



BSI Standards Publication

Electric vehicles conductive charging system

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

National foreword

This Published Document is the UK implementation of CLC IEC/TS 61851-3-7:2023. It is identical to IEC TS 61851-3-7:2023. It supersedes PD IEC TS 61851-3-7:2023, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/69, Electric vehicles.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

**Electric vehicles conductive charging system - Part 3-7: DC EV
supply equipment where protection relies on double or reinforced
insulation - Battery system communication
(IEC/TS 61851-3-7:2023)**

Système de charge conductive pour véhicules électriques -
Partie 3-7 : Exigences relatives aux véhicules électriques
légers - Communication avec les batteries
(IEC/TS 61851-3-7:2023)

Konduktive Ladesysteme für Elektrofahrzeuge - Teil 3-7:
Gleichstrom-Versorgungseinrichtungen für
Elektrofahrzeuge mit Schutzwirkung durch doppelte oder
verstärkte Isolierung - Batteriesystem Kommunikation
(IEC/TS 61851-3-7:2023)

This Technical Specification was approved by CENELEC on 2023-12-04.

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (CLC IEC/TS 61851-3-7:2023) consists of the text of IEC/TS 61851-3-7:2023, prepared by IEC/TC 69 "Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks".

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

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Endorsement notice

The text of the International Technical Specification IEC/TS 61851-3-7:2023 was approved by CENELEC as a European Technical Specification without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC/TS 61851-3-4	2023	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	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	-	-
		Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces - Part 4: CANopen	EN 50325-4	2002
		Secondary lithium batteries for light EV (electric vehicle) applications - Part 1: General safety requirements and test methods	EN 50604-1	2016

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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

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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.

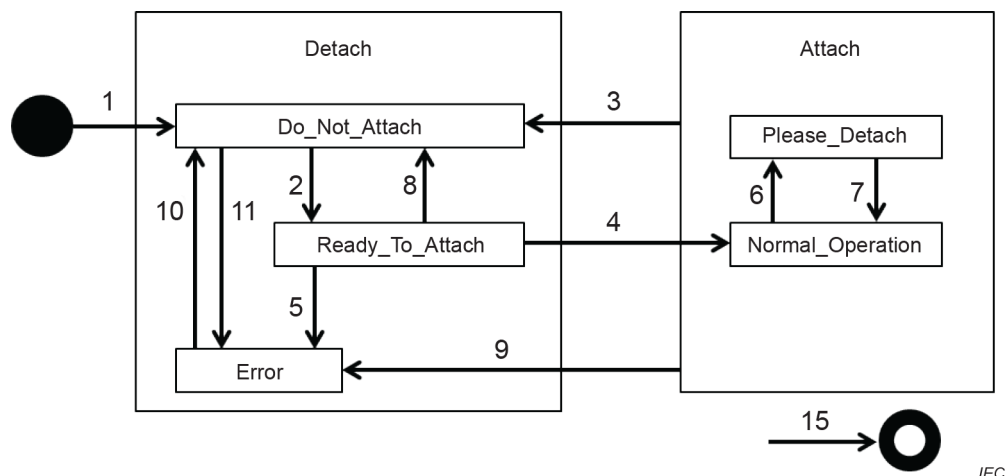


Figure 1 – FSA for battery system

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.

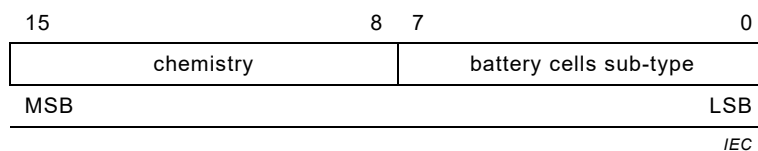


Figure 2 – Value structure

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-AlO
		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-AlO
		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
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 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
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
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