CHAdeMO - ECHONET Lite Linkage Guidelines

Ver.1.00

Revision record

- Version 1.00 Draft February 18, 2022
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all	・ Unified "charger" and "charger / discharger" into "charger / discharger" ・ Corrected the ESV symbol to the official description of ECHONET Lite (example: SetC) ・ Corrected the document name to the official name ・ Corrected all mistakes, omissions, etc.
3.1	・ Added (C) and (E) in some parts of Table 1.
3.7	・ Changed the description location for the description regarding discharge ・ Added explanation in Sequence 2 and Sequence 3 so that the difference between Fig. 10 and Fig. 11 can be seen.

CONTENTS

Chapter 1 Introduction

1.1 Objectives

With electric vehicles (EVs) becoming more and more popular around the world, there is great potential for their use as a distributed energy resource when connected to social infrastructure (such as electric power systems) via chargers and dischargers. Fig. 1 shows a general system configuration for the case described above.

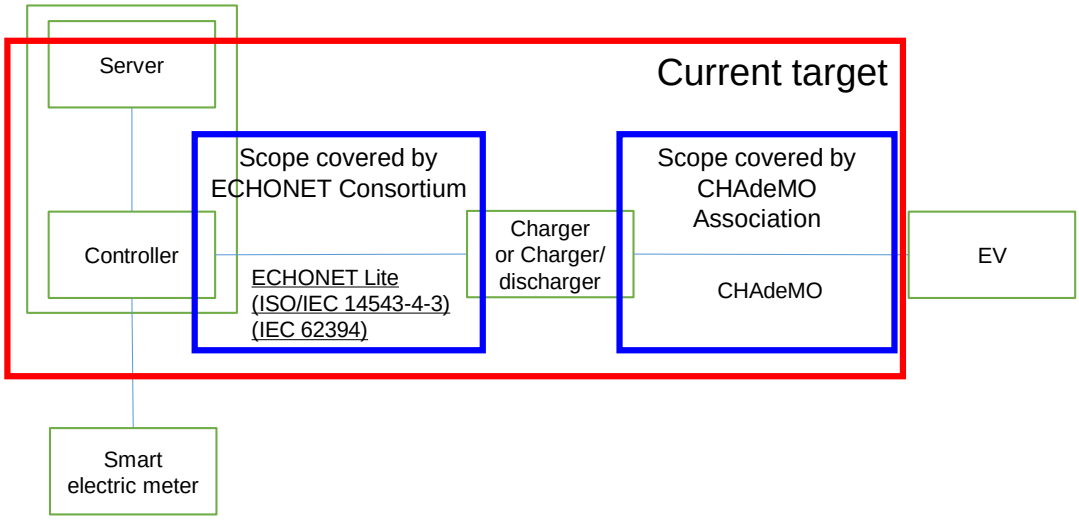


Fig. 1 General system configuration

Although the typical system configuration is as described above, this guideline covers charger / discharger. When controlling and remotely monitoring the charging or discharging of EVs from a controller or an application on a server via charger/discharger, the charger/discharger converts the “communication between the EV and the charger/discharger” and the “communication between the controller and the charger/discharger” to transmit the requests of the controller or application on the server to the electric vehicle. For this reason, chargers/dischargers are developed based on the tacit knowledge of manufacturers regarding the conversion between communication specifications, after referring to the communication specifications of each company.

In the system covered by this document, the communication specifications between the electric vehicle and the charger/discharger follow the rules established by the CHAdeMO Association and the Electric Vehicle Power Supply System Association (EVPOSSA), while the communication specifications between the controller and the charger/discharger follow the rules established by the ECHONET Consortium. The aim of this document is to improve the interoperability of the entire system by converting the linkage functions between CHAdeMO and ECHONET Lite to explicit knowledge. We will also widely promote connections between the ECHONET Lite and CHAdeMO specifications, including in international forums. Electric vehicle is hereinafter referred to as "EV".

1.2 Bibliography

For the communication specifications between controllers and chargers/dischargers, refer to the following document published by the ECHONET Consortium.

[Between controllers and chargers/dischargers]

- ECHONET Lite specification (published for the general public)
- APPENDIX Detailed Requirements for ECHONET Device objects (published for the general public)
- Interface Specification for Application Layer Communication between EV Chargers/Charger-Dischargers and HEMS Controllers (published for the general public)

For communication specifications between EVs and chargers/dischargers, refer to the following documents published by the CHAdeMO Association or the EVPOSSA.

[Between EVs and chargers/dischargers]

- Charging and Discharging System Guidelines for Electric Vehicles V2H DC Version (published for EVPOSSA and CHAdeMO members)
- CHAdeMO Standard Specifications (published for CHAdeMO members)

Chapter 2 Use cases to be examined

2.1 Introduction

In general, when connecting IoT devices to a system, it is common to combine the following functions to build the system.

- Connection of IoT devices to the network
- Discovery of IoT devices
- Information acquisition of IoT devices
- Control to IoT devices
- Status change of IoT devices
- Disconnection of IoT devices from the network

However, in the case of a system that includes an EV, the configuration is "device (charger/discharger) + EV", and the configuration to be considered is different from that of ordinary IoT devices, as shown in Fig. 2.

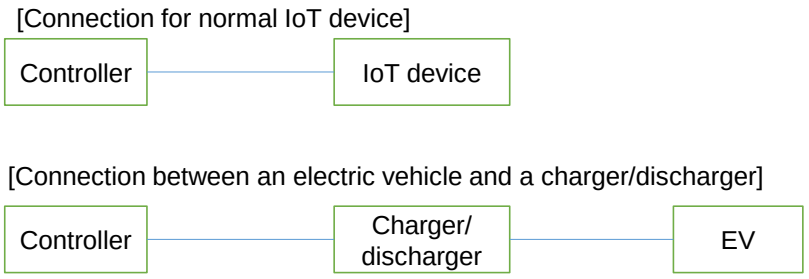
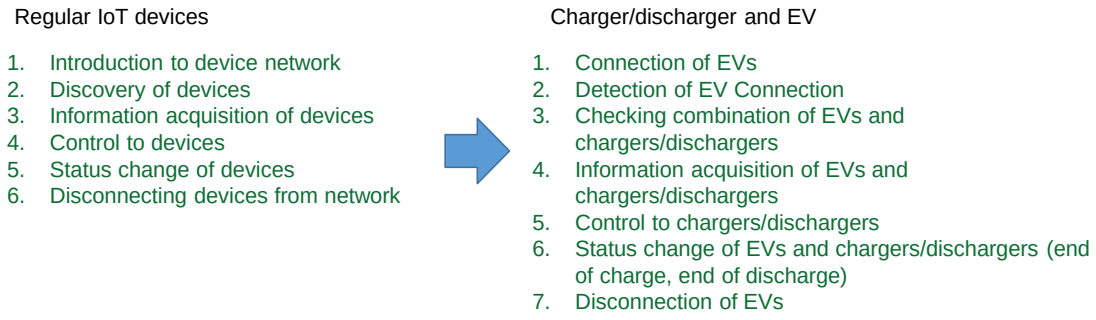


Fig. 2 Configuration differences between IoT device and EV

One difference from the identification of IoT devices by controllers is that controllers not only identify chargers/dischargers, but may also specify EVs. In the system envisioned in this document, when "specifying an EV", it is necessary to identify the EV connected to the charger/discharger, which is the direct control target of the controller.

Therefore, due to the difference in system configuration, the process of connecting/disconnecting EVs and confirming the combination of EVs and chargers/dischargers is necessary, where it is not with normal IoT devices.



First, we sort the use cases into those that require confirmation of the combination of an EV and charger/discharger and those that do not.

2.2 Case study of use cases

2.2.1 Cases specifying chargers/dischargers

The following applications can be assumed for information acquisition and control by specifying a charger/discharger

- Application assuming that only one charger/discharger is installed in a single-family home.
- For cases where multiple chargers/dischargers are installed, priority is given to controlling charging and discharging from an energy perspective, such as during peak shaving and the execution of VPP services, and there is no need to be aware of the owners of the EVs.
- Cases to control charging/discharging using an app that performs user authentication, etc. In this case, the app can respond as long as the charger/discharger can be specified, and there is no need to specify the EVs.

2.2.2 Cases specifying EVs

On the other hand, for information acquisition and control by specifying an EV, the following applications are assumed

- When linking with applications that perform operations by specifying cars, such as dispatch management systems used for sharing cars, rental cars, company cars, etc.
- When prioritizing the order of charging according to the remaining battery capacity of EVs
- When EVs have to be distinguished into those that can be controlled by discharge and those that cannot, based on the authority of the owner of the EVs, assuming VPP, etc., in an environment where company-owned and privately-owned vehicles are mixed.

Chapter 3 Basic sequence

3.1 Basic Concept

Basically, the service is realized by combining the seven types of processes shown in Chapter 2. Therefore, in this chapter, we sort the sequences into those that require confirmation of the combination of EVs and charger/discharger and those that do not. A list that outlines the sequences created in this chapter is shown in Table 1.

Table 1 Sequence overview

	Cases where identification is not required for both EVs and users (enough to distinguish charger/discharger)	Cases requiring EV identification (Cases that specify and control EVs)
3.2 Connection of EVs	1. Checking connection with EVs (C) 2. Notification of network connection to the ECHONET side (E)	
3.3 EV connection detection through service notification	1. Connecting EVs and chargers/dischargers (C) 2. Charger/discharger notifies ECHONET side that EVs are connected (E)	1. Connecting EVs and chargers/dischargers (C) 2. Linking EVs and chargers/dischargers *A) Linking using external devices (such as a smartphone)* *B) Linking by charger/discharger (C -> E)* *C) Linking at the EV side* 3. Charger/discharger notifies that EVs are connected to the ECHONET side (E)
3.4 Remote monitoring (“operation mode setting” and “remaining stored electricity of vehicle mounted battery”)	1. Sending a request to set an “operation mode” and acquire the “remaining battery capacity to the charger/discharger” specified by the application (E -> C) 2. Aquiring “remaining stored electricity of vehicle mounted battery” from EVs (C -> E) 3. Responding to an application with “operation mode setting” and “remaining stored electricity of vehicle mounted battery”	1. The application decides which EVs to acquire information from, and selects the chargers/dischargers that the EVs are connected to. 2. Sending a request to set an “operation mode” and acquire the “remaining stored electricity of vehicle mounted battery” to the charger specified by the application (E -> C) 3. Aquiring remaining capacity from EVs (C -> E) 4. Responding to an application with operation mode settings and remaining battery capacity
3.5 Remotely controlling charger/discharger (start charging)	1. Executing charge control for the charger specified by the application (E -> C) 2. Starting charging using EVs	1. Determining the EV to be controlled and selecting the charger that the EV is connected to. 2. Executing charge control for the corresponding charger from the application (E -> C) 3. Starting charging using EVs

3.6 Remotely controlling charger/discharger (start discharging)	1. Executing discharge control for the charger/discharger specified by the application (E -> C) 2. Starting discharging using EVs	1. Determining the EV to be controlled and selecting the charger/discharger that the EV is connected to. 2. Executing discharge control for the corresponding charger/discharger from the application (E -> C) 3. Starting discharging using EVs
3.7 Remotely controlling charger/discharger (controlling charging electric power/current)	1. Executing charge electric power/current control for the charger specified by the application (E -> C) 2. Starting charging using EVs	1. Determining the EV to be controlled and selecting the charger that the EV is connected to. 2. Executing charge control for the corresponding charger from the application (E -> C) 3. Starting charging using EVs
3.8 Change on EV and charger/discharger status (end of charge, end of discharge)	1. Making sure that the charger/discharger has finished charging/discharging. 2. Notifying that the charger/discharger has finished charging/discharging. 3. Notifying the application that the status of the corresponding charger/discharger has changed.	1. Making sure that the charger/discharger has finished charging/discharging. 2. Notifying that the charger/discharger has finished charging/discharging. 3. Notifying the application that the status of the corresponding charger/discharger has changed. 4. EVs connected to the charging setting status
3.9 Disconnection of EVs	1. Processing between EVs and chargers/dischargers when disconnecting vehicle 2. Notifying vehicle connection and chargeable/dischargeable status	1. Processing between EVs and chargers/dischargers when disconnecting vehicle 2. Notifying vehicle connection and chargeable/dischargeable status 3. (The application determines which EVs have disconnected from charger/discharger identifier)

(E): Contents specified by ECHONET Lite, (C): Contents specified by CHAdeMO, (No mark): Other (other means)

For use cases where each EV is not required to be identified, the sequence is described in the following sections.

In addition, standard specifications for linking EVs to chargers/dischargers do not exist at this moment, therefore various methods may be possible for the case of EV identification. For this reason, we will not organize them into a sequence, but show examples of how to link EVs and chargers/dischargers in Chapter 4.

3.2 Connection of EVs

This shows the sequence of events when the EV is connected to the charger/discharger.

1. Connecting cables between EVs and chargers/dischargers
2. Controllers periodically aquire the “vehicle connection and chargeable/dischargeable status” of charger/discharger (or “vehicle connection and chargeable status” in the case of a charger). If the acquired value is “undetermined”, the controller sends a write request to the corresponding charger/discharger to “confirm the vehicle connection”.
3. When “vehicle connection and chargeable/dischargeable status” values are changed, the charger/discharger notifies the ECHONET Lite network of the status change via multicast.

Fig. 3 shows the sequence when EV is connected. Note that the sequence shown in Fig. 3 does not necessarily show in time-series order, as explained above.

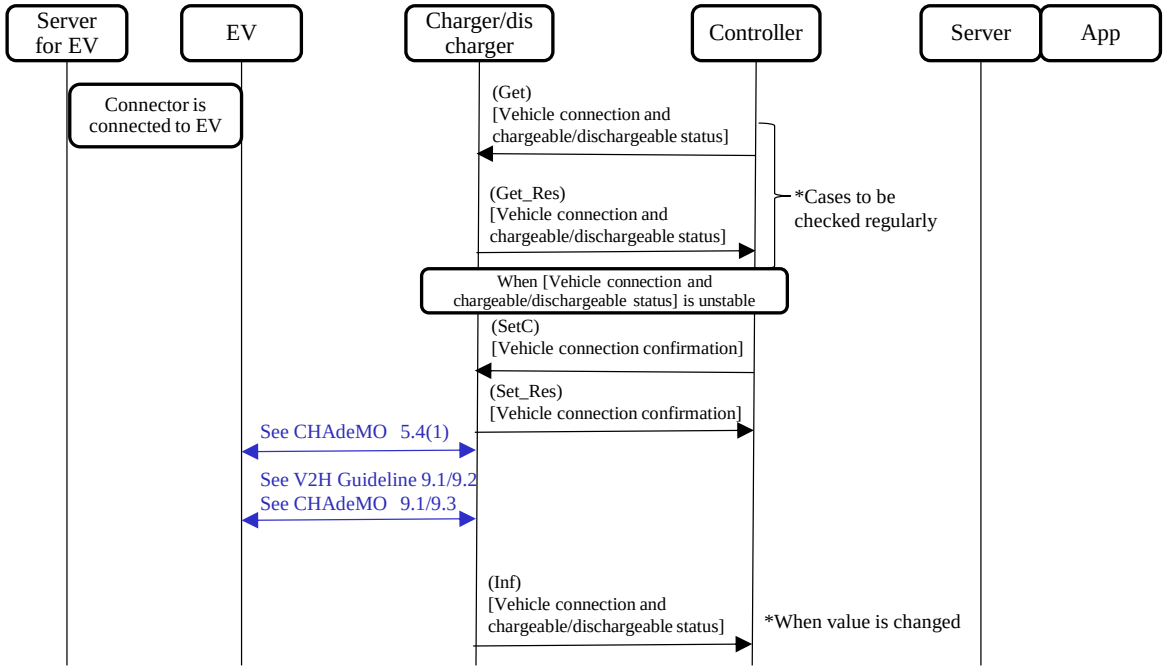


Fig. 3 Sequence when an EV is connected

Note that there is a difference in meaning between “simply having the cable connected to the EV” and “whether or not the charger/discharger recognizes it as ‘connected’”. In this guideline, “connected” indicates that the charger/discharger recognizes it as “connected”. The way to recognize as “connected” depends on the implemented specifications of the charger/discharger.

3.3 EV connection detection and service notification

The following figure shows the sequence from the detection of the connection of the charger/discharger with the EV to the transmission of information about the connection of the EV and the charginger/discharger to the application on the server..

1. When the charger/discharger detects that the cable has been connected to the EV according to the procedure described in Section 0, it sends a notification that “vehicle connection and chargeable/dischargeable status” is connected via multicast to the network connected to the charger/discharger. By receiving the notification, the controller aquires information about the connection between the EV and the charger/discharger.
2. Alternatively, the controller aquires information on the connection between the EV and the charger/discharger by periodically aquiring the value of the “vehicle connection and chargeable/dischargeable status” of the charger/discharger.
3. The controller sends the ID that identifies the charger/discharger and the “vehicle connection and chargeable/dischargeable status” of the corresponding charger/discharger to the server. By aquiring this information, the server aquires information on the connection status of the EV to the charger/discharger and chargeable/dischargeable status.

Fig. 4 shows the sequence above.

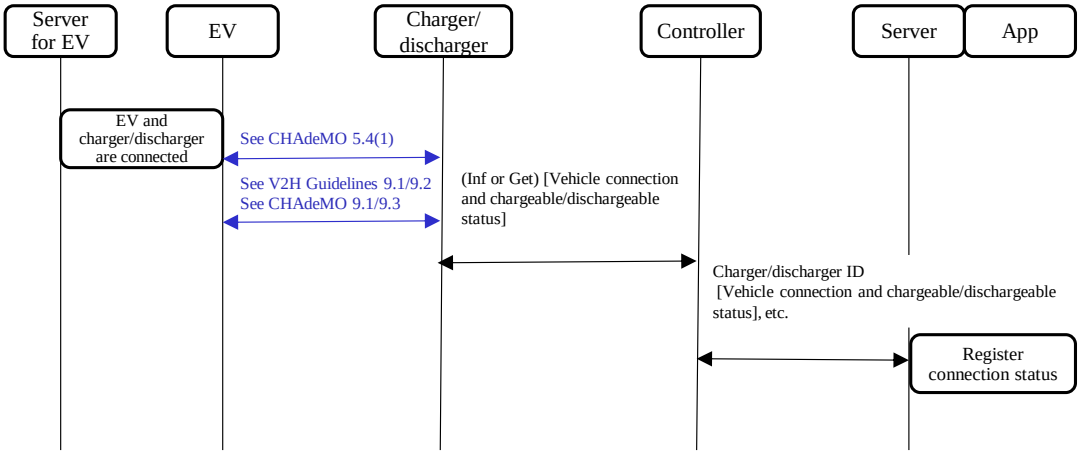


Fig. 4 Sequence for registering a device to a service

As shown in 2.2, there are cases where it is necessary to know the linkage between the chargers/dischargers and the EVs (which EV is connected to which charger).

3.4Remote monitoring (“operation mode setting” and “remaining stored electricity of vehicle mounted battery”)

The following shows the sequence of events when the controller remotely monitors the charger/discharger. As information for remote monitoring, this section will use the “operation mode setting”, which is information held by the charger/discharger, and the “remaining stored electricity of vehicle mounted battery”, which is information held by the EV, as examples.

1. The controller sends a request to the charger/discharger to aquirethe “operation mode setting” and the “remaining stored electricity of vehicle mounted battery”.
2. When CAN communication with the EVs is being performed regarding the “remaining stored electricity of vehicle mounted battery”, such as when the battery is currently being charged or discharged, the charger/discharger responds to the controller with the “remaining stored electricity of vehicle mounted battery” aquired from the EV and the “operation mode setting”. If the EV and the charger/discharger are connected but not communicating via CAN, the charger/discharger responds to the controller with the “remaining stored electricity of vehicle mounted battery” last aquired from the EV and the “operation mode setting”. If the charger/discharger does not detect a connection with the EV, the charger/discharger cannot respond with information about the “remaining stored electricity of vehicle mounted battery” of the EV. Therefore, only the “operation mode setting” is sent to the controller in the form of a “response-not-possible” response.

Fig. 5 shows the sequence of the status in which CAN communication is being performed, while Fig. 6 shows the sequence when the charger/discharger does not detect the connection with the EV, although it does not perform CAN communication. Fig. 7 shows the sequence when the charger/discharger does not detect a connection with the EV.

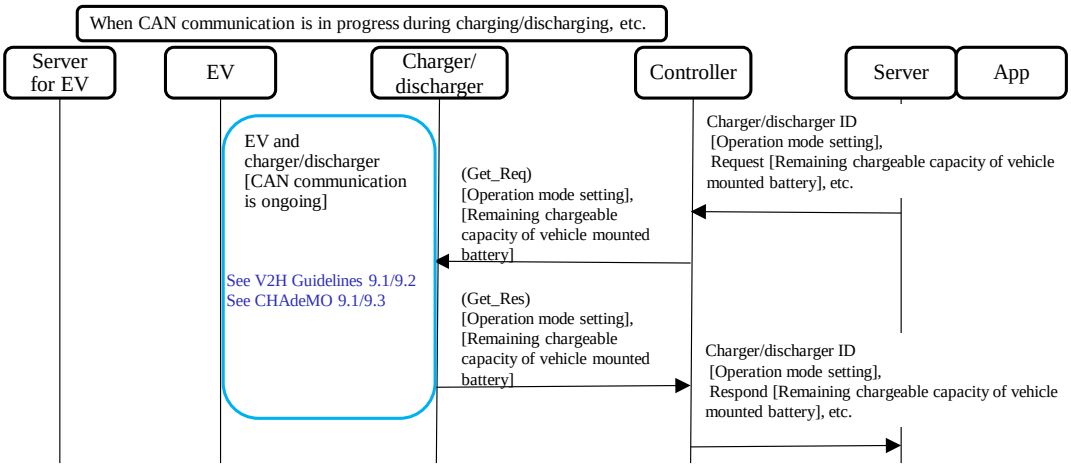


Fig. 5 Sequence during remote monitoring (1)

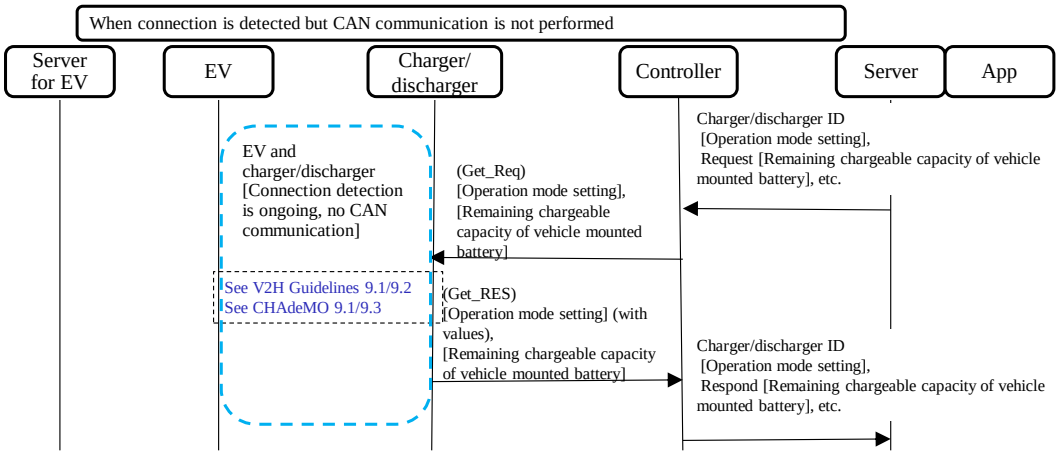


Fig. 6 Sequence during remote monitoring (2)

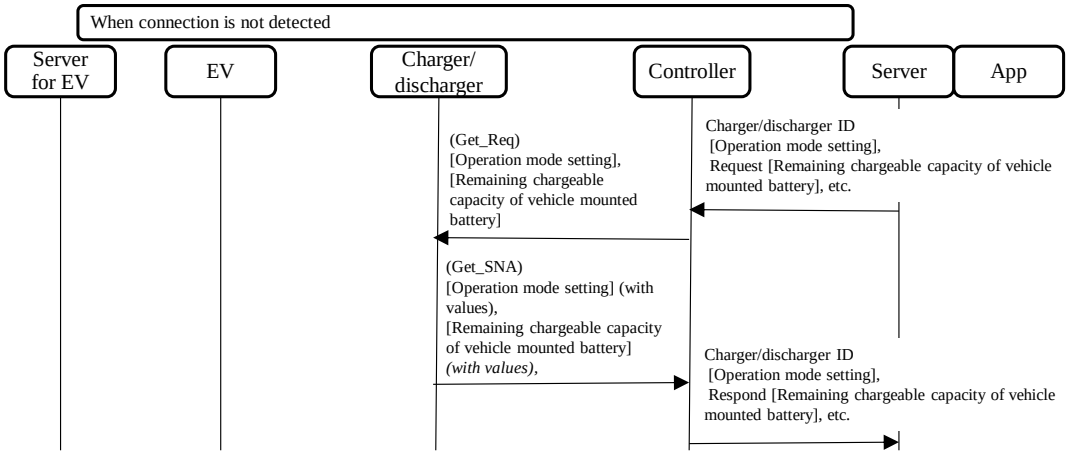


Fig. 7 Sequence during remote monitoring (3)

3.5 Remotely controlling the charger/discharger (start charging)

The sequence in which the controller starts charging of the charger / discharger is shown below..

1. The controller aquires the “vehicle connection and chargeable/dischargeable status” of the charger/discharger, and sends a write request to the charger/discharger to the “operation mode setting property” as charge, if it is ready to charge.
2. The charger/discharger will not start charging even if it receives a write request for charging when it is unable to do so due to a condition such as not detecting a connection to the EV.
3. Charger/discharger requests the EV to start charging.
4. When charging starts, the charger/discharger notifies the ECHONET Lite network via multicast that the “operation mode setting” has been changed to “charging”, if “operation mode setting” is changed to “charging”.
5. Because the controller may not be able to receive the above multicast notification ,it sends a read request for the “operation mode setting” to the corresponding charger/discharger, after sending a write request, in order to check whether the control is being performed normally.

Fig. 8 shows the sequence above.

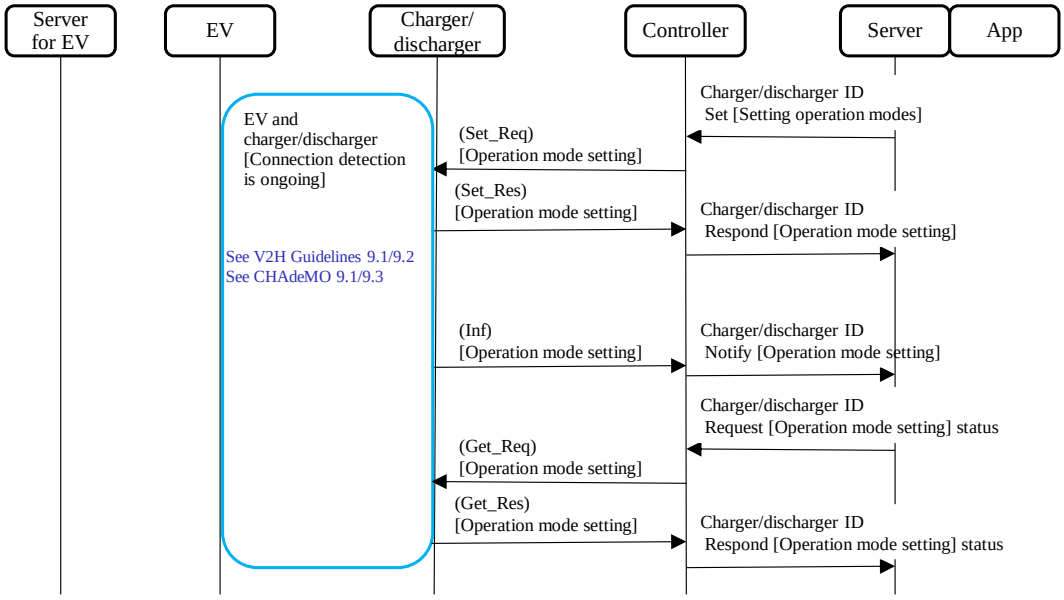


Fig. 8 Sequence at the start of charging

3.6 Remotely controlling the charger/discharger (start discharge)

The sequence in which the controller starts discharging of the charger / discharger is shown below.

1. The controller aquires the “vehicle connection and discharge/dischargeable status” of the charger/discharger and sends a write request to the charger/discharger to the “operation mode setting property” as discharge, if it is ready to discharge.
2. The charger/discharger will not start discharging even if it receives a write request for discharging when it is unable to do so due to a condition such as not detecting a connection to the EV.
3. Charger/discharger requests the EV to start discharging.
4. When discharging starts, the charger/discharger notifies the ECHONET Lite network via multicast that the “operation mode setting” has been changed to “discharging”, if “operation mode setting” is changed to “discharging”.
5. Because the controller may not be able to receive the above multicast notification, it sends a read request for the “operation mode setting” to the corresponding charger/discharger, after sending a write request, in order to check whether the control is being performed normally.

Fig. 9 shows the sequence above.

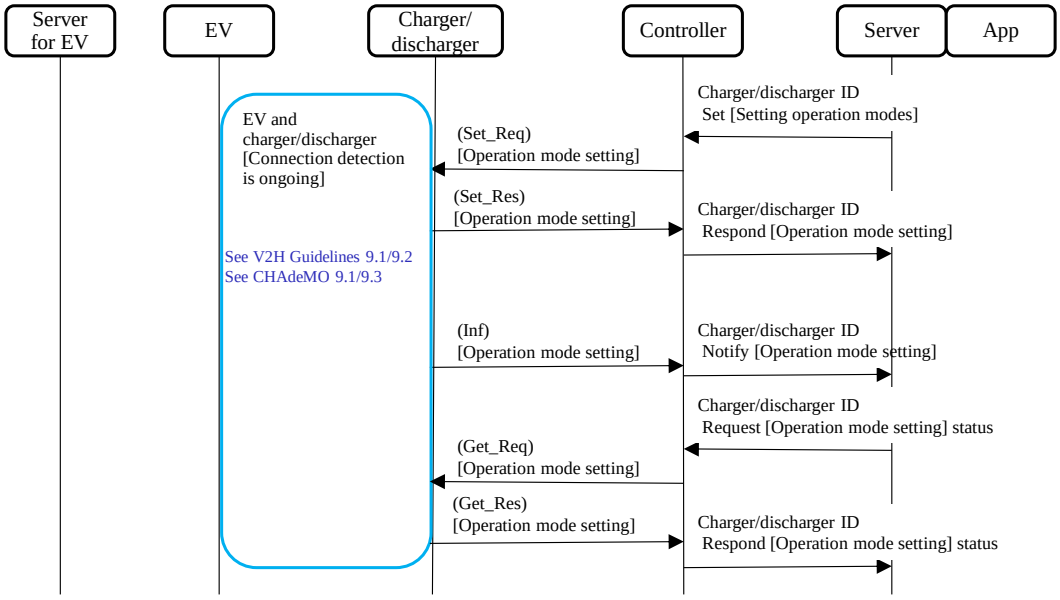


Fig. 9 Sequence at the start of discharging

3.7 Remotely controlling the charger/discharger (controlling charging electric power/current)

The sequence in which the controller performs the control to change the charging electric power, charging current, discharging electric power, and discharging current for the charger/discharger is shown below. In addition, although it is described in the case of changing electric power or current value related to “charging”, it is acceptable to replace charging with the parameters related to the respective target discharge, when controlling discharge-related issues.

1. The controller sends a write request to the charger/discharger to set the “charge electric power setting value”.
2. When CAN communication is being performed with the EV while it is currently being charged or discharged, etc., if the charger/discharger receives a “charge electric power setting value” or “charge current setting value” that is in range of the “charge current upper limit” specified by the EV, it charges the battery at the specified value. However, if a “charge electric power setting value” or “charge current setting value” that exceeds the “charge current upper limit" specified by the EV is received, charging is performed in the range of “charge current upper limit”. (Sequence shown in Fig. 10)
3. When the EV and the charger/discharger are connected but not communicating with the EV via CAN, and when the EV and the charger/discharger are not connected, the charger/discharger retains the received “charge electric power setting value” or “charging current setting” values. At the point when charging is performed after EV and the charger/discharger start CAN communication, a check is made to see if the value is in the range of “charge current upper limit” specified by the EV, and if it is in the range of “charge current upper limit”, charging is performed at the specified value. If the current is out of the range of “charge current upper limit”, then charging is performed in the range of “charge current upper limit”. (Sequence shown in Fig. 11)
4. The controller sends a read request for the “charge electric power setting value” to the corresponding charger/discharger, after sending a write request, to check whether the control is being performed normally.

Fig. 10 and Fig . 11 show the above sequence.

In general, the charger/discharger can charge and discharge in the range of “charge current upper limit" and “discharge current upper limit" specified by the EV. For example, if “charge current upper limit specified by the EV” > “charge current upper limit specified by the controller”, the EV is basically charged at the current value of the charge current setting value. If “charge current upper limit specified by the EV” < “charge current upper limit specified by the controller”, the EV is basically charged at the current value of the charge current setting value.

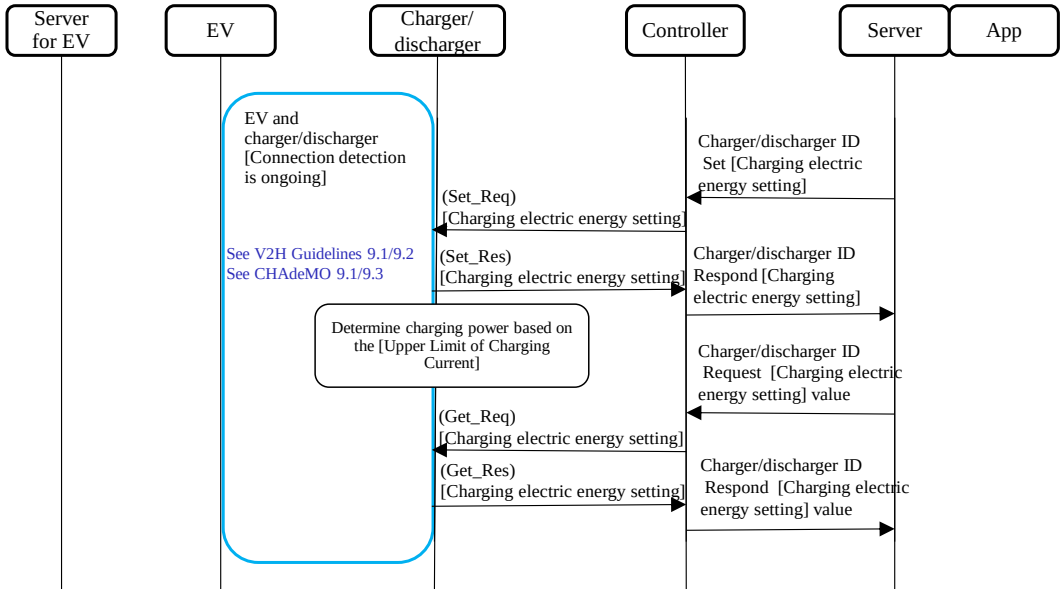


Fig. 10 Sequence at the setting of charging electric power (1)

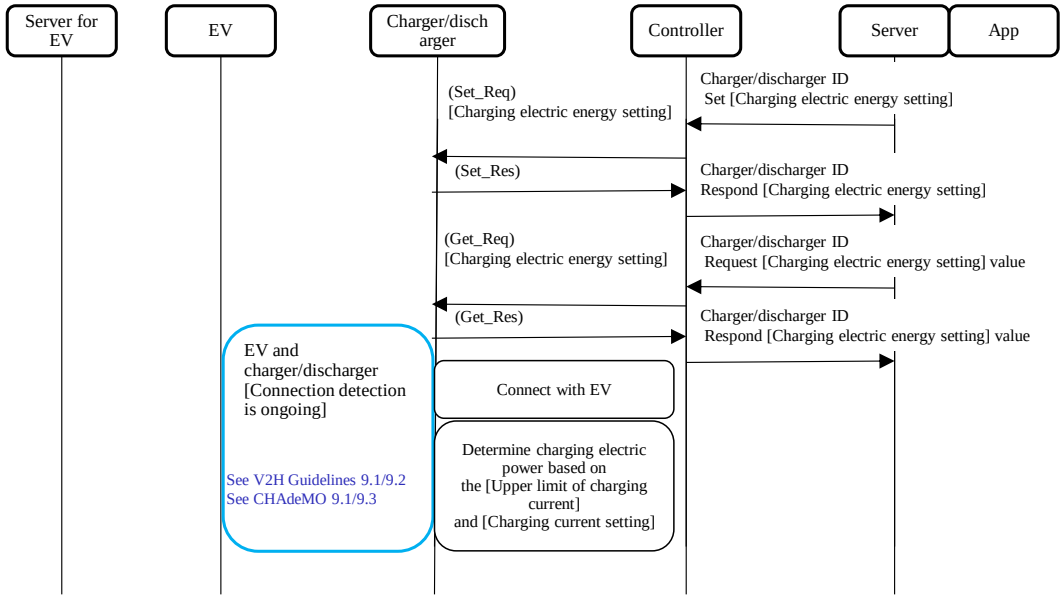


Fig . 11 Sequence at the setting of charging electric power (2)

3.8 Change of EV and charger/discharger status (end of charge, end of discharge)

The following shows the sequence of events when the charger/discharger determines that it has finished charging and/or discharging. In this section, the examples are described for cases related to “end of charge”, but similar sequences can be used for end of discharge. Cases in which charging ends include “when the EV’s vehicle mounted battery becomes fully charged” and “when the controller has specified the amount of charging/discharging to the charger/discharger in advance and the specified amount of charging (or discharging) has been reached”.

1. When the charger/discharger has determined that charging has ended, it instructs the EV to terminate charging/discharging control. Or, when the end of charging/discharging control is received from the EV, it is treated as the end of charging.
2. The charger/discharger notifies the ECHONET Lite network via multicast that the operation mode setting has been changed to “stop” or “standby”. Whether the operation mode setting is “stop” or “standby” depends on the status of the charger/discharger at the time. The timing of the multicast communication to the ECHONET Lite network and the communication regarding the termination of charging/discharging control of the above-mentioned EV depend on the implemented specifications of the charger/discharger.
3. When the controller receives the notification of the operation mode setting, it notifies the controller server that the operation mode setting has been changed along with the ID of the charger/discharger.

Fig. 12 shows the sequence above.

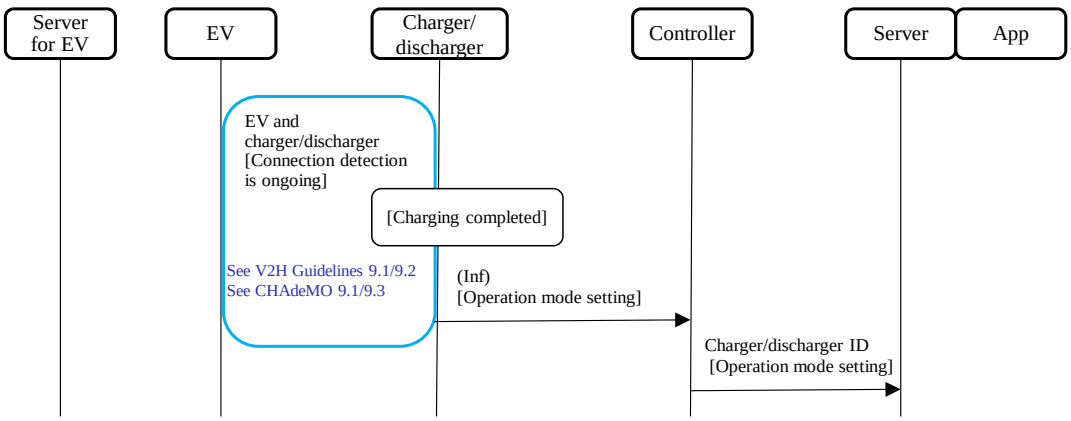


Fig. 12 Sequence at the end of charging

3.9 Disconnection of EVs

The sequence for detaching the cable from the EV and disconnecting the EV from the charger/discharger is shown below. Basically, the cable is not attached to or detached from the EV while charging or discharging.

1. When the charger/discharger detects that an EV has been disconnected, it changes the value of the “vehicle connection and chargeable/dischargeable status” to “vehicle not connected” and notifies the change to the ECHONET Lite network via multicast.
2. When the controller receives the notification of the “vehicle connection and chargeable/dischargeable status”, it notifies the controller server that the "vehicle connection and chargeable/dischargeable status" is "vehicle not connected" along with the ID of the charger/discharger.

Fig. 13 shows the sequence above.

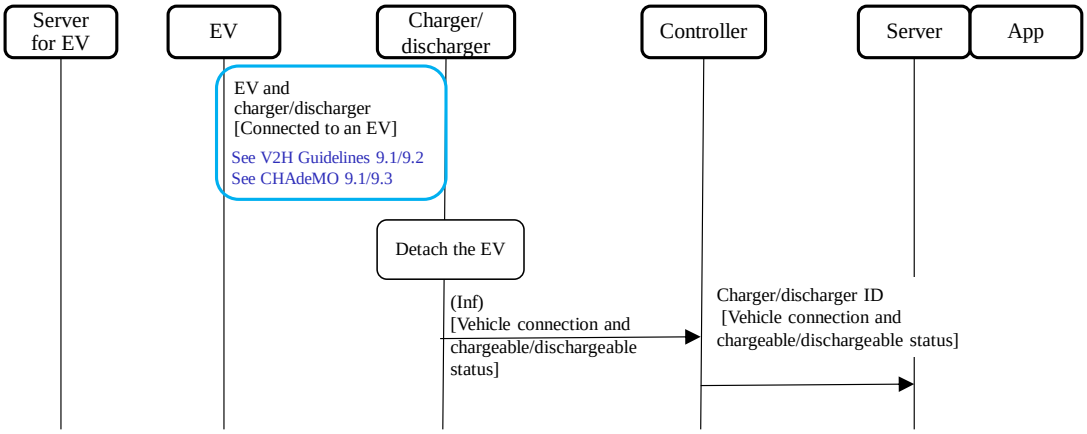


Fig. 13 Sequence for disconnecting EVs

Chapter 4 Policy for Linking EVs and Chargers/Dischargers

4.1 Basic Concept

Examples of the way how an application on a controller or server can identify the combination of EVs and chargers/dischargers are as follows.

- A charger/discharger links the ID of the EV with its own ID.
  - Charger/discharger acquires the vehicle ID from the EVs, using the CHAdeMO protocol.
  - Input the ID of the EV into the charger/discharger, using an external terminal, etc.
- An external terminal links the ID of the EV with the ID of a charger/discharger.
- An EV links its own ID with the ID of a charger/discharger.

In this chapter, we organize the examples of linking an EV to a charger/discharger in each case and the communication specifications between devices that should be referred to. Note that the definitions of vehicle IDs specified in CHAdeMO and ECHONET Lite are not specified in these guidelines.

4.2 When a charger/discharger links an EV to itself (1)

Fig. 14 shows a configuration example when the charger/discharger acquires the vehicle ID from an EV using the CHAdeMO protocol.

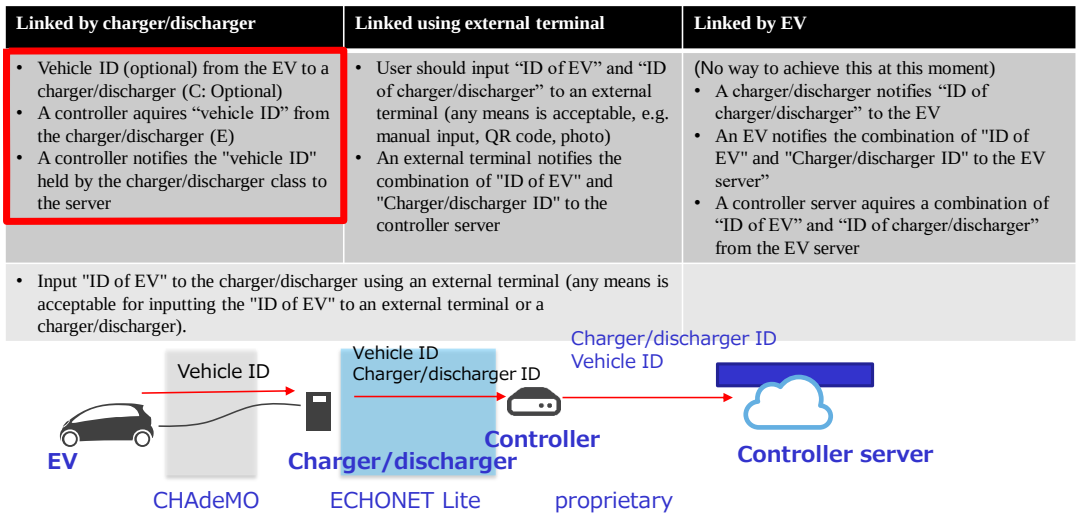


Fig. 14 Linking an EV and a charger/discharger by a charger/discharger (1)

The charger/discharger acquires the vehicle ID from the EV. By acquiring the “vehicle ID property” from the charger/discharger, the controller can link the EV to the charger/discharger.

The communication specifications between devices are shown in Table 2.

Table 2 List of communication specifications to be used between devices

Between devices	Communication specifications
Between EV and charger/discharger	• CHAdeMO Standard Specifications • Charging and Discharging System Guidelines for Electric Vehicles V2H DC Version
Between charger/discharger and controllers	• ECHONET Lite specification • APPENDIX Detailed Requirements for ECHONET Device objects • Interface Specification for Application Layer Communication between EV Chargers/Charger-Dischargers and HEMS Controllers
Between controller and server	• Basically assumed to be operated by the same vendor • Communication specifications are proprietary

4.3 When a charger/discharger links an EV to itself (2)

Fig. 15 shows a configuration example when a charger/discharger aquires the EV's ID from an EV using the external terminal.

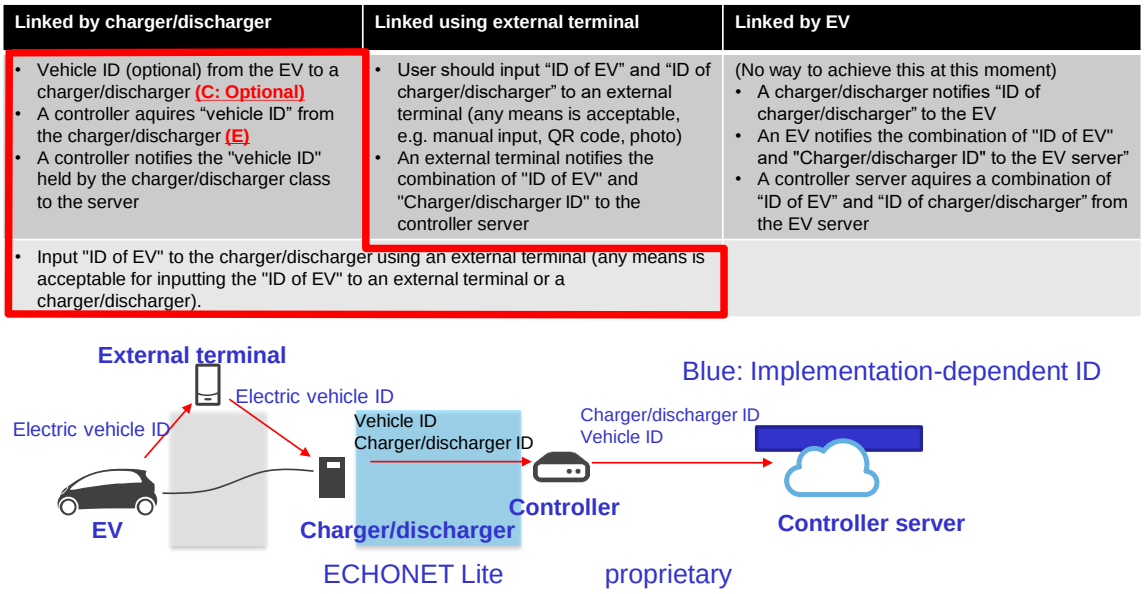


Fig. 15 Linking an EV and a charger/discharger by a charger/discharger (2)

External terminal aquires the ID of the EV from the EV. The "ID of the EV" shown here are possible in the following cases:

- ID held by an EV
- ID to be assigned to the EV by the service provider introducing the external terminal (e.g., QR code to be pasted to the EV and read by the external terminal, or ID to be manually entered into the external terminal)

The external terminal sets the ID of the EV to the charger/discharger. The setting method

shall be specified between the external terminal and the charger/discharger. By acquiring the "vehicle ID property" for the charger/discharger, the controller can determine the connection between the charger/discharger and the EV.

Communication specifications between devices are shown below.

Table 3 List of communication specifications to be used between devices

Between devices	Communication specifications
Between EV and external terminal	・ Follow the system specifications for installing an external terminal. ・ An EV and an external terminal may not always communicate with each other. For example, manual input, reading QR codes pasted to the EV, etc.
Between external terminal and charger/discharger	・ Follow the system specifications for installing an external terminal. ・ An External terminal and the charger/discharger may not always communicate with each other. For example, it may be assumed to display on an external terminal and manually input the data into the charger.
Between charger/discharger and controller	・ ECHONET Lite specification ・ APPENDIX Detailed Requirements for ECHONET Device Objects ・ Interface Specification for Application Layer Communication between EV Chargers/Charger-Dischargers and HEMS Controllers
Between controller and server	・ Basically assumed to be operated by the same vendor ・ Communication specifications are proprietary

4.4 When linking using an external terminal

Fig. 16 shows a configuration example when linking, after an external terminal aquires the IDs of the charger/discharger and the EV.

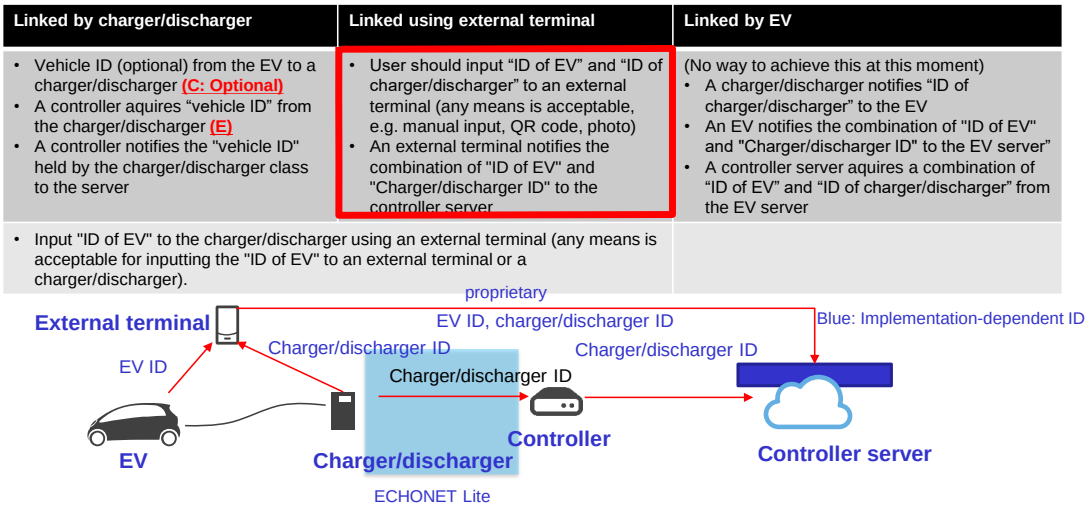


Fig. 16 Linking an EV and a charger/discharger using an external terminal

The external terminal aquires the ID of the EV from the EV, and the ID of the charger/discharger from the charger/discharger. The "ID of the EV" and the "ID of the charger/discharger" shown here are possible in the following cases:

- ID held by the EV, ID held by the charger/discharger
- ID to be assigned to the EV and charger/discharger by the service provider introducing the external terminal (e.g., QR code to be pasted to the EV and read by the external terminal, or ID to be manually entered into the external terminal)

Based on the ID aquired from the EV and the charger/discharger, the external terminal can determine the connection between the charger/discharger and the EV.

Communication specifications between devices are shown below.

Table 4 List of communication specifications to be used between devices

Between devices	Communication specifications
Between EV and external terminal	・ Follow the system specifications for installing an external terminal. ・ An EV and an external terminal may not always communicate with each other. For example, manual input, reading QR codes pasted to the EV, etc.
Between external terminal and charger/discharger	・ Follow the system specifications for installing an external terminal. ・ An External terminal and the charger/discharger may not always communicate with each other. For example, manual input, reading QR codes pasted to the EV, etc.
Between external terminal and controller server	・ Basically assumed to be operated by the same vendor ・ Communication specifications are proprietary
Between charger/discharger and controller	・ ECHONET Lite specification

	• APPENDIX Detailed Requirements for ECHONET Device Objects • Interface Specification for Application Layer Communication between EV Chargers/Charger-Dischargers and HEMS Controllers
Between controller and controller server	• Basically assumed to be operated by the same vendor • Communication specifications are proprietary

4.5 When linking with an EV

Fig. 17 shows a configuration example of an EV that aquires the ID of the charger/discharger by some kind of communication specification. At present, there are no regulations for communication specifications, so it is an assumption to be defined in the future.

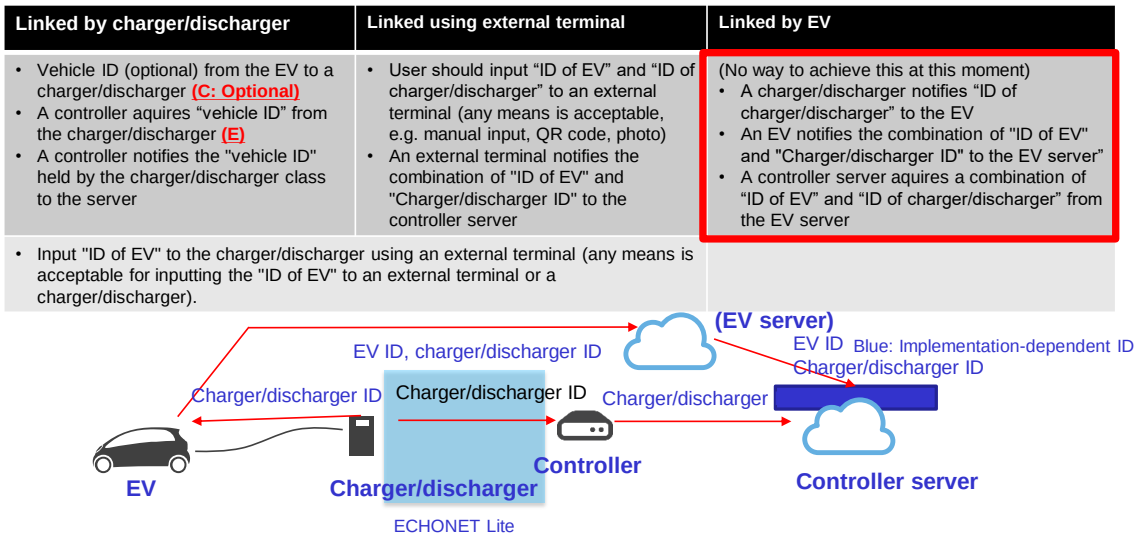


Fig. 17 Linking an EV and a charger/discharger by EV

The EV aquires the ID of the charger/discharger from the charger/discharger, the EV determines the link between the EV and the charger/discharger, and then uploads the information to the EV server. The controller server aquires the information regarding the combination of the charger/discharger and the EV, for example, using the ID of the charger/discharger as a key. The "EV ID" and the "charger/discharger ID" shown here are possible in the following cases:

- ID held by the EV, ID held by the charger/discharger

Based on the ID aquired from the EV and the charger/discharger, the EV can determine the connection between the charger/discharger and the EV.

Communication specifications between devices are shown below.

Table 5 List of communication specifications to be used between devices

between devices	Communication specifications
Between EV and charger/discharger	• Currently no corresponding specifications

Between EV and EV server	・ Basically assumed to be operated by the same vendor ・ Communication specifications are proprietary
Between charger/discharger and controller	・ ECHONET Lite specification ・ APPENDIX Detailed Requirements for ECHONET Device Objects ・ Interface Specification for Application Layer Communication between EV Chargers/Charger-Dischargers and HEMS Controllers
Between controller and controller server	・ Basically assumed to be operated by the same vendor ・ Communication specifications are proprietary
Between EV server and controller server	・ Connection based on the contract between the two companies ・ Communication specifications (including security) are formulated based on services under mutual agreement.