Interface Specifications

for Application Layer Communication between Bidirectional High-Voltage Smart Electric Energy Meters and Controllers

Version 1.00

Revision record

Date	Version	Explanation
Apr. 21, 2023	Ver.1.00 Draft	
Nov. 28, 2023	Ver.1.00	・Reviewed section numbers of 2.4.3, 2.4.4, 2.4.5, and 2.4.6. ・2.3 Table 2-4 Added comments of *2 and *3 to the Remarks. Changed “measured instantaneous currents” to “measured instantaneous currents 2” ・ ・2.4.1 Changed description for the successive requests3.3.3, 3.3.5 （2） Added a description for the sequence

CONTENTS

FIGURES

TABLES

Chapter 1 Introduction

This document specifies matters necessary for ensuring interoperability between the products of different manufacturers in connection with application layer communication between bidirectional high-voltage smart electric energy meters and controllers, using ECHONET Lite as an application protocol via UDP/IPv6 communications.

This document covers bidirectional high-voltage smart electric energy meters installed for customers supplied with power of 6.6kV or higher. Low-voltage smart electric energy meters installed for customers supplied with 400V or less shall comply with “Interface Specification for Application Layer Communication between Low-Voltage Smart Electric Energy Meters and Controllers.”

As shown in Fig 1-1, there are two configurations for bidirectional high-voltage smart electric energy meter devices to install the bidirectional high-voltage smart electric energy meter class to the ECHONET Lite node: (1) the bidirectional high-voltage smart electric energy meter class is installed alone or (2) the bidirectional high-voltage smart electric energy meter class is installed in combination with the high-voltage smart electric energy meter class.

In this document, only the requirements for the bidirectional high-voltage smart electric energy meter class are described. For the low-voltage smart electric energy meter class, refer to the Interface Specifications for Application Layer Communication between High-voltage Smart Electric Energy Meters and EMS Controllers.

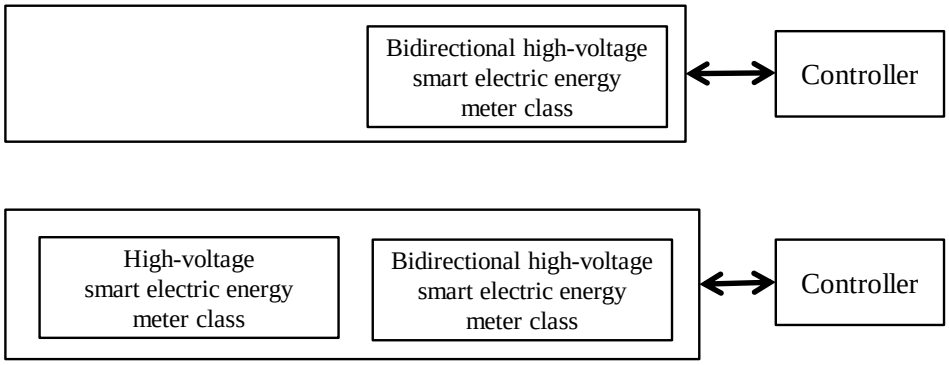

Fig 1-1 Connection configuration

Fig 1-2 shows the assumed network stack for operating ECHONET Lite in this document. ECHONET Lite will be operated as an application protocol via UDP/IPv6.

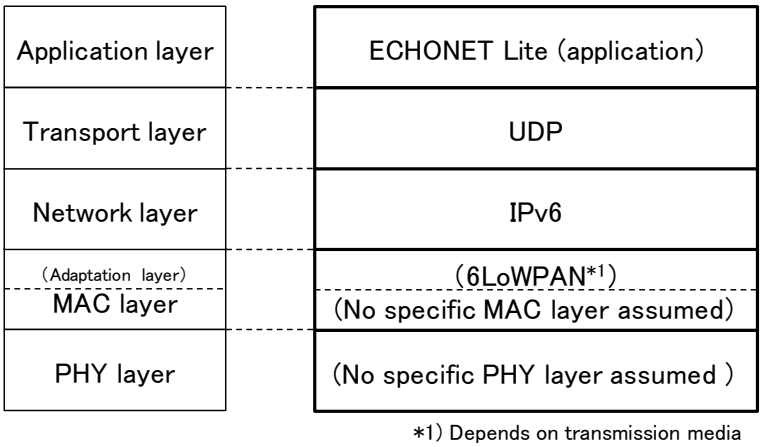

Fig 1-2 Assumed network stacks

Connection processing specific to each communication medium necessary before the start of ECHONET Lite communication is outside the scope of this document. In this document, application communication using ECHONET Lite will be described on the assumption that connection processing specific to those communication media is complete. Basically, it is assumed that IPv6 will be used, and installation of IPv6 is thus mandatory. Depending on the transmission media used, installation of IPv4 will also be possible as an option, in line with market trends.

1.1. Definitions

Controller	A node that communicates with a bidirectional high-voltage smart electric energy meter in ECHONET Lite in this document.
Bidirectional high-voltage smart electric energy meter	A node that communicates with a controller and provides various electric power data in ECHONET Lite in this document.

1.2. Reference Standards and documents

Standards referenced in this document are as stated below. Matters not specifically explained in this document shall be as described in each document.

[EL] ECHONET Lite Specification Version 1.01 or later

[ELOBJ] ECHONET Specification APPENDIX: Detailed Requirements for ECHONET Device Objects, Release R or later

[HVAIF] Interface Specification for Application Layer Communication between High-voltage Smart Electric Energy Meters and EMS Controllers

In addition, Chapter 6 of the ECHONET Lite System Design Guidelines [ELSDG] describes installation examples and expected behavior that may cause interoperability problems with respect to this document, and should be kept in mind when designing bidirectional high-voltage smart electric energy meters and controllers.

[ELSDG] ECHONET Lite System Design Guidelines

Chapter 2 Application Layer

ECHONET Lite [EL] will be adopted as the application layer. Nodes based on the descriptions in this document must support all mandatory functions specified in [EL].

2.1. ECHONET Objects (EOJ)

ECHONET objects (EOJ) installed in bidirectional high-voltage smart electric energy meters and controllers shall be as shown below. Refer to [HVAIF] for the EOJ if a bidirectional high-voltage smart electric energy meter installs a high-voltage smart electric energy meter class.

Table 2-1 ECHONET objects (EOJ)

	Group code	Class code	Class name	Instance code*
Bidirectional high-voltage smart electric energy meter	0x02	0x8F	Bidirectional high-voltage smart electric energy meter	0x01
	0x0E	0xF0	Node profile	0x01
Controller	0x05	0xFF	Controller	0x01
	0x0E	0xF0	Node profile	0x01

*The instance code shall be fixed at 0x01.

2.2. ECHONET Lite Services (ESV)

Bidirectional high-voltage smart electric energy meters and controllers shall support the ECHONET Lite service codes (ESV) shown in Table 2-2.

Table 2-2 ECHONET Lite service codes (ESV)

Service code (ESV)	ECHONET Lite service content	Symbol
0x51	Property value write “response-not-possible” response	SetC_SNA
0x52	Property value read “response-not-possible” response	Get_SNA
0x61	Property value write request (response required)	SetC
0x62	Property value read request	Get
0x71	Property value write response	Set_Res
0x72	Property value read response	Get_Res
0x73	Property value notification	INF

ESV = 0x60, 0x63, 0x6E, 0x74, 0x7A, 0x7E, 0x50, 0x53, and 0x5E shall not be subject to certification tests based on this document.

2.3. Object-Specific ECHONET Properties (EPC)

Bidirectional high-voltage smart electric energy meters shall install the ECHONET properties (EPC) of device objects shown in Table 2-3 and Table 2-4. ECHONET properties (EPC) of node profile objects shall only support mandatory properties.

Table 2-3 Device objects (super class requirements)

Property name	EPC	Access rule		Announcement at status change	Remarks
		Get	Set		
Installation location	0x81	◎	◎	◎	
Standard version information	0x82	◎	－	－	
Fault status	0x88	◎	－	◎	
Manufacturer code	0x8A	◎	－	－	
Production number	0x8D	○	－	－	To make it easier to judge whether a meter should be replaced due to malfunction or inspection expiry, it is recommended that this number be unique to each device in corresponding to the manufacturer code.
Current time setting	0x97	◎	●	－	
Current date setting	0x98	◎	●	－	
Status change announcement property map	0x9D	◎	－	－	
Set property map	0x9E	◎	－	－	
Get property map	0x9F	◎	－	－	

◎: mandatory, ○: optional, －: not supported, ●: installation prohibited

Table 2-4 Device objects (bidirectional high-voltage smart electric energy meter class requirements)

Property name	EPC	Access rule		Announcement at status change	Remarks
		Get	Set		
Operation status	0x80	◎	—	◎	
Route B identification number	0xC0	◎*1	—	—	
One-minute measured cumulative amount of active electric energy (normal and reverse directions)	0xD0	◎	—	—	
Coefficient	0xD3	◎	—	—	
Multiplying factor for coefficient	0xD4	◎	—	—	
Fixed date	0xE0	◎	—	—	
Day for which the historical data of measured cumulative amounts of electric energy is to be retrieved	0xE1	◎	◎	—	
Measured cumulative amount of active electric energy (normal and reverse directions)	0xE2	◎	—	—	*2
Cumulative amounts of active electric energy at fixed time (normal and reverse directions)	0xE3	◎	—	—	*2
Measurement data of cumulative amount of active electric energy for power factor measurement (normal and reverse directions)	0xE4	○	—	—	*3
Number of effective digits for cumulative amount of active electric energy	0xE5	◎	—	—	
Unit for cumulative amounts of active electric energy	0xE6	◎	—	—	
Historical data of measured cumulative amount of active electric energy (normal direction)	0xE7	◎	—	—	

Historical data of measured cumulative amount of active electric energy (reverse directions)	0xE8	◎	—	—	*2
Monthly maximum electric power demand (normal and reverse directions)	0xC1	◎	—	—	*2
Cumulative maximum electric power demand (normal and reverse directions)	0xC2	○			*3
Electric power demand at fixed time (30-minute average electric power) (normal and reverse directions)	0xC3	◎	—	—	*2
Number of effective digits of electric power demand	0xC4	◎	—	—	
Unit of electric power demand	0xC5	◎	—	—	
Historical data of measured electric power demand (normal direction)	0xC6	◎	—	—	
Historical data of measured electric power demand (reverse direction)	0xC8	◎	—	—	*2
Unit of cumulative maximum electric power demand	0xC7	○	—	—	
Measurement data of reactive electric energy (lag) for power factor measurement (normal and reverse directions)	0xCA	○	—	—	*3
Measurement data of cumulative amount of reactive electric energy (lag) at fixed time for power factor measurement (normal and reverse directions)	0xCB	○	—	—	*3
Number of effective digits for measurement data of cumulative amount of reactive electric energy	0xCC	○	—	—	
Unit of measurement data of cumulative amount of reactive electric energy	0xCD	○	—	—	

Historical data of measurement data of cumulative amount of reactive electric energy (lag) for power factor measurement (normal direction)	0xCE	○	－	－	
Historical data of measurement data of cumulative amount of reactive electric energy (lag) for power factor measurement (reverse direction)	0xCF	○	－	－	
Instantaneous measured electric energy	0xEA	◎	－	－	
Instantaneous measured currents 2	0xEB	◎	－	－	
Historical data of measured cumulative amount of active electric energy 2 (normal and reverse directions)	0xED	◎	－	－	
Day for which the historical data of measured cumulative amounts of electric energy is to be retrieved 2	0xEF	◎	◎	－	

◎: mandatory, ○: optional, －: not supported

Notes: *1 Bidirectional high-voltage smart electric energy meters in Japan must be equipped with this property.

*2 If there is no reverse direction measurement function, the reverse direction measurement value shall be 0xFFFFFFFE.

*3 If there is no reverse direction measurement function when this property is installed, the reverse direction measurement value shall be 0xFFFFFFFE.

2.4. Application Operation

2.4.1. Successive Requests

Bidirectional high-voltage smart electric energy meters and controllers shall operate on the basis of request and response sets; one request sent receives one response in return. If the controller receives a response in response to a request, it can make the next request without waiting for the response wait timer to timeout. On the other hand, if no response to the request is received, the controller can make another request after the response waiting timer timeout. Note that the "successive requests" means continuous requests made from the same device.

*Note that in the case of high-voltage smart electric energy meters installed by a General Electricity Transmission and Distribution Utility in Japan that comply with "The EMS/aggregation controller smart meter Route B (high -voltage smart electric energy meter) operational guidelines [Version 2.0 or later]", communication is supported with up to three controllers (communication frequency: 1 unit x 10[sec], 1 unit x 30[sec], and 1 unit x 30[min]) on a best-effort basis.

2.4.2. Response Wait Timer

The response wait timer values of a controller if a bidirectional high-voltage smart electric energy meter is responding to a request from a controller shall be based on Table 2-5. Here, the response wait timer value defines the waiting time that the controller waits until it can make the next request, after the bidirectional high-voltage smart electric energy meter does not respond to the request from the controller.

Table 2-5 Response wait timer values of controllers

Parameter name	Value	Remarks
Response wait timer 1	At least 40 [sec]	When the OPC value is 1, except when the EPC is as shown below. ・EPC=0xE7 Historical data of measured cumulative amount of active electric energy (normal direction) ・EPC=0xE8 Historical data of measured cumulative amount of active electric energy (reverse direction) ・EPC=0xC6 Historical data of measured electric power demand (normal direction)

		・EPC=0xC8 Historical data of measured electric power demand (reverse direction) ・EPC=0xCE Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction) ・EPC=0xCF Historical data of measurement data of cumulative amount of reactive electric energy (lag) for power factor measurement (reverse direction) ・EPC=0xED Historical data of measured cumulative amount of active electric energy 2 (normal direction, reverse direction)
Response wait timer 2	At least 180 [sec]	When the OPC value is 2 or more, or when the EPC is as shown below. ・EPC=0xE7 Historical data of measured cumulative amount of active electric energy (normal direction) ・EPC=0xE8 Historical data of measured cumulative amount of active electric energy (reverse direction) ・EPC=0xC6 Historical data of measured electric power demand (normal direction) ・EPC=0xC8 Historical data of measured electric power demand (reverse direction) ・EPC=0xCE Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction) ・EPC=0xCF Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (reverse direction) ・EPC=0xED Historical data of measured cumulative amount of active electric energy 2 (normal direction, reverse direction)

The response wait timer values of a bidirectional high-voltage smart electric energy meter when a controller is responding to a request from it shall be based on Table 2-6. Here, the response timer value defines the waiting time before the bidirectional high-voltage smart electric energy meter can make the next request, if there is no response received from the controller to respond to a request from bidirectional high-voltage smart electric energy meter.

Table 2-6 Response wait timer values of bidirectional high-voltage smart electric energy meters

Parameter name	Value	Remarks
Response wait timer	At least 20 [sec]	

2.4.3. Retransmission Processing

When bidirectional high-voltage smart electric energy meters and controllers are subject to a timeout at application (ECHONET Lite) level, data shall not be retransmitted within the frame of the same transaction ID (TID).

2.4.4. Processing Target Property Counter (OPC) Value

Bidirectional High-voltage smart electric energy meters must be capable of supporting OPC value 12 or more and controllers OPC value 3 or more. Note, however, that bidirectional high-voltage smart electric energy meters are not required to support two or more OPCs when receiving request messages, including EPCs, for the following: historical data of the measured cumulative amount of active electric energy (normal direction), historical data of the measured cumulative amount of active electric energy (reverse direction), historical data of the measured electric power demand (normal direction), historical data of the measured electric power demand (reverse direction), historical measurement data of the cumulative amount of reactive electric energy (lag) (normal direction), historical measurement data of the cumulative amount of reactive electric energy (lag) for the power factor measurement(reverse direction) to be described in 3.3.3, and historical data of the measured cumulative amount of active electric energy 2 (normal direction, reverse direction) to be described in 3.3.5.The maximum OPC values shown in this section are the values needed to process the messages shown in Chapter 3, and do not constitute requests to bidirectional high-voltage smart electric energy meters for a response to combinations of various properties up to OPC value 12.

Response to requests with more than one OPC value is given in the order of properties designated by EPC when the request was made.

2.4.5. Property Value Set Request

When a controller makes a SetC[0x61] request, a value outside the range of properties required by [ELOBJ] must not be set.

When a bidirectional high-voltage smart electric energy meter receives a SetC[0x61] request from a controller, a response shall be given with Set_Res[0x71] after the settings have been completely set. When the settings are outside the range and cannot be set, the response shall be SetC_SNA[0x51].

Therefore, when a controller receives Set_Res[0x71], set confirmation via Get[0x62] is not necessary.

2.5. Others

2.5.1. Treatment of Data Duplication

If a controller receives duplicated cumulative amounts of active electric energy at fixed time (normal and reverse directions), electric power demand at fixed time (30-minute average electric power) (normal and reverse directions), one-minute measured cumulative amount of active electric energy (normal and reverse directions), and measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal and reverse directions) from a bidirectional high-voltage smart electric energy meter at the same measurement time, the data arriving last shall be taken as correct.

Chapter 3 Standard Operation

In this Chapter, the standard operation between bidirectional high-voltage smart electric energy meters and controllers will be shown. Bidirectional high-voltage smart electric energy meters and controllers produced on the basis of this document must support the operation described in this Chapter.

Fig 3-1 illustrates a sequence of standard operations between a bidirectional high-voltage smart electric energy meter and a controller. Here, it shall be assumed that network connection processing in the lower layer between bidirectional high-voltage smart electric energy meters and controllers has been completed.

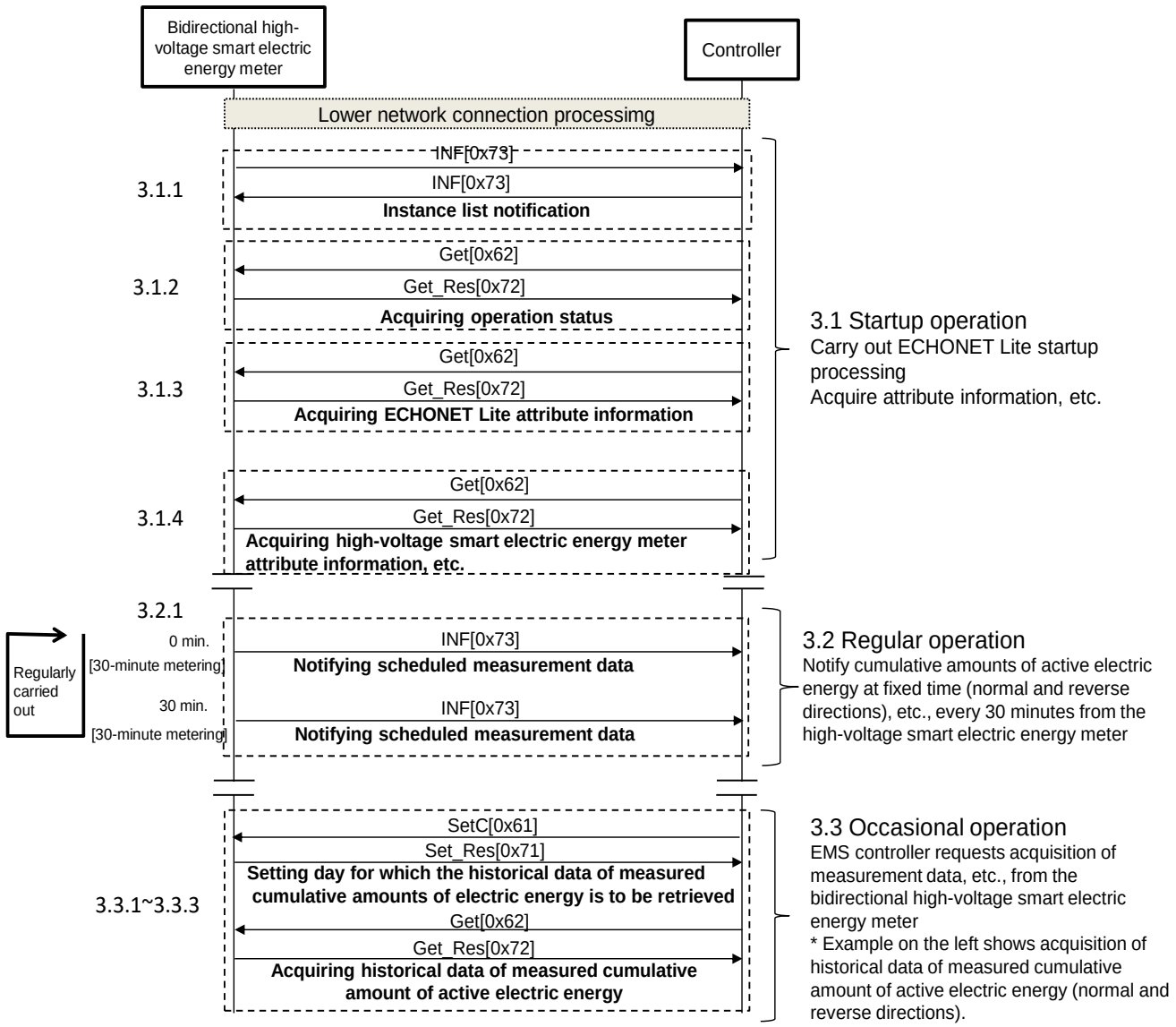

Fig 3-1 Example of standard operating sequence

3.1. Startup Operation

3.1.1. ECHONET Lite Node Startup Processing

After completing connection of lower layer network, the bidirectional high-voltage smart electric energy meter and the controller notify an instance list. If a bidirectional high-voltage smart electric energy meter device installs a high-voltage smart electric energy meter class, the bidirectional high-voltage smart electric energy meter class instance shall be stored before the high-voltage smart electric energy meter class instance in the instance list.

(1) Target properties (node profile objects)

- 0xD5: Instance list notification

3.1.2. Bidirectional High-Voltage Smart Electric Energy Meter Search Processing

In readiness for cases when the controller is unable to receive the instance list notification sent by the bidirectional high-voltage smart electric energy meter on startup, the controller implements the process of searching for the bidirectional high-voltage smart electric energy meter. Specifically, taking DEOJ as the bidirectional high-voltage smart electric energy meter class (instance code: 0x00) and EPC as the operation status, it sends a read request by multicast.

(1) Target properties (bidirectional high-voltage smart electric energy meter class)

- 0x80: Operation status

3.1.3. Acquiring ECHONET Lite Attribute Information

After receiving instance list notification from the bidirectional high-voltage smart electric energy meter, or after searching for the bidirectional high-voltage smart electric energy meter, the controller requests ECHONET Lite attribute information necessary for ECHONET Lite communication.

It is recommended that the controller confirms the Appendix Release No. and properties installed with the bidirectional high-voltage smart electric energy meter based on the ECHONET Lite attribute information, and makes requests in line with the installation status of the bidirectional high-voltage smart electric energy meter. The contents of this document shall apply to bidirectional high-voltage smart electric energy meters with Appendix Release No. R or later.

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

- 0x82: Standard version information
- 0x9D: Status change announcement property map
- 0x9E: Set property map
- 0x9F: Get property map

(2) Sequence

Fig 3-2 shows an example of the sequence for acquiring ECHONET Lite attribute information.

1. After receiving instance list notification from the bidirectional high-voltage smart electric energy meter, the controller requests target properties (combination and sequence may be arbitrary) via Get[0x62].
2. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res[0x72].

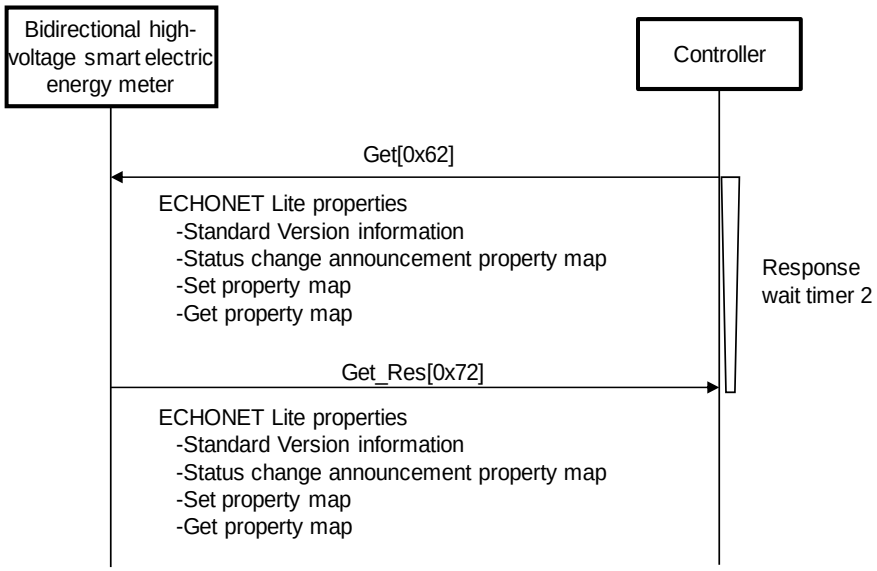

Fig 3-2 Example of sequence for acquiring ECHONET Lite attribute information

3.1.4 Acquiring Bidirectional High-Voltage Smart Electric Energy Meter Attribute Information, etc.

After acquiring ECHONET Lite attribute information from the bidirectional high-voltage smart electric energy meter, the controller requests attribute information, etc., from the bidirectional high-voltage smart electric energy meter. The attribute information, etc., of the bidirectional high-voltage smart electric energy meter may be re-acquired if necessary.

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

- 0x8D: Production number [optional property]
- 0xC0: Route B identification number
- 0xD3: Coefficient
- 0xD4: Multiplying factor for coefficient
- 0xE0: Fixed date
- 0xE5: Number of effective digits for cumulative amount of active electric energy
- 0xE6: Unit for cumulative amounts of active electric energy
- 0xC4: Number of effective digits of electric power demand
- 0xC5: Unit of electric power demand
- 0xC7: Unit of cumulative maximum electric power demand [optional property]
- 0xCC: Number of effective digits for measurement data of cumulative amount of reactive electric power consumption [optional property]
- 0xCD: Unit of measurement data of cumulative amount of reactive electric power consumption [optional property]

(2) Sequence

Fig 3-3 shows an example of the sequence for acquiring bidirectional high-voltage smart electric energy meter attribute information, etc.

1. After acquiring ECHONET Lite attribute information from the bidirectional high-voltage smart electric energy meter, the controller requests target properties (combination and sequence may be arbitrary) via Get[0x62].
2. The bidirectional high-voltage smart electric energy meters transmit the relevant property value via Get_Res[0x72]. If an uninstalled optional property is requested, the relevant property is transmitted via Get_SNA[0x52].

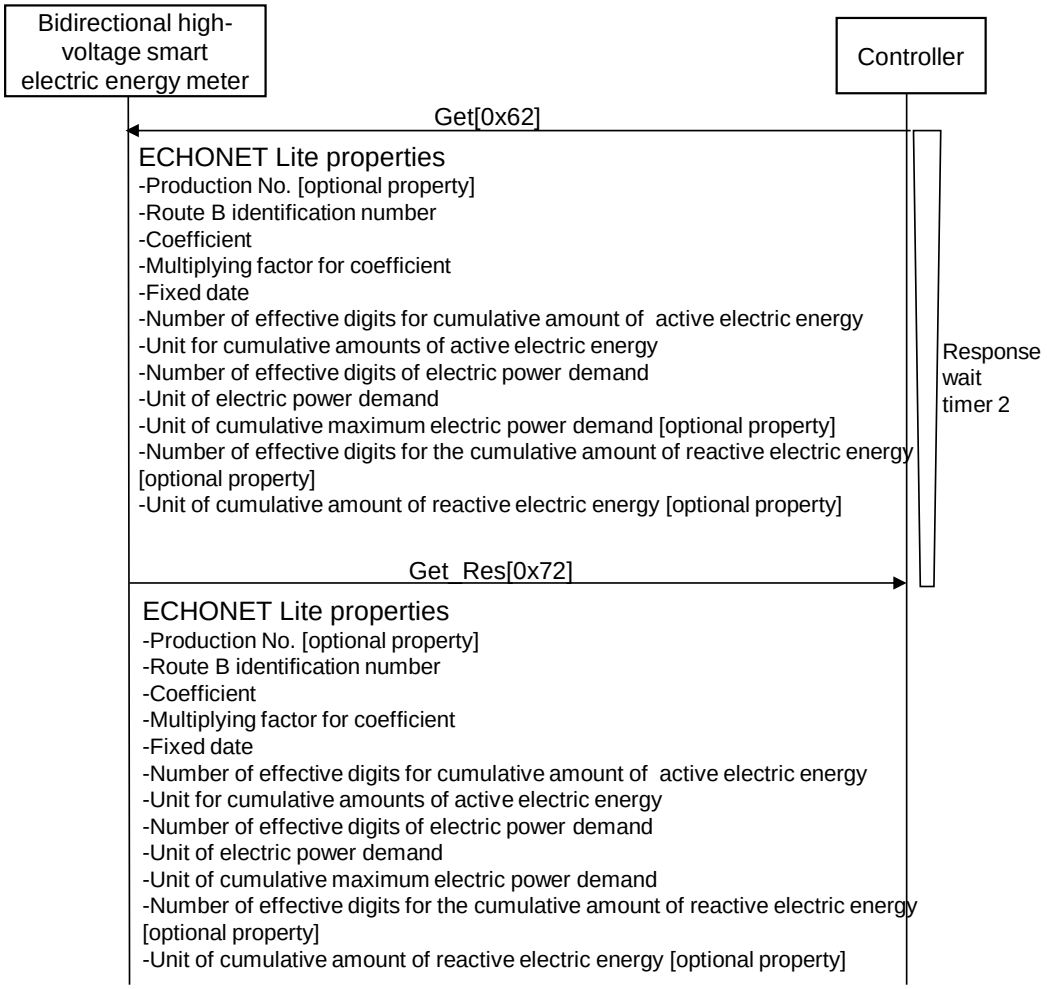

Fig 3-3 Example of sequence for acquiring bidirectional high-voltage smart electric energy meter attribute information, etc.

3.2. Regular Operation

3.2.1. Notifying Scheduled Measurement Data

The bidirectional high-voltage smart electric energy meter notifies the latest cumulative amounts of active electric energy at fixed time (normal, reverse directions), electric power demand at fixed time (30-minute average electric power energy) (normal, reverse directions), and measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions) to the controller within 5 minutes of 00 minutes and 30 minutes after every hour.

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

0xE3: Cumulative amounts of active electric energy at fixed time (normal, reverse directions)

0xC3: Electric power demand at fixed time (30-minute average electric power energy) (normal, reverse directions)

0xCB: Measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions) [optional property]

(2) Sequence

Fig 3-4 shows an example of the sequence for notification of cumulative amounts of active electric energy at fixed time (normal, reverse directions), electric power demand at fixed time (30-minute average electric power energy) (normal, reverse directions), and measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions).

1. The bidirectional high-voltage smart electric energy meter notifies target properties (combination and sequence may be arbitrary) to the controller by broadcast transmission via INF[0x73] within 5 minutes of 00 minutes and 30 minutes after every hour.

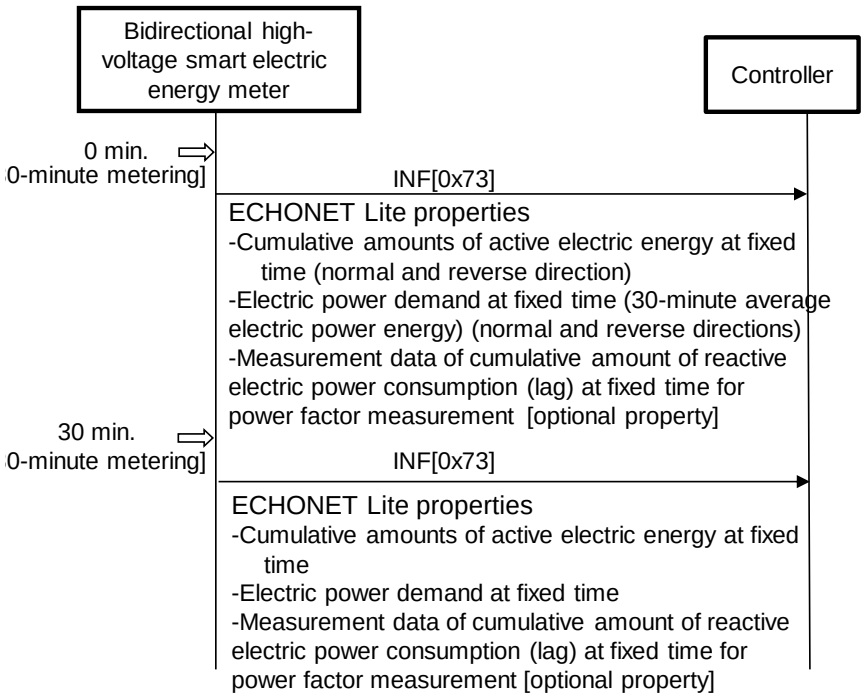

Fig 3-4 Example of sequence for notifying scheduled measurement data

3.3. Occasional Operation

3.3.1. Acquiring Scheduled Measurement Data

If necessary, the controller makes a request to the bidirectional high-voltage smart electric energy meter for cumulative amounts of active electric energy at fixed time (normal, reverse directions), electric power demand at fixed time (30-minute average electric power) (normal, reverse directions), and measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions). Normally, this is notified from the bidirectional high-voltage smart electric energy meter within 5 minutes of 00 minutes and 30 minutes after every hour as shown in 3.2.1. Therefore, this is used as a backup function in case data cannot be received due to temporary communication breakdown, etc.

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

- 0xE3: Cumulative amounts of active electric energy at fixed time (normal, reverse directions)
- 0xC3: Electric power demand at fixed time (30-minute average electric power) (normal, reverse directions)
- 0xCB: Measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions) [optional property]

(2) Sequence

Fig 3-5 shows an example of the sequence for acquiring cumulative amounts of active electric energy at fixed time (normal, reverse directions), electric power demand at fixed time (30-minute average electric power) (normal, reverse directions), and measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions).

1. If the controller is unable to receive cumulative amounts of active electric energy at fixed time (normal, reverse directions), electric power demand at fixed time (30-minute average electric power) (normal, reverse directions), and measurement data of cumulative amount of reactive electric power consumption (lag) at fixed time for power factor measurement (normal, reverse directions), it requests necessary data such as “Cumulative amounts of active electric energy at fixed time (normal, reverse directions)” via Get[0x62], targeting 05 minutes and 35 minutes after every hour or later.
2. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res [0x72]. If the normal value cannot be responded owing to a fault, Get_SNA[0x52] is transmitted.

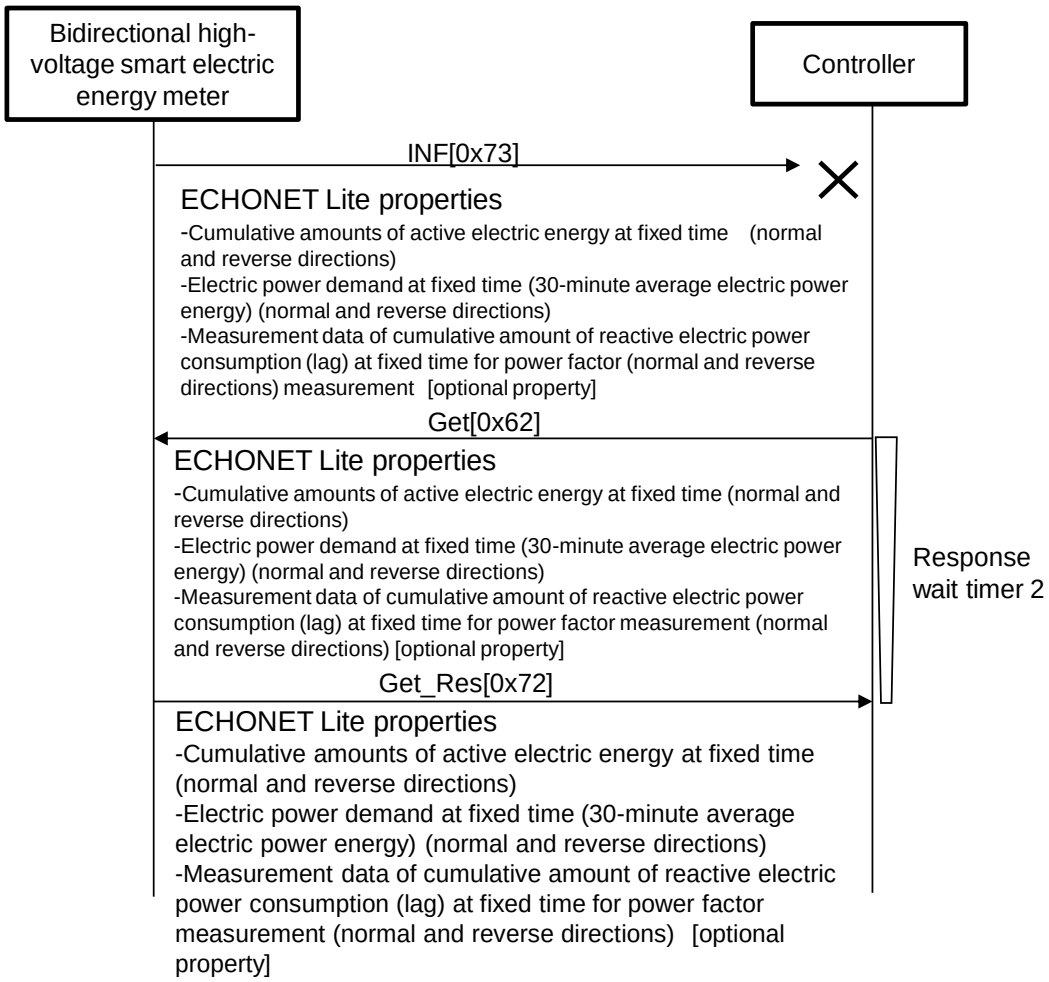

Fig 3-5 Example of sequence for acquiring scheduled measurement data

3.3.2. Acquiring Measurement Data from Bidirectional High-Voltage Smart Electric Energy Meters

If necessary, the controller requests measurement data from the bidirectional high-voltage smart electric energy meter.

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

- 0xE2: Measured cumulative amount of active electric energy (normal, reverse directions)
- 0xE4: Measurement data of cumulative amount of active electric energy for power factor measurement (normal, reverse directions) [optional property]
- 0xCA: Measurement data of reactive electric power consumption (lag) for power factor measurement (normal, reverse directions) [optional property]

(2) Sequence

Fig 3-6 shows an example of the sequence for acquiring measurement data from a bidirectional high-voltage smart electric energy meter.

1. The controller requests target properties (combination and sequence may be arbitrary) via Get[0x62].
2. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res[0x72].

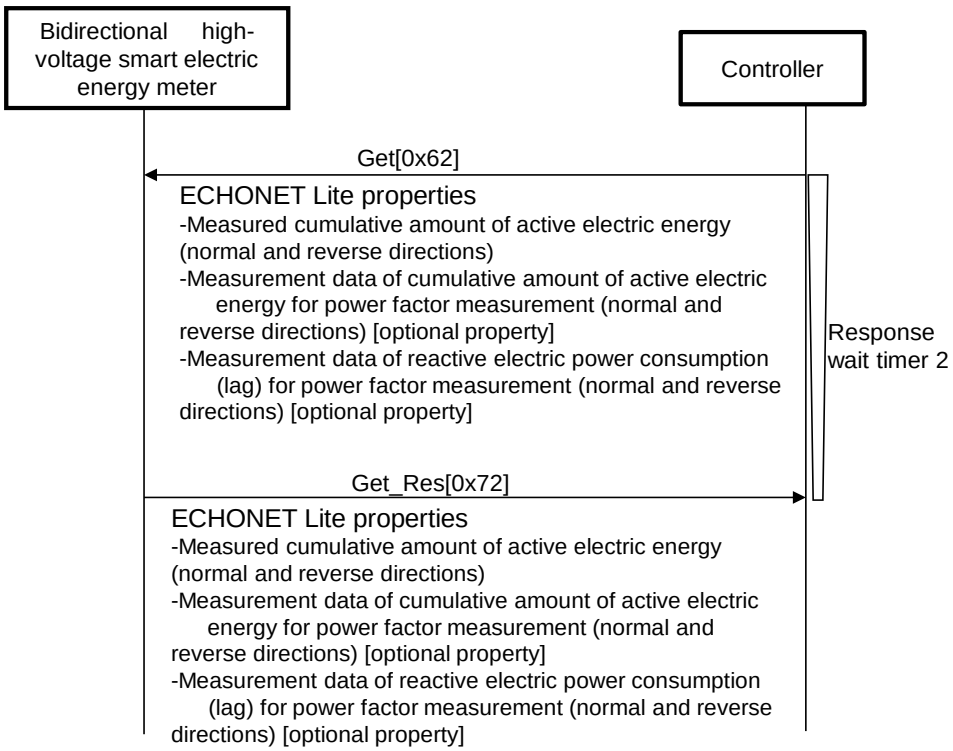

Fig 3-6 Example of sequence for acquiring measurement data from bidirectional high-voltage smart electric energy meters

3.3.3. Acquiring Historical Measurement Data (30-minute Value, 1-Day Basis)

If necessary, the controller requests historical data of measured cumulative amount of active electric energy (normal direction), historical data of measured cumulative amount of active electric energy (reverse direction), historical data of measured electric power demand (normal direction), historical data of measured electric power demand (reverse direction), historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction), and historical data of measurement data of cumulative amount of reactive electric power consumption

(lag) for power factor measurement (reverse direction).

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

- 0xE1: Day for which the historical data of measured cumulative amounts of electric energy is to be retrieved.
- 0xE7: Historical data of measured cumulative amount of active electric energy (normal direction)
- 0xE8 Historical data of measured cumulative amount of active electric energy (reverse direction)
- 0xC6: Historical data of measured electric power demand (normal direction)
- 0xC8: Historical data of measured electric power demand (reverse direction)
- 0xCE: Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction) [optional property]
- 0xCF: Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (reverse direction) [optional property]

(2) Sequence

Fig 3-7 shows an example of the sequence for acquiring historical data of measured cumulative amount of active electric energy (normal direction), historical data of measured cumulative amount of active electric energy (reverse direction), historical data of measured electric power demand (normal direction), historical data of measured electric power demand (reverse direction), historical data of measured cumulative amounts of reactive electric energy (lag) for power factor measurement (normal direction), and historical data of measured cumulative amounts of reactive electric energy (lag) for power factor measurement (reverse direction).

1. If the controller needs the “Historical data of measured cumulative amount of active electric energy (normal direction)”, “Historical data of measured cumulative amount of active electric energy (reverse direction)”, “Historical data of measured electric power demand (normal direction)”, “Historical data of measured electric power demand (reverse direction)”, “Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction)”, and “Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (reverse direction)” it sets the time needed in “Day for which the historical data of measured cumulative amounts of electric energy is to be retrieved” and makes a request via SetC[0x61].
2. After completing the set of the settings (EDT) designated by SetC[0x61], the bidirectional high-voltage smart electric energy meter responds with Set_Res[0x71].

If the designated settings (EDT) cannot be set because they are outside the range of the properties, etc., it responds with SetC_SNA[0x51].

3. After confirming the receipt of Set_Res[0x71], the controller requests one of "Historical data of measured cumulative amount of active electric energy (normal direction)", "Historical data of measured cumulative amount of active electric energy (reverse direction)" "Historical data of measured electric power demand (normal direction)", "Historical data of measured electric power demand (reverse direction)", "Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction)", or "Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (reverse direction)" via Get[0x62].
4. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res[0x72]. When it does not have the measurement data for the time in question, the data will be void, and the value will be given as 0xFFFFFFFE. If the normal value cannot be responded owing to a fault, Get_SNA[0x52] is transmitted.
5. If the controller also needs other historical data, it requests one of "Historical data of measured cumulative amount of active electric energy (normal direction)", "Historical data of measured cumulative amounts of active electric energy (reverse direction)", "Historical data of measured electric power demand (normal direction)", "Historical data of measured electric power demand (reverse direction)", "Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (normal direction)", or "Historical data of measurement data of cumulative amount of reactive electric power consumption (lag) for power factor measurement (reverse direction)" via Get[0x62].
6. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res[0x72]. When it does not have the measured electric energy for the time in question, the data will be void, and the value will be given as 0xFFFFFFFE. If the normal value cannot be responded owing to a fault, Get_SNA[0x52] is transmitted.

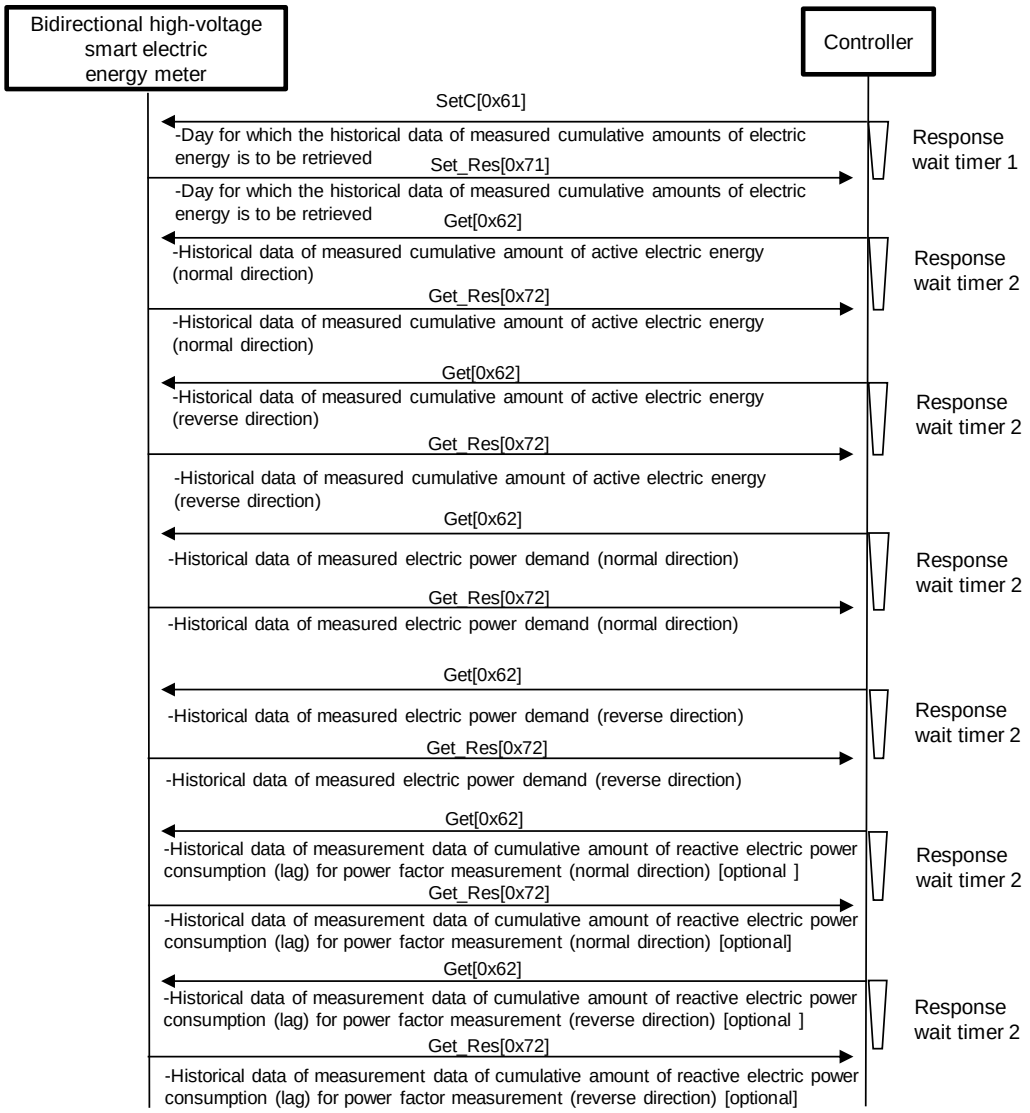

Fig 3-7 Example of sequence for acquiring historical measurement data

Here, in Sequences (4) and (6), the controller shall use the historical data, only after checking if the first date and time of the received historical data of measured cumulative amounts of electric energy is identical with the date and time set in the Sequence (1).

Considering that a conflict may occur if two or more controllers run sequence (1) at the same time, countermeasures should be taken by adjusting the timing of the initial run and retry of sequence (1) or by limiting the number of retries.

3.3.4 Acquiring one-minute measured cumulative amount of electric energy

If necessary, the controller makes a request to the bidirectional high-voltage smart electric energy meter for 1-minute value.

(1) Target property (bidirectional high-voltage smart electric energy meter objects)

・0xD0: One-minute measured cumulative amount of active electric energy (normal and reverse directions)

(2) Sequence

Fig 3-8 shows an example of the sequence for acquiring one-minute measured cumulative amount of electric energy (normal and reverse directions).

1. The controller requests the target properties via (Get[0x62]).
2. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res[0x72].

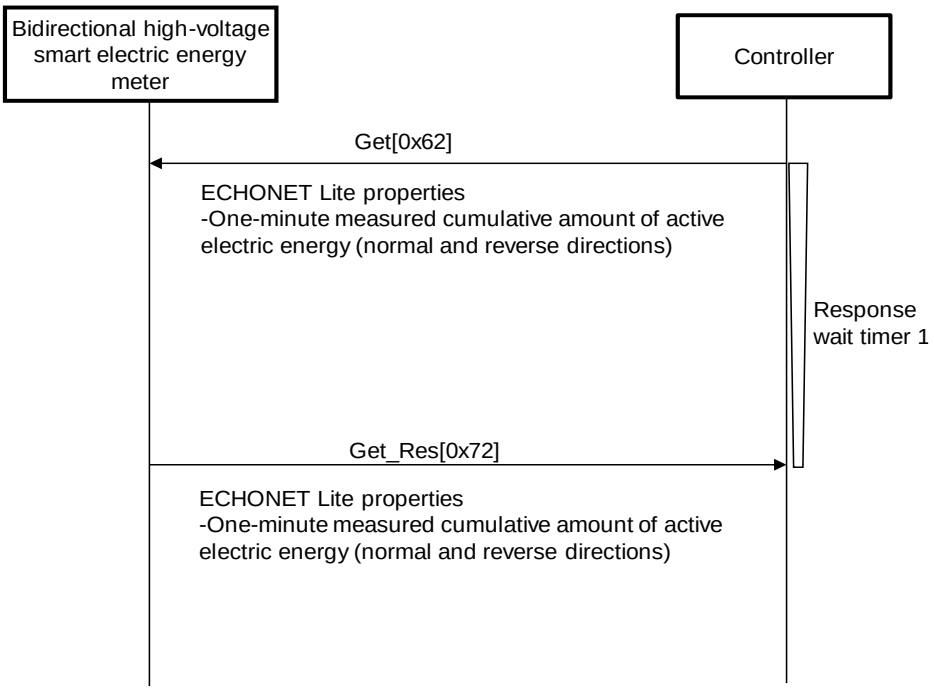

Fig 3-8 Example of the sequence for acquiring one-minute measured cumulative amount of electric energy (normal and reverse directions)

3.3.5 Acquiring historical data of measured (1-Minute, max. 10 Minutes)

If necessary, the controller makes a request of historical data of measured cumulative amount of active electric energy 2 (normal and reverse directions).

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)

- 0xED: Historical data of measured cumulative amounts of active electric energy 2 (normal and reverse directions)
- 0xEF: Day for which the historical data of measured cumulative amounts of electric energy is to be retrieved 2

(2)Sequence

Fig 3-9 shows an example of the sequence for acquiring historical data of measured cumulative amounts of active electric energy 2 (normal and reverse directions).

1. If the controller needs the “Historical data of measured cumulative amounts of electric energy 2 (normal and reverse directions)”, it sets the date and time needed in “Day for which the historical data of measured cumulative amounts of electric energy is to be retrieved 2” and makes a request via SetC[0x61].
2. After completing the set of settings (EDT) designated by SetC[0x61], the bidirectional high-voltage smart electric energy meter responds with Set_Res[0x71]. If the designated settings (EDT) cannot be set because they are outside the range of the properties, etc., it responds with SetC_SNA[0x51].
3. After confirming the receipt of Set_Res[0x71], the controller makes a request of “Historical data of measured cumulative amounts of active electric energy 2 (normal and reverse directions)” via Get[0x62].
4. The bidirectional high-voltage smart electric energy meter transmits the relevant property value via Get_Res[0x72]. If it does not have the measured value for the time in question, the data will be void, and the value will be given as 0xFFFFFFFE. If the normal value cannot be responded owing to a fault, Get_SNA[0x52] is transmitted.

   Here, the controller shall use the historical data, only after checking if the first date and time of the received historical data of measured cumulative amounts of electric energy is identical with the date and time set in the Sequence (1). Considering that a conflict may occur if two or more controllers run sequence (1) at the same time, countermeasures should be taken by adjusting the timing of the initial run and retry of sequence (1) or by limiting the number of retries.

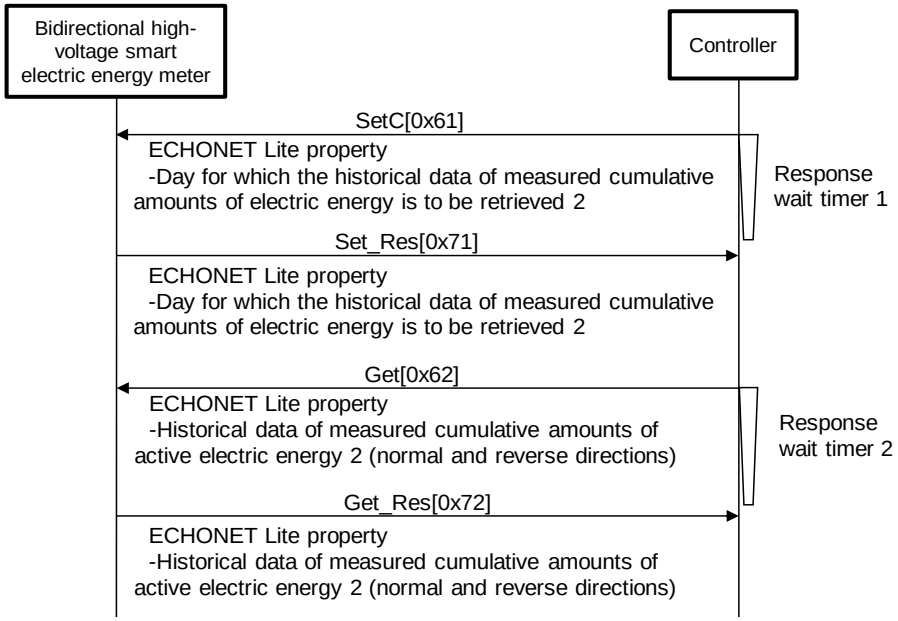

Fig 3-9 Example of the sequence for acquiring historical data of measured (one-minute, max. 10 minutes)

3.4. Operation during a Fault

3.4.1. Fault Status Notification

If the bidirectional high-voltage smart electric energy meter succumbs to a fault status making it unable to transmit the cumulative amounts of active electric energy at fixed time (normal, reverse directions), etc., it notifies the fault status (“Fault occurred”) to the controller. When it has recovered from the fault, it notifies the fault status (“No fault has occurred”) to the controller.

During the fault, the bidirectional high-voltage smart electric energy meter does not notify the cumulative amounts of active electric energy at fixed time (normal, reverse directions) and others described in 3.2.1. Operation of the EMS controller is not required while the bidirectional high-voltage smart electric energy meter is in fault status.

(1) Target properties (bidirectional high-voltage smart electric energy meter objects)
0x88: Fault status

Annex. 1 Handling of Each property Value for Use in Japan

In the case of smart electric energy meters installed by a General Electricity Transmission and Distribution Utility in Japan that comply with "The EMS/aggregation controller smart meter Route B (high-voltage smart electric energy meter) operational guidelines [Version 2.0 or later]", please note that the values of the relevant properties are handled as follows.

(1) "Route B identification number" property

The property values of the "Route B identification number" property shall indicate Route B Authentication ID in 16 bytes. The 1st to 4th bytes identifies the smart meter installation business operator. The 1st byte shall be fixed at 0x00, and the 2nd to 4th bytes shall be the manufacturer's codes. The 5th and following bytes are free space for the Route B Authentication ID.

(2) Properties related to the number of effective digits

For the "number of effective digits for cumulative amount of active electric energy", "number of effective digits of electric power demand", and "number of effective digits for the cumulative amount of reactive electric energy" properties, property values are consistently used as 0x08 (8 digits).

(3) Properties subject to verification of instrumental error

The values of the following properties are subject to the verification of instrumental error to examine accuracy of the measurement of amount of electric energy. Although bidirectional meters are verified in both the normal and reverse directions (bidirectional verification), there are meters that measure only in the normal direction (unidirectional verification). In this case, such meters are not verified for the reverse direction.

<Target properties (bidirectional high-voltage smart electric energy meter class)>

・0xD0: One-minute measured cumulative amount of active electric energy (normal and reverse directions)

・0xE2: Measured cumulative amounts of active electric energy (normal and reverse directions)

・0xE3: Cumulative amounts of active electric energy at fixed time (normal and reverse directions)

・0xE4: Measurement data of cumulative amount of active electric energy for power factor measurement (normal and reverse directions)

・0xE7: Historical data of measured cumulative amounts of active electric energy (normal direction)
・0xE8: Historical data of measured cumulative amounts of active electric energy (reverse direction)
・0xC1: Monthly maximum electric power demand (normal and reverse directions)
・0xC2: Cumulative maximum electric power demand (normal and reverse directions)
・0xC3: Electric power demand at fixed time (30-minute average electric power energy) (normal and reverse directions)
・0xC6: Historical data of measured electric power demand (normal direction)
・0xC8: Historical data of measured electric power demand (reverse direction)
・0xCA: Measurement data of reactive electric energy (lag) for power factor measurement (normal and reverse directions)
・0xCB: Measurement data of cumulative amount of reactive electric energy (lag) at fixed time for power factor measurement (normal and reverse directions)
・0xCE: Historical data of measurement data of cumulative amount of reactive electric energy (lag) for power factor measurement (normal direction)
・0xCF: Historical data of measurement data of cumulative amount of reactive electric energy (lag) for power factor measurement (reverse direction)
・0xED: Historical data of measured cumulative amounts of active electric energy 2 (normal and reverse directions)