description. Table 16 specifies the entry description.

Table 15 – Object description

Attribute	Value
Index	6126 _h
Name	Battery system maximum cell voltage
Object code	ARRAY
Data type	INTEGER32
Category	Optional, mandatory for rental/swap battery systems

Table 16 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.6 Object 6127_h: Battery system minimum cell voltage (optional, mandatory for rental/swap battery systems)

This object shall provide the minimum battery cell voltage. The values shall be given in multiples of 1 mV. Table 17 specifies the object description. Table 18 specifies the entry description.

Table 17 – Object description

Attribute	Value
Index	6127 _h
Name	Battery system minimum cell voltage
Object code	ARRAY
Data type	INTEGER32
Category	Optional, mandatory for rental/swap battery systems

Table 18 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.7 Object 6160_h: Actual battery system Wh capacity

This object shall provide the SOC Wh capacity value of actual battery system. The values shall be given in multiples of 1 mWh. Table 19 specifies the object description. Table 20 specifies the entry description.

Table 19 – Object description

Attribute	Value
Index	6160 _h
Name	Actual battery system Wh capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Mandatory

Table 20 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.8 Object 6162_h: Full EMS output battery system Wh capacity (optional, mandatory for rental/swap battery systems)

This object shall provide the last measured Wh capacity of a complete battery discharge. It may differ from the rated Wh capacity because capacity decreases while usage. The values shall be given in multiples of 1 mWh. Table 21 specifies the object description. Table 22 specifies the entry description.

Table 21 – Object description

Attribute	Value
Index	6162 _h
Name	Full EMS output battery system Wh capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional, mandatory for rental/swap battery systems

Table 22 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.9 Object 6164_h: Relative battery system Wh capacity (SOC) (optional)

This object shall provide the relative Wh capacity (SOC) of the battery system. The values shall be given in multiples of 0,01 % from full charge battery system Wh capacity (see object 6162_h). The value definition is provided in Table 23. Table 24 specifies the object description. Table 25 specifies the entry description.

Table 23 – Value definition

Value [hex]	Description
0000 to 2710	Battery system Wh capacity from 0,00 to 100,00%
2711 to FFFF	Reserved

Table 24 – Object description

Attribute	Value
Index	6164 _h
Name	Relative battery system Wh capacity
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 25 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.10 Object 6192_h: Reserved

This object is reserved and shall not be implemented for compatibility reasons.

6.4.11 Object 6193_h: Threshold time of the battery system maximum charging time

This object shall indicate the configuration of the threshold time period to stop the charging process in order to protect vehicle battery. This value is typically used at the AC-DC converter. The values shall be given in multiples of 1 min. Table 26 specifies the object description. Table 27 specifies the entry description.

Table 26 – Entry description

Attribute	Value
Index	6193h
Name	Threshold time of the battery system maximum charging time
Object code	ARRAY
Data type	UNSIGNED32
Category	Conditional; mandatory for active devices

Table 27 – Entry description

Attribute	Value
Sub-index	00h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01h to 7Fh
Default value	No
Sub-index	01h
Description	Battery pack VDN1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02h
Description	Battery pack VDN2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	7Fh
Description	Battery pack VDN127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

6.5 Produced application objects (optional)

6.5.1 General

Subclause 6.5 provides additional objects for treatment of battery systems. The information is of specific interest for battery swap systems. The following parameters are optional.

6.5.2 Object 6101_h: Battery system connecting status (optional)

This object shall provide status information on the battery system. Figure 3 illustrates the object structure. Table 28 shall provide the value definition. Table 29 specifies the object description and Table 30 specifies the entry description.

This parameter allows to indicate how many battery systems can be connected to the EMS (battery systems installed) and how many battery systems are currently available (battery systems connected).

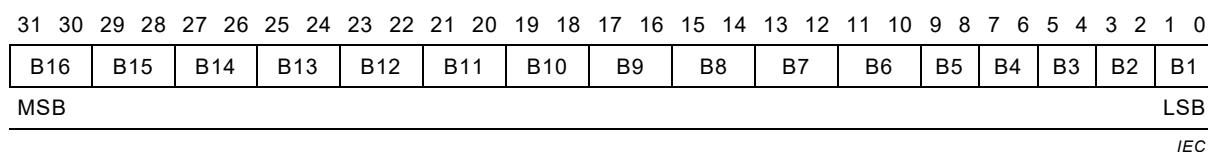


Figure 3 – Object structure

Table 28 – Value definition

Name	Bit number	Value	Description
Bx	2x-2	0 _b	Battery system x not installed
		1 _b	Battery system x installed
	2x-1	0 _b	Battery system x not connected
		1 _b	Battery system x connected
The character "x" shall be substituted by an integer value in the range of 1 to 16.			
NOTE 1 The bit number is calculated by the formula given in the bit number column.			

Table 29 – Object description

Attribute	Value
Index	6101 _h
Name	Battery system status
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 30 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.3 Object 6103_h: Battery system rated Ah capacity (optional)

This object shall provide the battery system rated Ah capacity. The values shall be given in multiples of 1 mAh. This value is set once the battery system is manufactured and will never change in the lifetime of the battery system. Table 31 specifies the object description and Table 32 specifies the entry description.

Table 31 – Object description

Attribute	Value
Index	6103 _h
Name	Battery system rated Ah capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

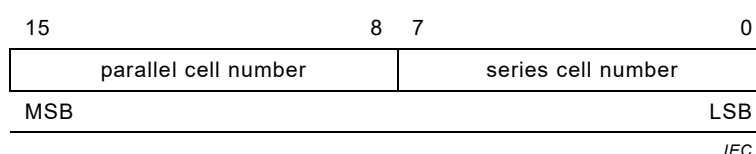
Table 32 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1 rated Ah capacity
Entry category	Mandatory
Access	Ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2 rated Ah capacity
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127 rated Ah capacity
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1 rated Ah capacity
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127 rated Ah capacity
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.4 Object 6104_h: Battery system number of cells (optional)

This object shall provide the number of cells in the battery system. Figure 4 illustrates the object structure. The value definition for parallel and series cells field is provided in Table 33. Table 34 specifies the object description and Table 35 specifies the entry description.



IEC

Figure 4 – Object structure

Table 33 – Value definition for the parallel and series cell number fields

Value	Description
00 _h	Reserved
01 _h to FE _h	1 to 254 cells
FF _h	Not available

Table 34 – Object description

Attribute	Value
Index	6104 _h
Name	Battery system number of cells
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 35 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No

Attribute	Value
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.5 Object 6106_h: Battery system lifetime (optional)

This object shall provide the battery system lifetime in hours, after activating the battery system for the first time. This value shall be used to calculate the SOH. The values shall be given in multiples of 1 min. Table 36 specifies the object description. Table 37 specifies the entry description.

Table 36 – Object description

Attribute	Value
Index	6106 _h
Name	Battery system lifetime
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 37 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to 7F _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system 16
Entry category	Optional
Access	Ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No

6.5.6 Object 6107_h: Battery system lifetime in cycles (optional)

This object shall provide the battery system lifetime in cycles. This shall be used to calculate the SOH. Table 38 specifies the object description. Table 39 specifies the entry description.

Table 38 – Object description

Attribute	Value
Index	6107 _h
Name	Battery system lifetime in cycles
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 39 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED16
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.7 Object 6108_h: Battery system lifetime EMS input capacity (optional)

This object shall provide the total battery system lifetime EMS input capacity. This shall be used to calculate the SOH. The values shall be given in multiples of 1 mWh. Table 40 specifies the object description. Table 41 specifies the entry description.

Table 40 – Object description

Attribute	Value
Index	6108 _h
Name	Battery system lifetime EMS input capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 41 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No

Attribute	Value
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery (pack) external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery (pack) external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.8 Object 6109_h: Battery system manufacturer (optional)

This object shall provide information on the battery system manufacturer. Table 42 shall provide the object description. Table 43 specifies the entry description.

Table 42 – Object description

Attribute	Value
Index	6109 _h
Name	Battery system manufacturer
Object code	ARRAY
Data type	VISIBLE_STRING
Category	Optional

Table 43 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Pack VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
Sub-index	02 _h
Description	Pack VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
to	
Sub-index	7F _h
Description	Pack VDN 127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
Sub-index	80 _h

Attribute	Value
Description	Pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.9 Object 610A_h: Battery system cell manufacturer (optional)

This object shall provide information on the battery cell manufacturer. Table 44 specifies object description. Table 45 specifies the entry description.

Table 44 – Object description

Attribute	Value
Index	610A _h
Name	Battery system cell manufacturer
Object code	ARRAY
Data type	VISIBLE_STRING
Category	Optional

Table 45 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No

Attribute	Value
Sub-index	01 _h
Description	Battery cell 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
to	
Sub-index	02 _h
Description	Battery cell 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
to	
Sub-index	FE _h
Description	Battery cell 254
Entry category	Optional
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No

6.5.10 Object 610B_h: Battery system cell notation (optional)

This object shall provide information on the battery cell notation. Table 46 shall provide the object description. Table 47 specifies the entry description.

Table 46 – Object description

Attribute	Value
Index	610B _h
Name	Battery system cell notation
Object code	ARRAY
Data type	VISIBLE_STRING
Category	Optional

Table 47 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery cell 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
Sub-index	02 _h
Description	Battery cell 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No
to	
Sub-index	FE _h
Description	Battery cell 254
Entry category	Optional
Access	ro
PDO mapping	No
Value range	VISIBLE_STRING
Default value	No

6.5.11 Object 6120_h: Battery system maximum charge start temperature (optional)

This object shall provide the allowed maximum temperature for charge start of the battery system. The values shall be given in multiples of 0,1 °C. Table 48 specifies the object description and Table 49 specifies the entry description.

A smart charging system may use such information to generate environmental conditions that allow power transfer within the operating limits of the battery system.

Table 48 – Object description

Attribute	Value
Index	6120 _h
Name	Battery system maximum charge start temperature
Object code	ARRAY
Data type	INTEGER16
Category	Optional

Table 49 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.12 Object 6121_h: Battery system minimum charge start temperature (optional)

This object shall provide the allowed minimum temperature for charge start of the battery system. The values shall be given in multiples of 0,1 °C. Table 50 specifies the object description and Table 51 specifies the entry description.

A smart charging system may use such information to generate environmental conditions that allow power transfer within the operating limits of the battery system.

Table 50 – Object description

Attribute	Value
Index	6121 _h
Name	Battery system minimum charge start temperature
Object code	ARRAY
Data type	INTEGER16
Category	Optional

Table 51 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.13 Object 6122_h: Battery system maximum discharge temperature (optional)

This object shall provide the maximal allowed temperature for discharge of the battery system. The values shall be given in multiples of 0,1 °C. Table 52 specifies the object description and Table 53 specifies the entry description.

Table 52 – Object description

Attribute	Value
Index	6122 _h
Name	Battery system maximum discharge temperature
Object code	ARRAY
Data type	INTEGER16
Category	Optional

Table 53 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.14 Object 6123_h: Battery system minimum discharge temperature (optional)

This object shall provide the allowed minimum temperature for discharge of the battery system. The values shall be given in multiples of 0,1 °C. Table 54 specifies the object description and Table 55 specifies the entry description.

Table 54 – Object description

Attribute	Value
Index	6123 _h
Name	Battery system minimum discharge temperature
Object code	ARRAY
Data type	INTEGER16
Category	Optional

Table 55 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.15 Object 6124_h: Battery system maximum temperature for storage (optional)

This object shall provide the allowed maximum temperature for storage of the battery system. The values shall be given in multiples of 0,1 °C. Table 56 specifies the object description and Table 57 specifies the entry description.

Table 56 – Object description

Attribute	Value
Index	6124 _h
Name	Battery system maximum temperature for storage
Object code	ARRAY
Data type	INTEGER16
Category	Optional

Table 57 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No

Attribute	Value
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.16 Object 6125_h: Battery system minimum temperature for storage (optional)

This object shall provide the battery systems allowed minimum temperature for storage. The values shall be given in multiples of 0,1 °C. Table 58 specifies the object description and Table 59 specifies the entry description.

Table 58 – Object description

Attribute	Value
Index	6125 _h
Name	Battery system minimum temperature for storage
Object code	ARRAY
Data type	INTEGER16
Category	Optional

Table 59 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No

Attribute	Value
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER16
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.17 Object 6161_h: Actual battery system Ah capacity (optional)

This object shall provide the SOC Ah capacity value of actual battery system. The values shall be given in multiples of 1 mAh. Table 60 specifies the object description. Table 61 specifies the entry description.

Table 60 – Object description

Attribute	Value
Index	6161 _h
Name	Actual battery system Ah capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 61 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.18 Object 6163_h: Full EMS output battery system Ah capacity (optional)

This object shall provide the last measured Ah capacity of a complete battery system discharge. It may differ from the rated Ah capacity because capacity decreases while usage. The values shall be given in multiples of 1 mAh. Table 62 specifies the object description. Table 63 specifies the entry description.

Table 62 – Object description

Attribute	Value
Index	6163 _h
Name	Full EMS output battery system Ah capacity
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 63 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.19 Object 6165_h: Battery system VDN 1 actual cell voltage (optional)

This object is related to the battery system that is maintained as virtual device number 1. It shall provide the voltage of each cell or several parallel cells in the battery system. The cell number 1 is connected near the battery system "-" pol. The values shall be given in multiples of 1 mV. Table 64 specifies the object description. Table 65 specifies the entry description.

Table 64 – Object description

Attribute	Value
Index	6165 _h
Name	Battery system VDN 1 actual cell voltage
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 65 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Cell 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	Cell 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	FE _h
Description	Cell 254
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No

6.5.20 Object 6166_h to 6174_h: Battery system VDN 2 to 16 actual cell voltage (optional)

Table 66 specifies the indices for the battery system VDN 2 to 16 actual cell voltages. The detailed specification corresponds to index 6165_h.

NOTE If supported, actual cell voltage of battery system 17 to 127 is maintained in a manufacturer-specific way.

Table 66 – Index assignments for battery system 2 to 16

Index	Object
6166 _h	Battery system 2 actual cell voltage
to	
6174 _h	Battery system 16 actual cell voltage

6.5.21 Object 6175_h: Battery system balance (optional)

This object shall provide the difference between the cell with the highest cell voltage and the cell with the lowest voltage in the battery system. The values shall be given in multiples of 0,01 %. The value definition is given in Table 67. Table 68 provides the object description. Table 69 specifies the entry description.

Table 67 – Value definition

Value [hex]	Description
0000	0 % Unbalanced; minimum and maximum cell voltage on same level
To	
1388	50 % Unbalanced; minimum cell voltage half of maximum cell voltage
To	
2710	100 % Unbalanced; minimum cell voltage is at least 100 times smaller than maximum cell voltage
2711 to FFFF	Reserved

Table 68 – Object description

Attribute	Value
Index	6175 _h
Name	Battery system balance
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 69 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	Ro
PDO mapping	No
Value range	01 _h to 10 _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	Ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No

6.5.22 Object 6176_h: Battery system SOH (optional)

This object shall provide the SOH calculated by the BMS of the battery system. The values shall be given in multiples of 0,01 %. Table 70 and Table 71 illustrate the value definition and the object description. Table 72 specifies the entry description.

Table 70 – Value definition

Value	Description
0000 _h	0% Battery system is completely damaged
0001 _h to 2709 _h	0,01 to 99,99 % Battery system's state of health is between 0,01 and 99,99%
2710 _h	100 % Battery system is new
2711 _h to FFFF _h	- Reserved

Table 71 – Object description

Attribute	Value
Index	6176 _h
Name	Battery system SOH
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 72 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No

Attribute	Value
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.23 Object 6177_h: Battery system EMS output time (optional)

This object shall provide the accumulated charge time of the battery system. The values shall be given in multiples of 1 min. Table 73 specifies the object description. Table 74 specifies the entry description.

Table 73 – Object description

Attribute	Value
Index	6177 _h
Name	Battery system EMS output time
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 74 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.24 Object 6178_h: Battery system EMS input time (optional)

This object shall provide the accumulated discharge time of the battery system. The values shall be given in multiples of 1 min. Table 75 specifies the object description. Table 76 specifies the entry description.

Table 75 – Object description

Attribute	Value
Index	6178 _h
Name	Battery system EMS input time
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 76 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.25 Object 6179_h: Battery system EMS output Ah counter (optional)

This object shall provide the charge Ah counter of the battery system. The values shall be given in multiples of 1 Ah. Table 77 specifies the object description. Table 78 specifies the entry description.

Table 77 – Object description

Attribute	Value
Index	6179 _h
Name	Battery system EMS output Ah counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 78 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.26 Object 617A_h: Battery system EMS input Ah counter (optional)

This object shall provide the discharge Ah counter of the battery system. The values shall be given in multiples of 1 Ah. Table 79 specifies the object description. Table 80 specifies the entry description.

Table 79 – Object description

Attribute	Value
Index	617A _h
Name	Battery system EMS input Ah counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 80 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.27 Object 617B_h: Battery system EMS output Wh counter (optional)

This object shall provide the EMS output Wh counter of the battery system. The values shall be given in multiples of 1 Wh. Table 81 specifies the object description. Table 82 specifies the entry description.

Table 81 – Object description

Attribute	Value
Index	617B _h
Name	Battery system EMS output Wh counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 82 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
UNSIGNED32	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.28 Object 617C_h: Battery system EMS input Wh counter (optional)

This object shall provide the discharge Wh counter of the battery system. The values shall be given in multiples of 1 Wh. Table 83 specifies the object description. Table 84 specifies the entry description.

Table 83 – Object description

Attribute	Value
Index	617C _h
Name	Battery system EMS input Wh counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 84 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.29 Object 617D_h: Battery system EMS output counter (optional)

This object shall provide the accumulated number of charging times. The values are dimensionless. The counting shall start as soon as charging of the battery system exceeds 20 % of the total capacity. Table 85 specifies the object description. Table 86 specifies the entry description.

Table 85 – Object description

Attribute	Value
Index	617D _h
Name	Battery system EMS output counter
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 86 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No

Attribute	Value
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.30 Object 617E_h: Battery system EMS input counter (optional)

This object shall provide the accumulated number of battery system discharges. The values are dimensionless. The counting shall start as soon as the discharging the battery system exceeds 20 % of the total capacity. Table 87 specifies the object description. Table 88 specifies the entry description.

Table 87 – Object description

Attribute	Value
Index	617E _h
Name	Battery system EMS input counter
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 88 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No

Attribute	Value
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.31 Object 617F_h: Battery system deep discharging counter (optional)

This object shall provide the accumulated number of deep discharging. The values are dimensionless. In case one of the cell voltages drops below the minimum level (see object 6127_h), the battery system generally switches the battery system off and increments the counter. Table 89 specifies the object description. Table 90 specifies the entry description.

Table 89 – Object description

Attribute	Value
Index	617F _h
Name	Battery system deep discharging counter
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 90 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

Attribute	Value
	to
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.32 Object 6180_h: Battery system short-circuit counter (optional)

This object shall provide the accumulated number of battery system switch off due to short-circuits. The values are dimensionless. Table 91 specifies the object description. Table 92 specifies the entry description.

Table 91 – Object description

Attribute	Value
Index	6180 _h
Name	Battery system short-circuit counter
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 92 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No

Attribute	Value
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN 127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
to	
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.33 Object 6181_h: Battery system over-temperature counter (optional)

This object shall provide the accumulated number of battery system switch offs due to over-temperature. The values are dimensionless. Table 93 specifies the object description. Table 94 specifies the entry description.

Table 93 – Object description

Attribute	Value
Index	6181 _h
Name	Battery system over-temperature counter
Object code	ARRAY
Data type	UNSIGNED16
Category	Optional

Table 94 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	01 _h to FE _h
Default value	No
Sub-index	01 _h
Description	Battery system VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
Sub-index	02 _h
Description	Battery system VDN 2
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No
to	
Sub-index	7F _h
Description	Battery system VDN127
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED16
Default value	No

Attribute	Value
Sub-index	80 _h
Description	Battery pack external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	Battery pack external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.5.34 Object 6182_h: Temperature dependent average EMS output current (optional)

This object shall provide average EMS output current for the temperature ranges defined in Table 3. This value allows the BMS to limit the EMS output current depending on the battery cell temperature, so the battery may operate near its low and high temperature limits. The values shall be given in multiples of 1 mA. Table 95 specifies the object description and Table 96 specifies the entry description.

Table 95 – Object description

Attribute	Value
Index	6182 _h
Name	Temperature dependent average EMS output current
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 96 – Entry description

Attribute	Value
Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	28 _h
Default value	28 _h
Sub-index	01 _h
Description	EMS output current at temperature range 1
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	INTEGER32
Default value	No
to	
Sub-index	28 _h
Description	EMS output current at temperature range 40
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	INTEGER32
Default value	No

6.5.35 Object 6183_h: Temperature dependent peak EMS output current (optional)

This object shall provide peak EMS output current for the temperature ranges defined in Table 3. This value allows the BMS to limit the EMS output current depending on the battery cell temperature, so the battery may operate near its low and high temperature limits. The values shall be given in multiples of 1 mA. Table 97 specifies the object description and Table 98 specifies the entry description.

Table 97 – Object description

Attribute	Value
Index	6183 _h
Name	Temperature dependent peak EMS output current
Object code	ARRAY
Data type	INTEGER32
Category	Optional