CiA® 419

Device profile for battery chargers

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HISTORY

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2003-03-23	*Publication of Version 1.0* as draft standard proposal
2005-01-01	*Publication of Version 1.0.1* as draft standard
2012-04-27	*Publication of Version 1.2.0* as public specification - Completely re-chaptered and partially re-worded - Minor editorial corrections - Added new PDO communication parameters NOTE: This document has been converted into “docx format”. The conversion caused minor layout differences to the predecessor document in “doc format”. The technical content word-by-word is the very same.

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1 Scope

This device profile specifies the battery charger communication and application objects in order to obtain sufficient information from the battery module to allow a charge to be carried out. Optional data is a selection of data commonly used in the industry to provide enhanced features. Chargers compliant to this standard shall use communication techniques, which conforms to those described in the CANopen application layer and communication profile.

2 Normative references

The following referenced documents are indispensable for the application 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.

/CiA301/ CiA 301, CANopen application layer and communication profile

/CiA302-5/ CiA 302-5, CANopen additional application layer functions – Part 5: SDO manager

/CiA303-1/ CiA 303-1, CANopen recommendation – Part 1: Cabling and connector pin assignment

/CiA418/ CiA 418, CANopen profile for battery chargers

/CiA801/ CiA 801, CANopen automatic bit-rate detection. Recommended practice and application hints

/ISO11898-2/ ISO 11898-2, Road vehicles – Controller area network (CAN) – Part 2: High-speed medium access unit

3 Terms and definitions

For the purpose of this document, the following terms and definitions and those given in /CiA301/, /CiA302-5/, /CiA303-1/, /CiA418/, /CiA801/ and /ISO11898-2/ apply.

4 Symbols and abbreviated terms

For the purpose of this document, the following symbols and abbreviated terms and those given in /CiA301/, /CiA302-5/, /CiA303-1/, /CiA418/, /CiA801/ and /ISO11898-2/ apply.

CAN Controller area network

CAN-ID CAN identifier

COB-ID Communication object identifier

PDO Process data object

RPDO Receive process data object

SDO Service data object

TPDO Transmit process data object

n.a. not applicable

5 Physical layer specification

5.1 General

This clause specifies the physical layer for this document.

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5.2 Transmission rates

The device compliant to this device profile shall support at least bit-rate of 125 kbit/s and may support the other bit-rates as defined in /CiA301/. The CiA 419 device shall use a CAN transceiver compliant to the /ISO11898-2/. The termination resistor of 124 Ohm shall be included in the default battery module configuration, if the charger is connected to a single battery module. In case the charger device is connected to the in-vehicles CANopen network, it shall support automatic bit-rate detection (see /CiA801/) and shall not use a termination resistor.

5.3 Connectors

The battery module shall have a 5-wire interconnect. The communications bus shall use three of these lines (CAN_L, CAN_H, and ground), and two shall be used for the pilot signal (see Annex B in /CiA418/). The actual connector used and its pin configuration will vary depending on the battery's application, and thus is outside of the scope of this document. The CANopen compliant connectors with recommended pinning are provided in /CiA303-1/.

5.4 Node-ID assignment

The used node-ID assignment method is manufacturer-specific. The node-ID assignment via the CANopen object dictionary is not recommended.

5.5 Network topology

Unless otherwise specified, the line topology is used.

6 Error handling

6.1 General

This clause specifies the handling of errors. Emergency messages shall (may) be supported and triggered by internal errors in the device (see /CiA301/ for a description of emergency message handling). By default, the emergency messages contain the error field with pre-defined error numbers and additional information.

6.2 Error behavior

If a severe device failure is detected in NMT operational state, the device shall automatically enter by default the NMT pre-operational state (see NMT state machine in /CiA301/).

If object 1029_h is implemented, the device may be alternatively configured in case of a device failure to automatically enter the stopped state or remain in the current state.

Device failures shall include the following communication errors:

- Bus-off conditions on the CAN interface;
- Heartbeat event with state 'occurred'.

Severe device errors may also be caused by device internal failures.

6.3 Additional error codes

There are no additional error codes specified.

7 Operating principles

7.1 General

This clause provides a description of the operating principles.

7.2 Functional description

The purpose of the charger is to provide a battery with the information required to perform charging. All devices compliant to this device profile shall support TPDO1 and RPDO1. Optional RPDOs are defined for receive battery voltage, current requests and state of charge. One optional TPDO adds charge returned to the data received. Charger parameter information may be configured by SDO services. The default PDOs shall be disabled by

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default (bit 31 of COB-ID is 1) because of the not pre-defined COB-ID parameters. These COB-ID parameters shall be configured dynamically. In order to achieve that, the charger module scans the network for the battery module by reading the object 1000h of all nodes. If the battery module is detected, the charger module reads the configured COB-IDs of the PDOs and assigns these values to its PDOs correspondingly. In order to request dynamically an SDO connection to the battery module, the charger device shall support dynamic SDO requests as defined in /CiA302-5/. The in-vehicle CANopen manager shall support dynamic establishment of SDO connections, too.

8 General pre-definitions

8.1 General

This clause specifies pre-defined communication parameters.

8.2 Network management and Heartbeat functionality

Devices compliant with this device profile shall support NMT slave functionality as defined in /CiA301/. Heartbeat producer functionality shall be supported. The CiA 419 device may optionally be a time-stamp producer.

8.3 Pre-defined communication objects

8.3.1 General

This clause provides additional definitions with regard to the pre-defined communication objects in /CiA301/. Modules compliant with this device profile shall have default values for some communication objects (1000_h to $1FFF_h$), which are not fully specified in /CiA301/.

8.3.2 Object 1000_h: Device type

This object shall indicate the type of battery module and its functionality. Figure 1 illustrates the parameter structure as specified in /CiA301/. Table 1 specifies the parameter definition for the additional information bit field. Table 2 specifies the object description, and Table 3 specifies the entry description.

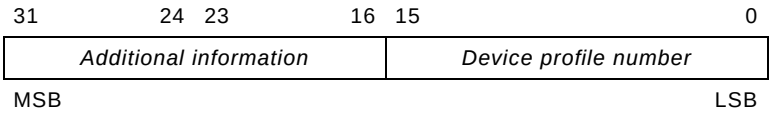

Figure 1 – Parameter structure

Table 1 – Parameter definition

Bit	Value	Description
0 to 15	419_d	Device profile number
16 to 31	0 (NOTE)	Additional information
NOTE The value $FFFF_h$ is reserved for multiple devices (see /CiA301/).		

Table 2 – Object description

Attribute	Value
Index	1000_h
Name	Device type
Object code	VAR
Data type	UNSIGNED32
Category	Mandatory

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Table 3 – Entry description

Attribute	Value
Sub-index	00_h
Access	ro
PDO mapping	No
Value range	See parameter definition
Default value	No

8.3.3 Object 1001_h: Error register

The device profile specific bit in the error register object is reserved. For details on this object see /CiA301/.

8.3.4 Object 1012_h: COB-ID time stamp object

This object is used in case device consumes or produces TIME message. For details see /CiA301/.

8.3.5 Object 1017_h: Heartbeat producer time

The object description and entry description are specified in /CiA301/.

8.3.6 Object 1018_h: Identity

The product code and the revision number shall be supported. Devices implemented according to this profile may support the serial number. For details see /CiA301/.

8.3.7 Object 1029_h: Error behavior

This object may be implemented.

8.3.8 RPDO 1

8.3.8.1 General

The RPDO1 shall contain battery temperature and status. This RPDO shall be received asynchronously. The mapped objects shall be updated immediately after successful RPDO reception.

8.3.8.2 Object 1400_h: RPDO1 communication parameter

This object shall indicate the communication parameters for the first RPDO. The parameter definition is given in /CiA301/. Object description and entry description are provided in Table 4 and Table 5.

Table 4 – Object description

Attribute	Value
Index	1400_h
Name	RPDO1 communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Mandatory

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Table 5 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	See /CiA301/
Default value	No
Sub-index	01_h
Description	COB-ID
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Bit 31 equal 1, other bit – do not care
Sub-index	02_h
Description	Transmission type
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	FF_h
Sub-index	05_h
Description	Event timer
Entry category	Optional
Access	rw
PDO mapping	No
Value range	UNSIGNED16
Default value	0
Sub-index	06_h
Description	SYNC start value
Entry category	Optional
Access	rw
PDO mapping	No
Value range	UNSIGNED8
Default value	Manufacturer-specific

8.3.8.3 Object 1600_h: RPDO1 mapping parameter

This object shall indicate the mapping parameters for the first RPDO. The parameter definition is given in /CiA301/. Object description and entry description are provided in Table 6 and Table 7.

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Table 6 – Object description

Attribute	Value
Index	1600_h
Name	RPDO1 mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional: Mandatory, if object 1400_h is implemented

Table 7 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	02_h
Sub-index	01_h
Description	Application object 1
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6010 00 10_h
Sub-index	02_h
Description	Application object 2
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6000 00 08_h

8.3.9 TPDO 1

8.3.9.1 General

The TPDO1 shall contain the charger status information. This TPDO shall be transmitted periodically, if enabled. The data shall be updated before transmission, no matter if the transmission is triggered by the event timer or by CAN remote frame.

NOTE Do not use CAN implementations, which respond to remote frames automatically.

8.3.9.2 Object 1800_h: TPDO1 Communication parameter

This object shall indicate the communication parameters for the first TPDO. The value definition is given in /CiA301/. Table 8 and Table 9 provide the object description and the entry description.

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Table 8 – Object description

Attribute	Value
Index	1800_h
Name	TPDO1 communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Mandatory

Table 9 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	05_h
Sub-index	01_h
Description	COB-ID
Entry category	Mandatory
Access	ro or rw
PDO mapping	No
Value range	See /CiA301/
Default value	Bit 31 equal 1, other bit – do not care
Sub-index	02_h
Description	Transmission type
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	FF_h
Sub-index	03_h
Description	Inhibit time
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	0

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Attribute	Value
Sub-index	05_h
Description	Event timer
Entry category	Optional
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	$00C8_h$
Sub-index	06_h
Description	SYNC start value
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Manufacturer-specific

8.3.9.3 Object $1A00_h$: TPDO1 mapping parameter

This object shall indicate the mapping parameters for the first TPDO. The value definition is given in /CiA301/. Object description and entry description are provided in Table 10 and in Table 11.

Table 10 – Object description

Attribute	Value
Index	$1A00_h$
Name	TPDO1 mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Mandatory

Table 11 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	01_h

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Attribute	Value
Sub-index	01_h
Description	Application object 1
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6001 00 08_h

8.3.10 RPDO 2

8.3.10.1 General

This RPDO is an optional substitute for the RPDO1 and shall contain the battery voltage, temperature and status. This RPDO shall be received asynchronously. The mapped objects shall be updated immediately after successful RPDO reception. If the battery module supports the corresponding TPDO, the charger may disable the RPDO1 and enable this one.

8.3.10.2 Object 1401_h: RPDO2 communication parameter

This object shall indicate the communication parameters for the second RPDO. The value definition is given in /CiA301/. Object description and entry description are provided in Table 12 and Table 13.

Table 12 – Object description

Attribute	Value
Index	1401_h
Name	RPDO2 communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Optional

Table 13 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	See /CiA301/
Default value	No
Sub-index	01_h
Description	COB-ID
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Bit 31 equal 1, other bit – do not care

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Attribute	Value
Sub-index	02_h
Description	Transmission type
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	FF_h
Sub-index	05_h
Description	Event timer
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	0
Sub-index	06_h
Description	SYNC start value
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Manufacturer-specific

8.3.10.3 Object 1601_h: RPDO2 mapping parameter

This object shall indicate the mapping parameters for the RPDO2. The value definition is given in /CiA301/. Object description and entry description are provided in Table 14 and Table 15.

Table 14 – Object description

Attribute	Value
Index	1601_h
Name	RPDO2 mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional: Mandatory if 1401_h supported

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Table 15 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	03_h
Sub-index	01_h
Description	Application object 1
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6010 00 08_h
Sub-index	02_h
Description	Application object 2
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6000 00 08_h
Sub-index	03_h
Description	Application object 3
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6060 00 20_h

8.3.11 TPDO 2

8.3.11.1 General

This TPDO is an optional substitute for the TPDO1 and shall contain the charger status and the Ah returned during the charge in progress. The data shall be updated before transmission, no matter if the transmission is triggered by the event timer or by CAN remote frame.

NOTE Do not use CAN implementations, which respond to remote frames automatically.

8.3.11.2 Object 1801_h: TPDO2 Communication parameter

This object shall indicate the communication parameters for the second TPDO. The value definition is given in /CiA301/. Table 8 and Table 9 provide the object description and the entry description.

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Table 16 – Object description

Attribute	Value
Index	1801_h
Name	TPDO2 communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Optional

Table 17 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	05_h
Sub-index	01_h
Description	COB-ID
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Bit 31 equal 1, other bit – do not care
Sub-index	02_h
Description	Transmission type
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	FF_h
Sub-index	03_h
Description	Inhibit time
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	0

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Attribute	Value
Sub-index	05_h
Description	Event timer
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	$00C8_h$
Sub-index	06_h
Description	SYNC start value
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Manufacturer-specific

8.3.11.3 Object $1A01_h$: TPDO2 mapping parameter

This object shall indicate the mapping parameters for the second TPDO. The value definition is given in /CiA301/. Object description and entry description are provided in Table 10 and Table 11.

Table 18 – Object description

Attribute	Value
Index	$1A01_h$
Name	TPDO2 mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional: Mandatory if 1801_h supported

Table 19 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	02_h

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Attribute	Value
Sub-index	01_h
Description	Application object 1
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6001 00 08_h
Sub-index	02_h
Description	Application object 2
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6052 00 10_h

8.3.12 RPDO 3

8.3.12.1 General

This RPDO shall contain battery status of charge and requested current value. The mapped objects shall be updated immediately after successful RPDO reception.

8.3.12.2 Object 1402_h: RPDO3 communication parameter

This object shall indicate the communication parameters for the third RPDO. The value definition is given in /CiA301/. Object description and entry description are provided in Table 20 and Table 22.

Table 20 – Object description

Attribute	Value
Index	1402_h
Name	RPDO3 communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Optional

Table 21 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	ro
PDO mapping	No
Value range	See /CiA301/
Default value	No

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Attribute	Value
Sub-index	01_h
Description	COB-ID
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Bit 31 equal 1, other bit – do not care
Sub-index	02_h
Description	Transmission type
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	FF_h
Sub-index	05_h
Description	Event timer
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	0
Sub-index	06_h
Description	SYNC start value
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Manufacturer-specific

8.3.12.3 Object 1602_h: RPDO3 mapping parameter

This object shall indicate the mapping parameters for the RPDO3. The value definition is given in /CiA301/. Object description and entry description are provided in Table 14 and Table 15.

Table 22 – Object description

Attribute	Value
Index	1602_h
Name	RPDO3 mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional: Mandatory if 1402_h supported

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Table 23 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	02_h
Sub-index	01_h
Description	Application object 1
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6070 00 10_h
Sub-index	02_h
Description	Application object 2
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6081 00 08_h

8.3.13 TPDO 3

8.3.13.1 General

This TPDO shall contain charger status, the Ah returned during the charge in progress and the charger state of charge. The data shall be updated before transmission.

NOTE Do not use CAN implementations, which respond to remote frames automatically.

8.3.13.2 Object 1802_h: TPDO3 Communication parameter

This object shall indicate the communication parameters for the third TPDO. The value definition is given in /CiA301/. Table 24 and Table 25 provide the object description and the entry description.

Table 24 – Object description

Attribute	Value
Index	1802_h
Name	TPDO3 communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Optional

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Table 25 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	05_h
Sub-index	01_h
Description	COB-ID
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Bit 31 equal 1, other bit – do not care
Sub-index	02_h
Description	Transmission type
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	FF_h
Sub-index	03_h
Description	Inhibit time
Entry category	Mandatory
Access	Optional
PDO mapping	No
Value range	See /CiA301/
Default value	0
Sub-index	05_h
Description	Event timer
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	$00C8_h$

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Attribute	Value
Sub-index	06_h
Description	SYNC start value
Entry category	Optional
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	Manufacturer-specific

8.3.13.3 Object $1A02_h$: TPDO3 mapping parameter

This object shall indicate the mapping parameters for the third TPDO. The value definition is given in /CiA301/. Object description and entry description are provided in Table 26 and Table 27.

Table 26 – Object description

Attribute	Value
Index	$1A02_h$
Name	TPDO3 mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional: Mandatory if 1802_h supported

Table 27 – Entry description

Attribute	Value
Sub-index	00_h
Description	Highest sub-index supported
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	See /CiA301/
Default value	03_h
Sub-index	01_h
Description	Application object 1
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6001 00 08_h

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Attribute	Value
Sub-index	02_h
Description	Application object 2
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6052 00 10_h
Sub-index	03_h
Description	Application object 3
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	See /CiA301/
Default value	6080 00 08_h

9 Detailed parameter specification

9.1 General

This clause provides the detailed parameter specifications. All parameters in this profile are grouped in the object dictionary, and defined by attributes as defined in /CiA301/. Each object within the CANopen object dictionary is addressed uniquely by using a 16-bit index and an 8-bit sub-index. The objects may be read respectively written via the CANopen network. The standardized device profile area in the index range of 6000_h to $9FFF_h$ contains all application objects, e.g. configuration parameter, process data, diagnostic information, etc., common to this document. Within this range of parameters, it is possible to implement up to eight logical (see /CiA301/). The following index ranges are used:

- 6000_h to $67FF_h$: 1st logical device
- 6800_h to $6FFF_h$: 2nd logical device
- 7000_h to $77FE_h$: 3rd logical device
- 7800_h to $7FFF_h$: 4th logical device
- 8000_h to $87FF_h$: 5th logical device
- 8800_h to $8FFF_h$: 6th logical device
- 9000_h to $97FF_h$: 7th logical device
- 9800_h to $9FFF_h$: 8th logical device

NOTE In this sub-clause allocation rules for application-specific multiple logical devices may be provided as well.

9.2 General application objects

9.2.1 General

This clause provides all application objects, common to all CANopen devices compliant with this document.

9.2.2 Object 6000_h: Battery status

This object shall indicate the status of the battery as the readiness of the battery to accept a charge or not. Figure 2 illustrates the parameter structure. Table 28 provides the parameter definition.

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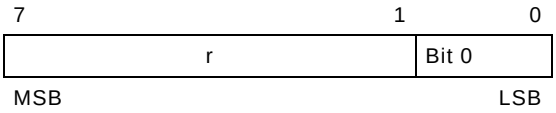

Figure 2 – Parameter structure

Table 28 – Parameter definition

Name	Bit	Value	Description
Bit 0	0	0_b	Not ready
		1_b	Ready
r	1 to 7	Reserved (always 0)	

Table 29 specifies the object description and Table 30 specifies the entry description.

Table 29 – Object description

Attribute	Value
Index	6000_h
Name	Battery status
Object code	VAR
Data type	UNSIGNED8
Category	Mandatory

Table 30 – Entry description

Attribute	Value
Sub-index	00_h
Access	rw
PDO mapping	Default
Value range	See parameter definition
Default value	0

9.2.3 Object 6001_h: Charger status

This object shall provide readiness of the charger to deliver a charge to the battery. Figure 3 illustrates the parameter structure. Table 31 provides the parameter definition.

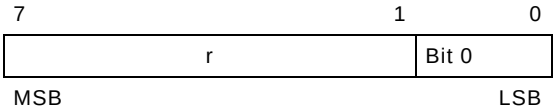

Figure 3 – Parameter structure

Table 31 – Parameter definition

Name	Bit	Value	Description
Bit 0	0	0_b	Not ready
		1_b	Ready
r	1 to 7	Reserved (always 0)	

Table 32 specifies the object description and Table 33 specifies the entry description.

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Table 32 – Object description

Attribute	Value
Index	6001_h
Name	Charger status
Object code	VAR
Data type	UNSIGNED8
Category	Mandatory

Table 33 – Entry description

Attribute	Value
Sub-index	00_h
Access	ro
PDO mapping	Default
Value range	See parameter definition
Default value	No

9.2.4 Object 6010_h: Temperature

This object shall indicate the temperature of the battery pack as measured by a temperature reading device physically mounted somewhere on the battery module. The value shall be given in multiples of 0,125 °C. The minimum range of values shall be -320_d to $+680_d$ (i.e. -40.0 °C to +85.0 °C). The value 8000_h shall indicate an invalid measurement value (see definition of INTEGER16 in /CiA301/). Table 34 specifies the object description and Table 35 specifies the entry description.

Table 34 – Object description

Attribute	Value
Index	6010_h
Name	Temperature
Object code	VAR
Data type	INTEGER16
Category	Mandatory

Table 35 – Entry description

Attribute	Value
Sub-index	00_h
Access	rw
PDO mapping	Default
Value range	$FEC0_h$ to $02A8_h$
Default value	$FFFF_h$

9.2.5 Object 6052_h: Ah returned during last charge

This object shall provide the number of Ampere-hours delivered to the battery by the charger during the last charge event. The charger read the previous value from the battery module via SDO and writes back the current value at the completion of the charging. The values shall be given in multiples of 0,125 Ah. The value $FFFF_h$ shall indicate an invalid measurement value. Table 36 specifies the object description and Table 37 specifies the entry description.

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Table 36 – Object description

Attribute	Value
Index	6052_h
Name	Ah returned during last charge
Object code	VAR
Data type	UNSIGNED16
Category	Conditional: Mandatory if TPDO2 supported

Table 37 – Entry description

Attribute	Value
Sub-index	00_h
Access	ro
PDO mapping	Default, mandatory, if TPDO2 supported
Value range	UNSIGNED16
Default value	No

9.2.6 Object 6060_h: Battery voltage

This object shall indicate the instantaneous voltage across the battery terminals as measured by a voltage-measuring device on the battery or charger. The values shall be given in multiples of (1/1024) V. A value of FFFF $FFFF_h$ shall indicate an invalid measurement. Table 38 specifies the object description and Table 39 specifies the entry description.

Table 38 – Object description

Attribute	Value
Index	6060_h
Name	Battery voltage
Object code	VAR
Data type	UNSIGNED32
Category	Conditional: Mandatory, if RPDO2 supported

Table 39 – Entry description

Attribute	Value
Sub-index	00_h
Access	rw
PDO mapping	Default, mandatory, if RPDO2 supported
Value range	UNSIGNED32
Default value	FFFF $FFFF_h$

9.2.7 Object 6070_h: Charge current requested

This object shall indicate the electrical current in Amperes requested by the battery module to be delivered by the charger to the battery. The values shall be given in multiples of (1/16) A. The value $FFFF_h$ shall indicate the invalid value. Table 40 specifies the object description and Table 41 specifies the entry description.

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Table 40 – Object description

Attribute	Value
Index	6070_h
Name	Charge current requested
Object code	VAR
Data type	UNSIGNED16
Category	Conditional: Mandatory, if RPDO3 supported

Table 41 – Entry description

Attribute	Value
Sub-index	00_h
Access	rw
PDO mapping	Default, mandatory, if RPDO3 supported
Value range	UNSIGNED16
Default value	$FFFF_h$

9.2.8 Object 6080_h: Charger state of charge

This object shall provide the charger's estimation of the amount of energy contained in the battery, expressed as a percentage of the total amount of energy the battery can store. The values shall be given in multiples of 1 %. The value FF_h shall indicate the invalid value. Table 42 specifies the object description and Table 43 specifies the entry description.

Table 42 – Object description

Attribute	Value
Index	6080_h
Name	Charger state of charge
Object code	VAR
Data type	UNSIGNED8
Category	Conditional: Mandatory, if TPDO2 to 3 supported

Table 43 – Entry description

Attribute	Value
Sub-index	00_h
Access	ro
PDO mapping	Default, mandatory, if TPDO2 to 3 supported
Value range	00_h to 64_h and FF_h
Default value	No

9.2.9 Object 6081_h: Battery state of charge

This object shall indicate the battery's measurement of the amount of energy contained in the battery, expressed as a percentage of the total amount of energy the battery can store. The values shall be given in multiples of 1 %. The value FF_h shall indicate the invalid value. Table 44 specifies the object description and Table 45 specifies the entry description.

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Table 44 – Object description

Attribute	Value
Index	6081_h
Name	Battery state of charge
Object code	VAR
Data type	UNSIGNED8
Category	Conditional: Mandatory, if RPDO3 supported

Table 45 – Entry description

Attribute	Value
Sub-index	00_h
Access	rw
PDO mapping	Default, mandatory, if RPDO3 supported
Value range	00_h to 64_h and FF_h
Default value	FF_h

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Annex A (informative): Overview on application objects

The charger specific mandatory and optional application objects are listed in Table 46. For battery type parameters and circuit diagram for pilot signal see /CiA418/.

Table 46 – Overview on application objects

Index	Object code	Name	Data type	Access	Category
6000_h	VAR	Battery status	UNSIGNED8	rw	M
6001_h	VAR	Charger status	UNSIGNED8	ro	M
6010_h	VAR	Temperature	INTEGER16	rw	M
6052_h	VAR	Ah returned during last charge	UNSIGNED16	ro	C
6060_h	VAR	Battery voltage	UNSIGNED32	rw	C
6070_h	VAR	Charge current requested	UNSIGNED16	rw	C
6080_h	VAR	Charger state of charge	UNSIGNED8	ro	C
6081_h	VAR	Battery state of charge	UNSIGNED8	rw	C

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