IEC 61851-24

Edition 1.0 2014-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Electric vehicle conductive charging system – Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

Système de charge conductive pour véhicules électriques – Partie 24: Communication digitale entre la borne de charge à courant continu et le véhicule électrique pour le contrôle de la charge à courant continu

IEC 61851-24:2014-03(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
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COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX V

ICS 43.120

ISBN 978-2-8322-1441-1

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

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

FDIS	Report on voting
69/273FDIS	69/280/RVD

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

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

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

The contents of the corrigendum of June 2015 have been included in this copy.

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INTRODUCTION

The introduction and commercialisation of electric vehicles has been accelerated in the global market, responding to the global concerns on CO_2 reduction and energy security. Concurrently, the development of charging infrastructure for electric vehicles has also been expanding. As supplementary system of a.c. charging system, d.c. charging is recognized as an effective solution to extend the available range of electric vehicles, and different d.c. charging systems are being used over the world. The international standardization in terms of charging infrastructure including d.c. charging systems is indispensable for the diffusion of electric vehicles, and this standard is developed for the manufacturers' convenience by providing general specifications for control communication protocols between off-board d.c. charger and electric vehicles.

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

1 Scope

This part of IEC 61851, together with IEC 61851-23, applies to digital communication between a d.c. EV charging station and an electric road vehicle (EV) for control of d.c. charging, with an a.c. or d.c. input voltage up to 1 000 V a.c. and up to 1 500 V d.c. for the conductive charging procedure.

The EV charging mode is mode 4, according to IEC 61851-23. The charging station supplied by high voltage a.c. supply is not covered by this standard.

Annexes A, B, and C give descriptions of digital communications for control of d.c. charging specific to d.c. EV charging systems A, B and C as defined in Part 23.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61851-1:2010, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-23:2014, *Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station*

ISO/IEC 15118-1[1], *Road vehicles – Vehicle to grid communication interface – Part 1: General information and use-case definition*

ISO/IEC 15118-2:—[1], *Road vehicles – Vehicle to grid communication interface – Part 2: Technical protocol description and open systems interconnections (OSI) layer requirements*

ISO/IEC 15118-3:—[1], *Road vehicles – Vehicle to grid communication interface – Part 3 Physical layer requirements*

ISO 11898-1:2003, *Road vehicles – Controller area network (CAN) – Part 1: Data link layer and physical signalling*

ISO 11898-2:2003, *Road vehicles – Controller area network (CAN) – Part 2: High-speed medium access unit*

[1] To be published.

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 61851-1 and IEC 61851-23 as well as the following apply.

3.1
digital communication
digitally encoded information exchanged between a d.c. EV charging station and an EV, as well as the method by which it is exchanged.

3.2
parameter
single piece of information relevant to charging control, and that is exchanged between a d.c. EV charging station and an EV using a form of digital communication

3.3
signal
data element that is communicated between a d.c. EV charging station and an EV using any means other than digital communication

4 System configuration

The system configuration shall be in accordance with 102.2 of IEC 61851-23:—..

5 Digital communication architecture

In this standard, two digital communication architectures are used:

– one, based on CAN using a dedicated data communication circuit; CAN protocol is given in ISO 11898-1; refer to Annex A and Annex B for specific implementation details; and

– the other, based on Homeplug Green PHY™[1] over the control pilot line; refer to Annex C for specific implementation details.

6 Charging control process

The charging control process shall be in accordance with 102.5 of IEC 61851-23:—.

7 Overview of charging control

The digital communication of d.c. charging control covered by this standard is as shown in Figure 1. This standard does not cover the control protocol internal to the d.c. EV charging station, nor the vehicle, such as power control protocol for a.c./d.c. inverter of d.c. EV charging station and battery management control in the vehicle.

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[1] Homeplug Green PHY ™ is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this product.

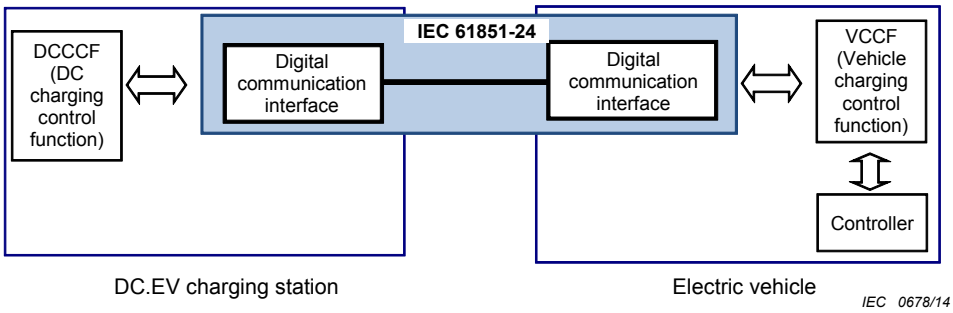


Figure 1 – Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

8 Exchanged information for d.c. charging control

This clause describes information which shall be exchanged between a d.c. EV charging station and a vehicle during the charging process according to IEC 61851-23. The information in Table 1 is common to all systems described in Annexes A, B and C. Each information listed in Table 1 is defined as a parameter in each annex. Each system may need additional parameters, and these parameters are defined in each annex.

Table 1 – Exchanged information for d.c. charging control

No.	Information	Description	Relevant requirement in IEC 61851-23:— (unless specified as IEC 61851-1)
a-1	Current request for the controlled current charging (CCC) system	Exchange of current value requested by EV	6.4.3.101 DC supply
a-2	Voltage request for the controlled voltage charging (CVC) system	Exchange of voltage value requested by EV	
a-3	Maximum rated voltage of d.c. EV charging station	Exchange of maximum rated voltage value of d.c. EV charging station	- 6.4.3.101 DC supply - 6.4.3.105 Compatibility assessment - 6.4.3.107 Protection against overvoltage at the battery
a-4	Maximum rated current of d.c. EV charging station	Exchange of maximum rated current value of d.c. EV charging station	- 6.4.3.101 DC supply for EV - 6.4.3.105 Compatibility assessment
b-1	Communication protocol	Exchange of software version of a charging system	6.4.3.105 Compatibility assessment
b-2	Maximum voltage limit of EV	Exchange of maximum voltage limit value of vehicle.	
b-3	EV minimum current limit, only for the controlled voltage charging (CVC) system	Under consideration.	

No.	Information	Description	Relevant requirement in IEC 61851-23:— (unless specified as IEC 61851-1)
c	Insulation test result	Exchange of the result of insulation test before charging - If insulation test fails, a signal is sent that charging is not allowed.	6.4.3.106 Insulation test before charging
d	Short circuit test before charging	Exchange of information on short circuit test before charging	6.4.3.110 Short circuit test before charging
e	Charging stopped by user	Exchange of information on charge stop command by the user of d.c. EV charging station	6.4.3.111 User initiated shutdown
f	EVSE real time available load current (optional)	Exchange of EVSE real time available load current for demand management. Required for system providing that function.	6.4.4.2 (of IEC 61851-1) Detection/adjustment of the real time available load current of EVSE
g	Loss of digital communication	Detection of loss of digital communication - If a receiver does not get information expected to receive within time out period, it is considered as loss of digital communication.	9.4 Breaking capacity
h-1	Zero current confirmed	Notification of zero current confirmed - Station informs EV that low current condition has been met (to allow connector unlocking)	102.5 Charging control process and state
h-2	Welding detection	Exchange of information on the whole process of welding detection	

Annex A
(normative)

Digital communication for control of d.c. EV charging system A

A.1 General

This annex shows the specification of digital communication for control of the d.c EV charging station of system A (in this annex, referred to as "system A station" or "station") as specified in Annex AA of IEC 61851-23:—. More detailed information on system A is defined in JIS/TSD0007.

A.2 Digital communication actions during charging control process

The communication actions and parameters according to the charging control process as defined in Table 103 of IEC 61851-23:— are shown in Table A.1.

Table A.1 – Communication actions and parameters during d.c. charging control process between system A station and vehicle *(1 of 2)*

Charging control stage		State	High level action at system level [a]	Digital communication action	Parameter	
					From d.c. EV charging station	From vehicle
Initialization	Handshaking	DC-A	Vehicle unconnected	None	N/A	N/A
		DC-B1	Connector plugged in	None	N/A	N/A
		DC-B1	Wake up of DCCCF and VCCF	None	None	(default CAN)
			Communication data initialization	Preparation for digital communication	(default CAN)	(default CAN)
		DC-B1→ DC-B2	Communication established, parameters exchanged, and compatibility checked	Exchange of charging control parameters	– Control protocol number – Available output voltage – Available output current – Battery incompatibility	– Control protocol number – Rated capacity of battery – Maximum battery voltage – Maximum charging time – Target battery voltage – Vehicle charging enabled
	Charge preparation	DC-B2 →DC-B3	Connector locked	Notification of connector locked status	– Vehicle connector lock	None
		DC-B3	Insulation test for d.c. power line	None	Charging system malfunction	None
		DC-B3	Pre-charge (depending on the system architecture)	N/A	N/A	N/A

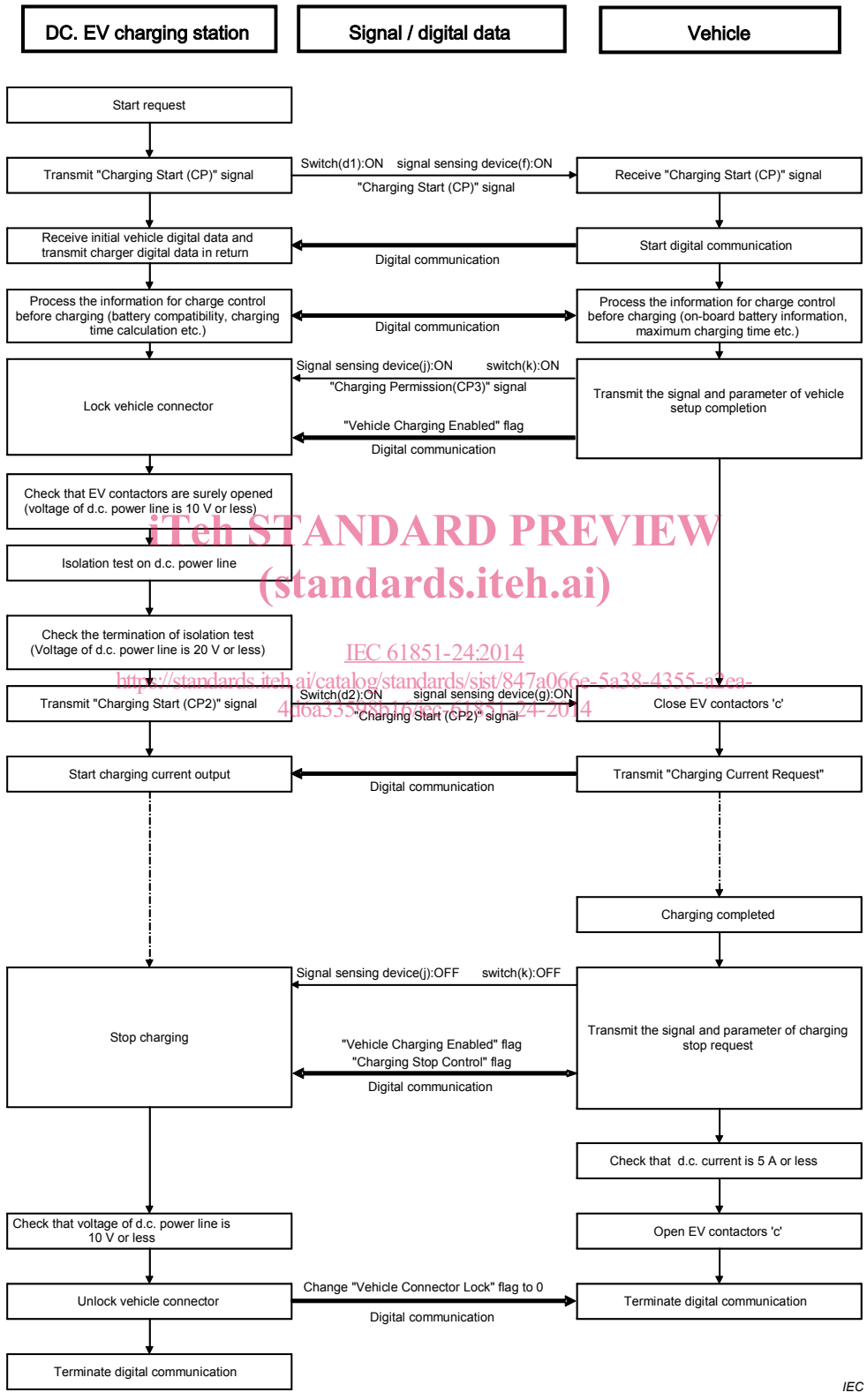
Table A.1 *(2 of 2)*

Charging control stage	State	High level action at system level[a]	Digital communication action	Parameter	
				From d.c. EV charging station	From vehicle
Energy transfer	DC-C or DC-D	Vehicle side contactors closed	Notification of vehicle main contactor closed status	None	None
	DC-C or DC-D	Charging by current demand (for CCC)	Notification of request value of charging current (or voltage)	– Station status – Output voltage – Output current – Remaining charging time – Station malfunction – Charging system malfunction	– Charging current request – Charging system fault – Vehicle shift lever position
	DC-C or DC-D	Charging by voltage demand (for CVC)	N/A	N/A	N/A
	DC-C,(D) →DC-B'1	Current suppression	Request of energy transfer shut-off	– Station status – Charging stop control – Output voltage – Output current	Vehicle charging enabled
Shutdown	DC-B'1	Zero current confirmed	Notification of energy transfer shut-off	– Station status – Charging system malfunction	
	DC-B'1→ DC-B'2	Welding detection (by vehicle)		None	None
	DC-B'2	Vehicle side contactors open	None	None	None
	DC-B'2	DC power line voltage verification	Notification of present voltage	Output voltage	None
	DC-B'3	Connector unlocked	Notification of connector unlocked status	Vehicle connector lock	None
	DC-B'4	End of charge at communication level	Terminate the digital communication	None	None
	DC-A	Connector unplugged		N/A	N/A

[a] The order of actions does not refer to the procedure of charging control process.

A.3 Digital communication of d.c. charging control

The parameters for digital communication of d.c. charging control shall be exchanged according to the sequence diagram as shown in Figure A.1.



For symbols, see Table AA.1 of IEC 61851-23:2014.

Figure A.1 – Sequence diagram of d.c. charging control communication for system A