



BSI Standards Publication

Electric vehicles conductive charging system

Part 3-6: DC EV supply equipment where protection relies on double or reinforced insulation — Voltage converter unit communication

National foreword

This Published Document is the UK implementation of CLC IEC/TS 61851-3-6:2023. It is identical to IEC TS 61851-3-6:2023. It supersedes PD IEC TS 61851-3-6:2023, which is withdrawn.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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Date	Text affected
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English Version

**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 61851-3-6:2023)**

Système de charge conductive pour véhicules électriques -
Partie 3-6 : Exigences relatives aux véhicules électriques
légers - Communication avec l'unité de conversion
(IEC/TS 61851-3-6:2023)

Konduktive Ladesysteme für Elektrofahrzeuge - Teil 3-6:
Gleichstrom-Versorgungseinrichtungen für
Elektrofahrzeuge mit Schutzwirkung durch doppelte oder
verstärkte Isolierung - Spannungswandler Kommunikation
(IEC/TS 61851-3-6:2023)

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

European foreword

This document (CLC IEC/TS 61851-3-6:2023) consists of the text of IEC/TS 61851-3-6:2023, prepared by IEC/TC 69 "Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks".

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Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Technical Specification IEC/TS 61851-3-6:2023 was approved by CENELEC as a European Technical Specification without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC/TS 61851-3-7:2023 NOTE Approved as CLC IEC/TS 61851-3-7:2023 (not modified)

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 61851-3-2	2023	Electric vehicle conductive charging system - 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	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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLES CONDUCTIVE CHARGING SYSTEM –**Part 3-6: DC EV supply equipment where protection relies on double or reinforced insulation – Voltage converter unit 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.
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IEC TS 61851-3-6 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
69/652/DTS	69/673/RVDTS 69/673A/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.

In this document, 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 system – 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 3-6: DC EV supply equipment where protection relies on double or reinforced insulation – Voltage converter unit 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 provides application objects provided by the AC/DC VCU or DC/DC VCU.

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 61851-3-2:2023, *Electric vehicles conductive charging system – 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: 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*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61851-3-4:2023 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 61851-3-4:2023 apply.

5 Operating principles

5.1 General

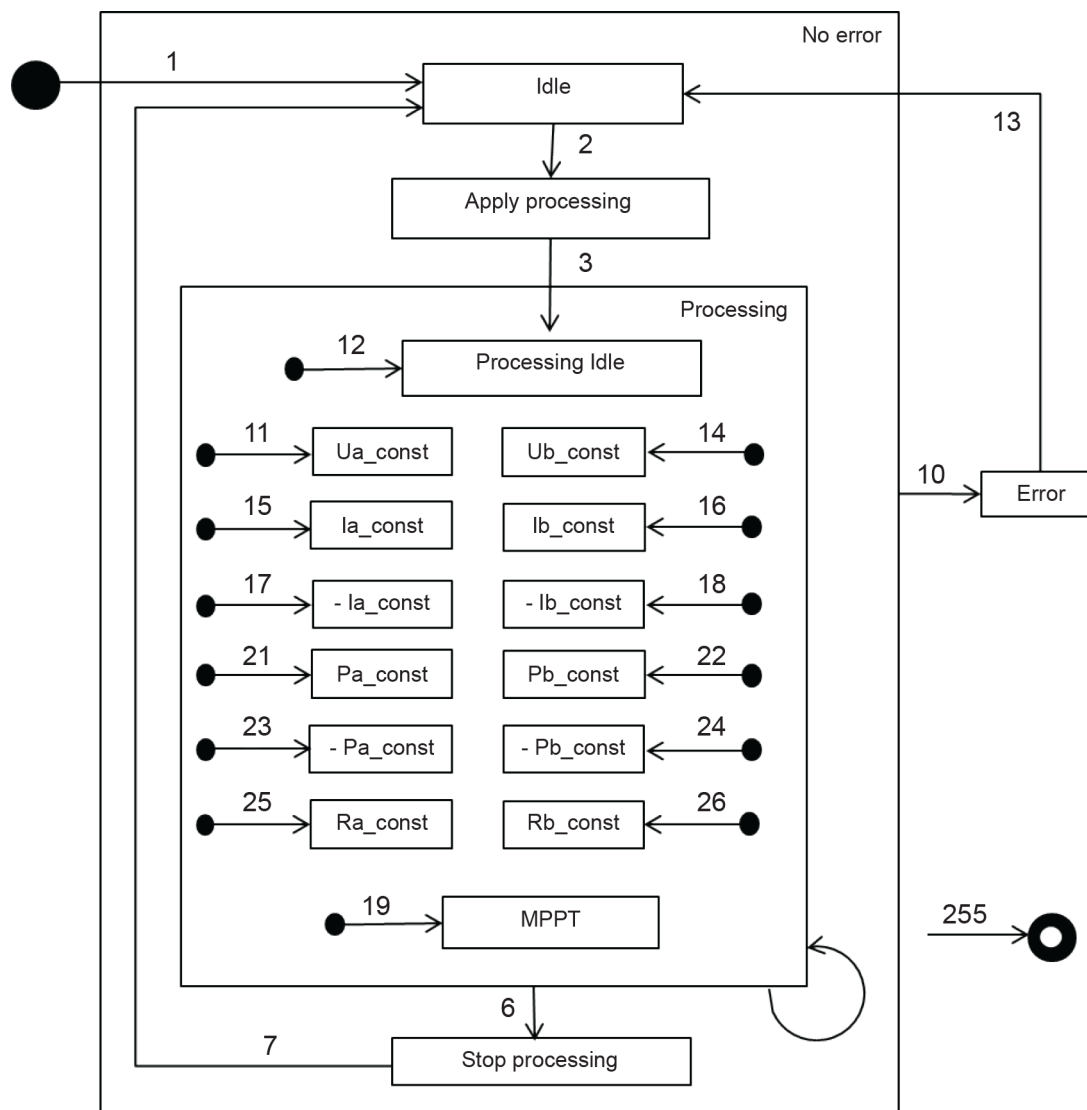
In addition to the finite state automaton (FSA) defined by IEC TS 61851-3-4:2021, this document defines an additional VCU specific FSA to operate voltage converters in a common way. The FSA consists of mandatory and optional FSA states and sub-states. Any VCU supports the mandatory FSA states. Optional FSA states are only supported in case the related functionality is supported. State transitions within the FSA are based on device internal events (e.g. occurrence of device errors) or on the reception of the FSA command. The VCU typically has at least a voltage input at one side and a voltage output at the other side. In this document, the VCU is defined as a device that transfers power from the "side A" to the "side B" and from "side B" to "side A" as defined in Annex B of IEC TS 61851-3-2:2023.

5.2 Voltage converter unit specific FSA

The VCU specific FSA as defined in Figure 1 shall start with the initial entry in the EMS FSA state **"Operating"** and shall exist as long as the running state is not left.

The FSA defines the application behaviour of the VCU (see also Table 1). Due to the requirement that the VCU provides local control even when the CAN network is not working properly, the NMT slave FSA (VCU) as defined in EN 50325-4:2002, the EMS FSA and the VCU FSA are only 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.



IEC

Figure 1 – FSA for voltage converter unit

5.3 State definitions

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

Table 1 – States behaviour

Name	Behaviour	Category of sub states
Initial	This shall be a pseudo state indicating the start when the FSA is activated during the initial entry into the running state.	-
IDLE	The VCU shall transit to this state after the initial entry in the running state of the EMS FSA (see 9.1 of IEC TS 61851-3-4:2021). The VCU shall be in IDLE state, when it is not in any other of the defined states.	-
Apply_Processing	Preparation of the VCU's process interface so that power transfer from one side to the other is possible.	-
Processing	State where the VCU operates. The VCU applies the adjusted power to the output lines at side A or B.	-
Processing_IDLE	Sub state of Processing; the VCU is ready to operate in principle. There is no power transferred from one side to the other.	-
Ua_const	Sub state of Processing; the power transfer shall be active in a way, that Ua remains constant.	o
Ub_const	Sub state of Processing; the power transfer shall be active in a way, that Ub remains constant.	m
Ia_const	Sub state of Processing; the power transfer shall be active in a way, that Ia remains constant and the current flow is from the VCU's side A into the power line.	o
Ib_const	Sub state of Processing; the power transfer shall be active in a way, that Ib remains constant and the current flow is from the VCU's side B into the power line.	m
-Ia_const	Sub state of Processing; the power transfer shall be active in a way, that Ia remains constant and the current flow is from the power line into VCU's side A.	o
-Ib_const	Sub state of Processing; the power transfer shall be active in a way, that Ib remains constant and the current flow is from the power line into VCU's side B.	o
Pa_const	Sub state of Processing; the power transfer from VCU's side A to the power line shall be active and PA remains constant.	o
Pb_const	Sub state of Processing; the power transfer from VCU's side B to the power line shall be active and Pb remains constant.	o
-Pa_const	Sub state of Processing; the power transfer from the power line to VCU's side A shall be active and Pa remains constant.	o
-Pb_const	Sub state of Processing; the power transfer from the power line to VCU's side B shall be active and Pb remains constant.	o
Ra_const	Sub state of Processing; the power transfer shall be active in a way, that Ra remains constant.	o
Rb_const	Sub state of Processing; the power transfer shall be active in a way, that Rb remains constant.	o
MPPT	Sub state of Processing; a maximum power point tracker shall set the output voltage to that value, where the maximum output of a power source such as e.g. a photo voltaic module is reached.	o
Stop_Processing	The power transfer between side A and B is stopped. The VCU's process interface is disabled.	-
Error	The VCU application is in an error condition. There is no power transferred from one side to the other. See also Clause 7 of IEC TS 61851-3-4:2021.	-
Final	Pseudo state, indicating the deactivation of the FSA; e.g. by leaving the EMS FSA Running state.	-
NOTE 1 For VCUs according to Figure BB.1, BB.2, BB.3, BB.4 and BB.6 of IEC TS 61851-3-2:2023 the sub states of processing "m" shall be supported, sub states of processing "o" may be supported.		
NOTE 2 For VCUs according to Figure BB.5 of IEC TS 61851-3-2:2023 the sub states of processing m) and o) may be supported.		

5.4 Transitions in the FSA for VCU

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

Table 2 – Transitions, events and actions

Transition	Event(s)	Action(s)
1	Power on	Update VCU status word
2	Trigger Apply processing in control word remotely	Apply processing at VCU's process interface; update status word
3	Transition as soon as processing is active	Processing is enabled in principle; Update status word
6	Switch off processing command in control word remotely or local command ^a	Disable processing at VCU's process interface; update status word
7	Transition as soon as processing at VCU's process interface is disabled	Update status word
10	Transition in case an Error is detected ^b .	Update status word; execute manufacturer-specific counter measures.
11	Enter processing method Ua_const in control word remotely or via local command	Start processing Ua_const at VCU's process interface; update status word
12	Enter Processing_IDLE in control word remotely or via local command	Stop current processing method but processing remains enabled in principle; update status word
13	State transition in case all occurred errors are removed	The VCU's process interface is disabled and no error is active; update status word
14	Enter processing method Ub_const in control word remotely or via local command	Start processing Ub_const at VCU's process interface; update status word
15	Enter processing method la_const in control word remotely or via local command	Start processing la_const at VCU's process interface; update status word
16	Enter processing method lb_const in control word remotely or via local command	Start processing lb_const at VCU's process interface; update status word
17	Enter processing method -la_const in control word remotely or via local command	Start processing -la_const at VCU's process interface; update status word
18	Enter processing method -lb_const in control word remotely or via local command	Start processing -lb_const at VCU's process interface; update status word
19	Enter processing method MPPT in control word remotely or via local command	Start processing MPPT at VCU's process interface; update status word
21	Enter processing method Pa_const in control word remotely or via local command	Start processing Pa_const at VCU's process interface; update status word
22	Enter processing method Pb_const in control word remotely or via local command	Start processing Pb_const at VCU's process interface; update status word
23	Enter processing method -Pa_const in control word remotely or via local command	Start processing -Pa_const at VCU's process interface; update status word
24	Enter processing method -Pb_const in control word remotely or via local command	Start processing -Pb_const at VCU's process interface; update status word
25	Enter processing method Ra_const in control word remotely or via local command	Start processing Ra_const at VCU's process interface; update status word
26	Enter processing method Rb_const in control word remotely or via local command	Start processing Rb_const at VCU's process interface; update status word
255	Local shut down	Abort running operation and leave state machine
Transition numbers are shown in Figure 1.		
^a Leaving the EMS FSA Operating state may trigger this local command as well.		
^b Leaving the EMS FSA Operating state may be considered as an error.		

6 Object dictionary

6.1 General

Clause 6 defines the application objects of a VCU unit. As the AC/DC converter functionality is an important functionality in the application field of EVs, the objects for this functionality are described separately from the objects related to the other converter functionalities.

6.2 Additional definitions to general application objects

6.2.1 General

Subclause 6.2 provides additional definitions to the general application objects that are specified in IEC TS 61851-3-5:2021.

6.2.2 Object 6001_h: Control word

The bit field "VD specific FSA control" shall control the virtual device specific FSA for VCUs; as specified in Table 3.

Table 3 – Value definition for VD specific FSA control

Value	Description
00 _h	No action
02 _h	Prepare processing
06 _h	Switch off processing
0B _h	Enter processing method Ua_const
0C _h	Enter Processing idle
0E _h	Enter processing method Ub_const
0F _h	Enter processing method Ia_const
10 _h	Enter processing method Ib_const
11 _h	Enter processing method -Ia_const
12 _h	Enter processing method -Ib_const
13 _h	Enter processing method MPPT
15 _h	Enter processing method Pa_const
16 _h	Enter processing method Pb_const
17 _h	Enter processing method -Pa_const
18 _h	Enter processing method -Pb_const
19 _h	Enter processing method Ra_const
1A _h	Enter processing method Rb_const
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 VCUs; as specified in Table 4.

Table 4 – Value definition for virtual device FSA state

Value	FSA state
00 _h	VD specific FSA not active
01 _h	IDLE
02 _h	Apply_Processing
03 _h	Processing_ IDLE
06 _h	Stop_Processing
0A _h	Error
0B _h	Processing sub state Ua_const
0E _h	Processing sub state Ub_const
0F _h	Processing sub state Ia_const
10 _h	Processing sub state Ib_const
11 _h	Processing sub state -Ia_const
12 _h	Processing sub state -Ib_const
13 _h	Processing sub state Pa_const
14 _h	Processing sub state Pb_const
15 _h	Processing sub state -Pa_const
16 _h	Processing sub state -Pb_const
17 _h	Processing sub state MPPT
18 _h	Processing sub state Ra_const
19 _h	Processing sub state Rb_const
All other values shall be reserved.	

6.3 Produced application objects by AC-DC converter functionality (mandatory)

6.3.1 General

Subclause 6.3 defines the application objects produced by the AC-DC converter functionality, which is a subset of the VCU functionality. The application object range for the AC-DC converter functionality is from 6096_h to 60E0_h.

6.3.2 Object 60A0_h: AC-DC converter capability

This object shall provide basic information about the capability of the AC-DC converter. Figure 2 illustrates the value structure and Table 5 shall provide the value definition. Table 6 specifies the object description and Table 7 specifies the entry description.

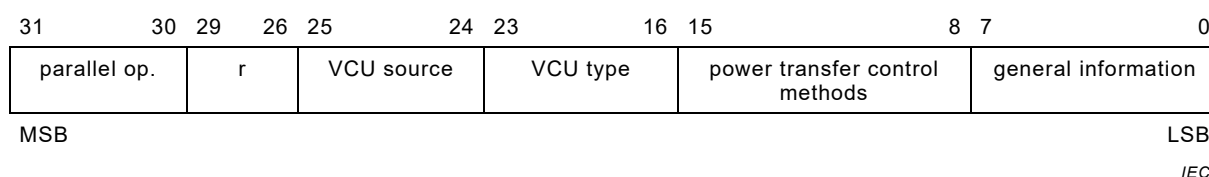
**Figure 2 – Value structure**

Table 5 – Value definition

Name	Bit	Value	Description
general information	0	0 _b	EV VCU not supported
		1 _b	EV VCU supported
	1	0 _b	EV supply device VCU not supported
		1 _b	EV supply device VCU supported
	2	0 _b	Isolated VCU (only for EV VCU) not supported
		1 _b	Isolated VCU (only for EV VCU) supported
	3	0 _b	Non-isolated VCU (only for EV VCU) not supported
		1 _b	Non-isolated VCU (only for EV VCU) supported
	4	0 _b	Maximum power point tracker not supported
		1 _b	Maximum power point tracker supported
	5	0 _b	Not capable to create AC grid
		1 _b	Capable to create AC grid
	6	0 _b	2-point topology on side B
		1 _b	3-point topology on side B
	7	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
power transfer control methods	8	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
	9	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
	10	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
	11	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
	12	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
	13	0 _b	Reserved (always 0)
		1 _b	Reserved (always 0)
	14	Reserved (always 0)	
	15	Reserved (always 0)	
VCU type	16	0 _b	Pulse VCU not supported
		1 _b	Pulse VCU supported
	17	0 _b	Wireless power transfer (WPT) not supported
		1 _b	Wireless power transfer (WPT) supported
	18	0 _b	Power Factor Correction (PFC) VCU not supported
		1 _b	Power Factor Correction (PFC) VCU supported
	19	0 _b	USB-based VCU not supported

Name	Bit	Value	Description
		1 _b	USB-based VCU supported
	20 to 23	0 _b	Reserved
		1 _b	
VCU source	24	0 _b	AC not supported
		1 _b	AC supported
	25	0 _b	Solar panel not supported
		1 _b	Solar panel supported
	26 to 29	0 _b	Reserved
		1 _b	
Parallel operation	30 to 31	00 _b	No parallel operation supported
		01 _b	Droop control supported (voltage difference of the battery systems is considered during power transfer)
		10 _b	Single changing master switch control supported (consecutive power transfer from/to the battery systems)
		11 _b	Wired/Wireless switch control (power transfer not decided by the VCU)

Table 6 – Object description

Attribute	Value
Index	60A0 _h
Name	AC-DC converter capability
Object code	ARRAY
Data type	UNSIGNED32
Category	Mandatory

Table 7 – 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	AC-DC converter capability VDN 1
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	02 _h
Description	AC-DC converter capability VDN 2
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter capability VDN 127
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No
Sub-index	80 _h
Description	AC-DC converter capability 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	AC-DC converter capability external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4 Produced application objects by AC-DC converter (optional)

6.4.1 General

Subclause 6.4 defines the application objects produced by the AC-DC converter functionality, which is a subset of the VCU functionality. This function is typically implemented in EVs, for example for VCU applications. The application object range for the AC-DC converter is from 6096_h to 60E0_h.

6.4.2 Object 60A1_h: AC-DC converter minimum AC voltage

This object shall provide the minimum AC voltage of the AC-DC converter and describes the external power source, outside the EMS. The values shall be given in multiples of 1 mV. Table 8 specifies the object description and Table 9 specifies the entry description.

Table 8 – Object description

Attribute	Value
Index	60A1 _h
Name	AC-DC converter minimum AC voltage
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 9 – 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	AC-DC converter VDN 1 minimum AC voltage
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	AC-DC converter VDN 2 minimum AC voltage
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN127 minimum AC voltage
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	80 _h
Description	AC-DC converter minimum AC voltage 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	AC-DC converter minimum AC voltage external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.3 Object 60A2_h: AC-DC converter maximum AC voltage

This object shall provide the maximum AC voltage of the AC-DC converter and describes the external power source, outside the EMS. The values shall be given in multiples of 1 mV. Table 10 specifies the object description and Table 11 specifies the entry description.

Table 10 – Object description

Attribute	Value
Index	60A2 _h
Name	AC-DC converter maximum AC voltage
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 11 – 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	AC-DC converter VDN 1 maximum AC voltage
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 maximum AC voltage
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN127 maximum AC voltage
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No

Attribute	Value
Sub-index	80 _h
Description	AC-DC converter maximum AC voltage 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	
Sub-index	FE _h
Description	AC-DC converter maximum AC voltage 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.4 Object 60A3_h: AC-DC converter maximum AC current

This object shall provide the maximum AC current limit of the AC-DC converter and describes the external power source, outside the EMS. The values shall be given in multiples of 1 mA. Table 12 specifies the object description and Table 13 specifies the entry description.

Table 12 – Object description

Attribute	Value
Index	60A3 _h
Name	AC-DC converter maximum AC current
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 13 – 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	AC-DC converter VDN 1 maximum AC current
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 maximum AC current
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter 8 maximum AC current
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	80 _h
Description	AC-DC converter maximum AC current 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	AC-DC converter maximum AC current external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.5 Object 60A4_h: AC-DC converter maximum AC power

This object shall provide the maximum AC power limit of the device, required for the external power source, outside the EMS. The values shall be given in multiples of 1 mW. Table 14 specifies the object description and Table 15 specifies the entry description.

Table 14 – Object description

Attribute	Value
Index	60A4 _h
Name	AC-DC converter maximum AC power
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 15 – 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	AC-DC converter VDN 1 maximum AC power
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 maximum AC power
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	

Attribute	Value
Sub-index	7F _h
Description	AC-DC converter VDN 127 maximum AC power
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	80 _h
Description	AC-DC converter maximum AC power 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	AC-DC converter maximum AC power external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.6 Object 60AA_h: AC-DC converter power transfer time

This object shall provide the statistical value of the sum of power transfer time over the AC-DC converter lifetime. The values shall be given in multiples of 1 min. Table 16 specifies the object description and Table 17 specifies the entry description.

Table 16 – Object description

Attribute	Value
Index	60AA _h
Name	AC-DC converter power transfer time
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 17 – 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	AC-DC converter VDN 1 power transfer time
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 power transfer time
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	08 _h
Description	AC-DC converter VDN 127 power transfer time
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	AC-DC converter charging time external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	

Attribute	Value
Sub-index	FE _h
Description	AC-DC converter charging time external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.7 Object 60AB_h: AC-DC converter discharging power transfer time

This object shall provide the statistical value of the sum of discharging time over the AC-DC converter lifetime. The values shall be given in multiples of 1 min. Table 18 specifies the object description and Table 19 specifies the entry description.

Table 18 – Object description

Attribute	Value
Index	60AB _h
Name	AC-DC converter discharging time
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 19 – 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	AC-DC converter VDN 1 discharging time
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	AC-DC converter VDN 2 discharging time
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN 127 discharging time
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	80 _h
Description	AC-DC converter discharging time 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	AC-DC converter discharging time external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.8 Object 60AC_h: AC-DC converter power transfer Ah counter

This object shall provide the statistical sum of the counter over the AC-DC converter lifetime. The values shall be given in multiples of 1 Ah. Table 20 specifies the object description and Table 21 specifies the entry description.

Table 20 – Object description

Attribute	Value
Index	60AC _h
Name	AC-DC converter power transfer Ah counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 21 – 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	AC-DC converter VDN 1 power transfer Ah counter
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 power transfer Ah counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN 127 power transfer Ah counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No

Attribute	Value
Sub-index	80 _h
Description	AC-DC converter charging Ah counter 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	AC-DC converter charging Ah counter external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.9 Object 60AD_h: AC-DC converter discharging Ah counter

This object shall provide the statistical sum of the counter over the AC-DC converter lifetime. The values shall be given in multiples of 1 Ah. Table 22 specifies the object description and Table 23 specifies the entry description.

Table 22 – Object description

Attribute	Value
Index	60AD _h
Name	AC-DC converter discharging Ah counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 23 – 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	AC-DC converter VDN 1 discharging Ah counter
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 discharging Ah counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN 127 discharging Ah counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	AC-DC converter discharging Ah counter 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	AC-DC converter discharging Ah counter external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.10 Object 60AE_h: AC-DC converter power transfer Wh counter

This object shall provide the statistical sum of the counter over the AC-DC converter lifetime. The values shall be given in multiples of 1 Wh; measured at DC-side. Table 24 specifies the object description and Table 25 specifies the entry description.

Table 24 – Object description

Attribute	Value
Index	60AE _h
Name	AC-DC converter counter power transfer Wh
Object code	ARRAY
Data type	UNSIGNED32
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	AC-DC converter VDN1 power transfer Wh counter
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 power transfer Wh counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	

Attribute	Value
Sub-index	7F _h
Description	AC-DC converter VDN 127 power transfer Wh counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	AC-DC converter charging Wh counter 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	AC-DC converter charging Wh counter external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.11 Object 60AF_h: AC-DC converter discharging Wh counter

This object shall provide the statistical sum of the counter over the AC-DC converter lifetime. The values shall be given in multiples of 1 Wh. Table 26 specifies the object description and Table 27 specifies the entry description.

Table 26 – Object description

Attribute	Value
Index	60AF _h
Name	AC-DC converter discharging Wh counter
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

Table 27 – 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	AC-DC converter VDN 1 discharging Wh counter
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 discharging Wh counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN127 discharging Wh counter
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	AC-DC converter charging Wh counter external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	

Attribute	Value
Sub-index	FE _h
Description	AC-DC converter charging Wh counter external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.12 Object 60B0_h: AC-DC converter actual AC voltage

This object shall provide the AC voltage value in case the power transfer is measured. The values shall be given in multiples of 1 mV. Table 28 specifies the object description and Table 29 specifies the entry description.

Table 28 – Object description

Attribute	Value
Index	60B0 _h
Name	AC-DC converter actual AC voltage
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 29 – 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	AC-DC converter VDN 1 actual AC voltage
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No

Attribute	Value
Sub-index	02 _h
Description	AC-DC converter VDN 2 actual AC voltage
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN127 actual AC voltage
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	80 _h
Description	AC-DC converter actual AC voltage 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	AC-DC converter actual AC voltage external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.13 Object 60B1_h: AC-DC converter actual AC current

This object shall provide the AC current value in case the power transfer is measured. The values shall be given in multiples of 1 mA. Table 30 specifies the object description and Table 31 specifies the entry description.

NOTE A positive value indicates a current flow from the AC-DC converter to the EMS. A negative value indicates a current flow from the EMS to the AC-DC converter.

Table 30 – Object description

Attribute	Value
Index	60B1 _h
Name	AC-DC converter actual AC current
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 31 – 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	AC-DC converter VDN 1 actual AC current
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 actual AC current
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN127 actual AC current
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No

Attribute	Value
Sub-index	80 _h
Description	AC-DC converter capability 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	AC-DC converter capability external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.14 Object 60B2_h: AC-DC converter actual AC power

This object shall provide the AC power value in case the power transfer is measured. The values shall be given in multiples of 1 mW. Table 32 specifies the object description and Table 33 specifies the entry description.

Table 32 – Object description

Attribute	Value
Index	60B2 _h
Name	AC-DC converter actual AC power
Object code	ARRAY
Data type	INTEGER32
Category	Optional

Table 33 – 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	AC-DC converter VDN 1 actual AC power
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 actual AC power
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN 127 actual AC power
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	INTEGER32
Default value	No
Sub-index	80 _h
Description	AC-DC converter actual AC power 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	AC-DC converter actual AC power external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.15 Object 60B3_h: AC-DC converter power transfer count number

This object shall provide the statistical sum of the count numbers over the AC-DC converter lifetime. The value shall be dimensionless. Table 34 specifies the object description and Table 35 specifies the entry description.

Table 34 – Object description

Attribute	Value
Index	60B3 _h
Name	AC-DC converter power transfer count number
Object code	ARRAY
Data type	UNSIGNED32
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	AC-DC converter VDN 1 power transfer count number
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 power transfer count number
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	

Attribute	Value
Sub-index	08 _h
Description	AC-DC converter VDN 127 power transfer count number
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	AC-DC converter charging count number 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	AC-DC converter charging count number external data 127
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific

6.4.16 Object 60B4_h: AC-DC converter discharging count number

This object shall provide the statistical sum of the count numbers over the AC-DC converter lifetime. The value shall be dimensionless. Table 36 specifies the object description and Table 37 specifies the entry description.

Table 36 – Object description

Attribute	Value
Index	60B4 _h
Name	AC-DC converter discharging count number
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 FE _h
Default value	No
Sub-index	01 _h
Description	AC-DC converter VDN 1 discharging count number
Entry category	Mandatory
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	02 _h
Description	AC-DC converter VDN 2 discharging count number
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
to	
Sub-index	7F _h
Description	AC-DC converter VDN127 discharging count number
Entry category	Optional
Access	ro
PDO mapping	Optional
Value range	UNSIGNED32
Default value	No
Sub-index	80 _h
Description	AC-DC converter discharging count number external data 1
Entry category	Optional
Access	rw
PDO mapping	Optional
Value range	See value definition
Default value	Manufacturer-specific
to	