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**Information technology – Home Electronic System (HES) architecture –
Part 4-301: Application protocols for home air conditioners and controllers**

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**Information technology – Home Electronic System (HES) architecture –
Part 4-301: Application protocols for home air conditioners and controllers**

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**INFORMATION TECHNOLOGY –
HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –**

**Part 4-301: Application protocols for
home air conditioners and controllers**

FOREWORD

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International Standard ISO/IEC 14543-4-301 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14543 series, under the general title *Information technology – Home Electronic System (HES) architecture*, can be found on the IEC and ISO websites.

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

CDV	Report on voting
JTC1-SC25/2929/CDV	JTC1-SC25/2952/RVC

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

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document specifies the message structure, sequences and protocol of the application layer for networked enhanced control devices used in the Home Electronic System. Some services are targeted for communications between devices. Other services are exclusively reserved for management purposes. Some services can be used for both management and run-time communications. This document is applicable for energy management services, mobile access, remote appliance maintenance services, home healthcare services, home security services and comfort control.

This document specifies the detailed procedures and behaviours of both home air conditioners and controllers at the application level communication based on ISO/IEC 14543-4-3.

Figure 1 shows the relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543−4−301. The existing ISO/IEC 14543-4-3 specifies the message structure, sequences and protocol for a general-purpose communication for use in network enhanced control devices of the Home Electronic System (HES) Class 1. ISO/IEC 14543-4-3 provides the common interfaces for the use-level process and the services such as energy management, remote maintenance, and other services for easily building a system consisting of multi-vendor devices and equipment. The existing IEC 62394 specifies the detailed lists of control commands on NECD objects. Annex A shows terms and NECD frame format on ISO/IEC 14543-4-3 and IEC 62394.

Since ISO/IEC 14543-4-3 is a general-purpose communication specification that applies to a variety of devices, it does not focus on the detailed procedures and behaviours for each device such as a home air conditioner.

In order to enhance interoperability, it is necessary to specify how to implement ISO/IEC 14543−4-3 for each device or controller at the application level: command sequences, timeout requirements, required combinations of acceptable commands, etc.
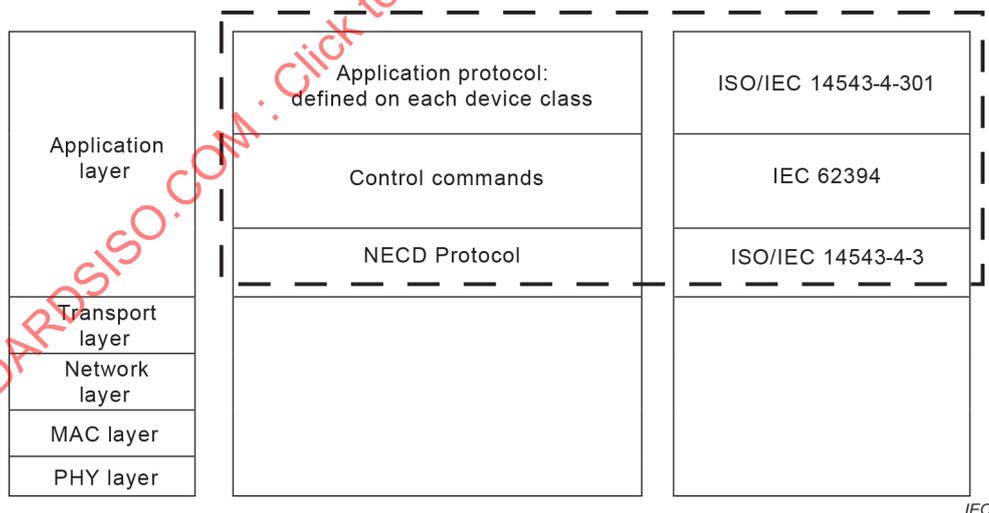
Figure 1 – Relationship between IEC 62394, ISO/IEC 14543-4-3 and ISO/IEC 14543-4-301

**INFORMATION TECHNOLOGY –
HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –**

**Part 4-301: Application protocols for
home air conditioners and controllers**

1 Scope

This part of ISO/IEC 14543 specifies an application-layer protocol necessary for ensuring interoperability among the products of various manufacturers regarding communications between home air conditioners and controllers, using a protocol called network enhanced communications device (NECD) as specified in ISO/IEC 14543-4-3. This protocol is based on user datagram protocol (UDP) using IPv4 or IPv6 (TCP is optional).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14543-2-1, *Information technology – Home Electronic System (HES) architecture – Part 2-1: Introduction and device modularity*

ISO/IEC 14543-4-3, *Information technology – Home Electronic System (HES) architecture – Part 4-3: Application layer interface to lower communications layers for network enhanced control devices of HES Class 1*

IEC 62394, *Service diagnostic interface for consumer electronics products and networks – Implementation for ECHONET*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 14543-2-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/

- ISO Online browsing platform: available at http://www.iso.org/obp

**3.1.1
controller**
function embedded on unspecified devices for controlling home air conditioners

**3.1.2
device object**
NECD object other than node profile object

Note 1 to entry: In this document, it refers to home air conditioner object only.

3.1.3
home air conditioner
air conditioning device for home use including a communications interface that supports the NECD protocol

Note 1 to entry: As used in this document, this term means the home air conditioner includes a communications interface that supports the NECD protocol.

3.1.4
NECD communication middleware
middleware between the lower communication layers and the application layer that performs communications processing according to the protocol specified in this document

3.1.5
NECD communication processing block
processing block for the communication middleware

Note 1 to entry: This block performs communications protocol processing to facilitate remote device control and monitoring processing for application software, stores information for the above and controls various data on the device as well as the status of other devices.

3.1.6
NECD data
NDATA
data region for a message exchanged by NECD communication middleware

3.1.7
NECD header
NHD
data containing the protocol type and message format for the NDATA section

3.1.8
NECD object
NOJ
model of information to be disclosed to the network from information owned by the NECD communication processing block, or an access procedure model

Note 1 to entry: The information or control target owned by each device is specified as a property and the operating method (setting, browsing) for this is specified as a service.

3.1.9
NECD property code
NPC
code value related to the NECD property

3.1.10
NECD protocol
communication protocol used in NECD communication specified in ISO/IEC 14543-4-3

3.1.11
NECD service
NSV
code value related to the NECD service

3.1.12
NECD frame
frame composed of NHD1, NHD2, TID and NDATA

3.1.13
node profile
description of objects implemented in each node

3.1.14
property data counter
PDC
indication of the size of the NDT region

3.1.15
property value data
data value related to the NECD property code (NPC)

EXAMPLE   Status notification or specific setting.

Note 1 to entry: Property value data is controlled by the NECD service (NSV).

3.1.16
remote control
control from outside the home

3.1.17
response wait timer
timer that counts the time from a controller request until a response from a targeted home air conditioner

3.1.18
transaction ID
TID
parameter to link a sent request with a received response

3.1.19
super class
set of properties that are inherited to and implemented in all device object classes

3.2   Abbreviated terms

DNOJ   destination NECD object

IP   internet protocol

NDATA   NECD DATA

NDT   NECD Data

NECD   network enhanced control device

NHD   NECD header

NPC   NECD property code

NSV   NECD service

OPC   processing object property counter

PDC   property data counter

SNOJ   source NECD object

TID   transaction ID

UDP   user datagram protocol

4   Conformance

Home air conditioners and controllers of HES Class 1 that claim conformance to this document shall:

- send, receive and process sequences and procedures as specified in Clause 7;
- provide application services and properties specified in 6.2, 6.3 and 6.4 that may be needed by home air conditioners and controllers for which the application is intended.

5   Connection configuration

This document specifies matters necessary for ensuring interoperability between the products of different manufacturers in connection with application communication between home air conditioners and controllers, using NECD protocol as an application protocol via UDP(TCP)/IPv6 communications.

Figure 2 shows the configurations assumed under these specifications.
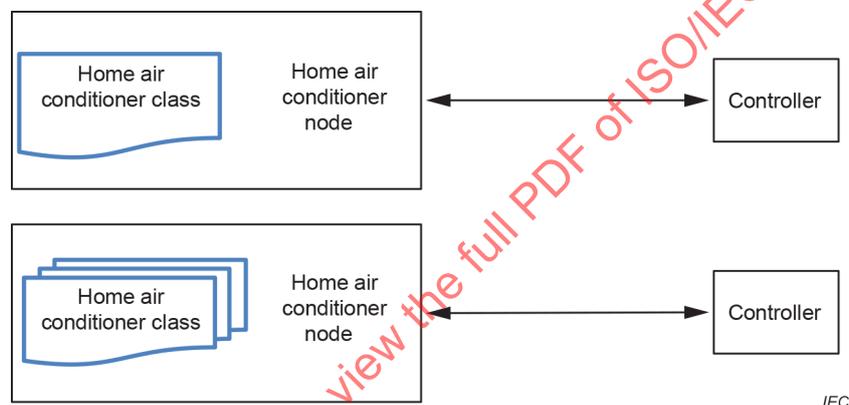
Figure 2 – Connection configurations

The upper illustration in Figure 2 shows the case where a single device object is installed in a single node. The lower illustration shows the case where multiple device objects are installed in a single node. The latter case occurs when multiple indoor units are attached to a single outdoor unit, such as a so-called multi-split packaged air conditioner. In this case, there are multiple home air conditioner class objects in a single home air conditioner node (i.e. at a single IP address). Controllers are required to support nodes that configure multiple device objects in a single node.

Controllers are required to be capable of handling multiple nodes and objects. The maximal number of nodes and objects to be handled is implementation-dependent of the controllers. In case that multiple controllers are connected to a single system, this would not be recognized by the home air conditioner. In other words, the home air conditioner shall be controlled by the last write request if multiple requests from multiple controllers arrive continuously before responding.

Figure 3 shows the assumed network stack for operating NECD protocol in this document. NECD protocol operation is assumed as an application protocol on UDP(TCP)/IPv6. Note that TCP installation is optional. As a rule, the stack uses IPv6; however, IPv4 is allowed depending on the market trends for migration from IPv4 to IPv6.

Application layer	ISO/IEC 14543-4-301 IEC 62394 ISO/IEC 14543-4-3
Transport layer	UDP(TCP)
Network layer	IPv6 or IPv4
(Adaptation layer)	(6LoWPAN[a])
MAC layer	(No specific MAC layer assumed)
PHY layer	(No specific PHY layer assumed)

IEC

[a]   Depends on transmission media using IPv6

Figure 3 – Assumed network stack

Connection processing specific to each lower layer communication medium that is necessary in advance of the start of NECD communication is out of the scope of this document. In this document, application communication using NECD protocol is described on the assumption that connection processing specific to those communication media is complete.

6   Application layer

6.1   General

NECD protocol shall be used at the application layer. All nodes that conform to this document shall support all mandatory functions specified in ISO/IEC 14543-4-3.

6.2   NECD objects

Home air conditioners and controllers shall have the NECD objects shown in Table 1.

Table 1 – NECD objects

NECD object	Class group code	Class code	Class name	Instance code
Home air conditioner	0x01	0x30	Home air conditioner	0x01 to 0x7F
	0x0E	0xF0	Node profile	0x01
Controller	0x05	0xFF	Controller	0x01 to 0x7F
	0x0E	0xF0	Node profile	0x01

NOTE   Instance code 0x00 is designated to specify all instances of the same class in a node.

6.3   NECD services

Home air conditioners and controllers shall support the NECD services shown in Table 2.

Table 2 – NECD services

NSV code	NECD 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

NOTE   NSV codes which are specified in ISO/IEC 14543-4-3 but are not shown in Table 2 (0x60, 0x63, 0x6E, 0x74, 0x7A, 0x7E, 0x50, 0x53, and 0x5E) are not subject to the certification tests based on this document.

6.4 Object-specific NECD properties

Home air conditioners shall install the NECD properties of device object shown in Table 3 and Table 4. NECD properties of node profile object shall support at least mandatory properties.

Controllers shall send requests to the device object properties shown in Table 3 and Table 4. In case a controller can control home air conditioners via a public network, its remote control operations which set properties of home air conditioners shall include a write request (SetC[0x61]) to Remote control setting property (0x93).

Table 3 – NECD properties of device object (super class)

Property name	NPC	Access rule		Announcement at status change	Remarks
		Get	Set		
Installation location	0x81	M	M	M	
Standard version information	0x82	M	—	—	
Identification number	0x83	O	—	—	
Manufacturer's fault code	0x86	O	—	—	
Fault status	0x88	M	—	M	
Fault description	0x89	O	—	—	
Manufacturer code	0x8A	M	—	—	
Remote control setting	0x93	O	O	—	
Status change announcement property map	0x9D	M	—	—	
Set property map	0x9E	M	—	—	
Get property map	0x9F	M	—	—	
M: mandatory, O: optional, —: not supported					

Table 4 – NECD properties of device object

Property name	NPC	Access rule		Announcement at status change	Remarks
		Get	Set		
Operation status	0x80	M	M	M	
Operation power-saving	0x8F	M	M	M	
Operation mode setting	0xB0	M	M	M	
Set temperature value	0xB3	M	M	—	
Measured value of room temperature	0xBB	M	—	—	
Air flow rate setting	0xA0	M	M	M	
M: mandatory, —: not supported					

6.5   Application operation

6.5.1   General

Subclauses 6.5.2 to 6.5.6 describe the operations on home air conditioners and controllers at the application level.

6.5.2   Continuous requests

A request from a controller and its corresponding response from a home air conditioner is a basic unit of communication, which means that a home air conditioner returns a single response to a single request. Controllers that issue continuous requests to a home air conditioner shall be designed with a timer defined in 6.5.3. When receiving a response, the timer is reset and the controller can send a new request.

In case a controller resends or continuously sends requests in an interval shorter than the response wait timer value specified in 6.5.3, home air conditioners may not accept the requests, may not renew the values to respond, or may not be able to renew the values correctly. Note that "continuous requests" means continued requests to the same instance in the same home air conditioner node.

6.5.3   Response wait timer value for controllers

The value of the response wait timer, which counts the time from a controller's request till the response from the targeted home air conditioner, is specified in Table 5.

Table 5 – Response wait timer value for controllers

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

Note that home air conditioners shall respond within 20 seconds, in case the received request's OPC is 1 or in case the home air conditioner processes operations described in Clause 7 only. In case the request's DNOJ instance code is an all-instance designation code (0x00), the targeted home air conditioners shall return the first response frame within 20 seconds.

6.5.4   Resending a frame

In case a controller sends a request to a home air conditioner and does not receive the response from the home air conditioner within the response wait timer value specified in 6.5.3, the frame shall not be retransmitted in a frame of the same TID. Sending a message with a different TID shall not be regarded as resending.

6.5.5   Processing object property counter

Home air conditioners shall be capable of supporting OPC value of 4 or more. Note that the maximal number of processable OPC value is not specified. If 5 or more NPCs are requested in a frame, some home air conditioners may not be able to complete all processes due to constraints in the number of processable NPCs at one time.

The sequence of NPCs of the response to a request with multiple NPCs shall be the same as the request.

6.5.6   Property values of write requests

When a controller issues a write request (SetC[0x61]), a value within the range specified in IEC 62394 shall be set.

Home air conditioners shall return Set_Res[0x71] if the property value is within the value range defined in IEC 62394 and acceptable for the home air conditioner. SetC_SNA[0x51] or Set_Res[0x71] shall be returned if the write value cannot be set because the value is out of the value range.

Due to a home air conditioner's characteristics, home air conditioners may set different values from the values in write requests from a controller, even if the values in write requests are within the value range defined for home air conditioners. Therefore, even when a controller receives Set_Res[0x71], it is recommended to check the actual values of the written properties by issuing read requests after write requests.

7   Normal operation

7.1   General

Clause 7 describes normal operations between home air conditioners and controllers.

Figure 4 shows an example of normal operation sequences between a home air conditioner and a controller. Here, the connection process of the lower-layer network between home air conditioner and controller is assumed completed.
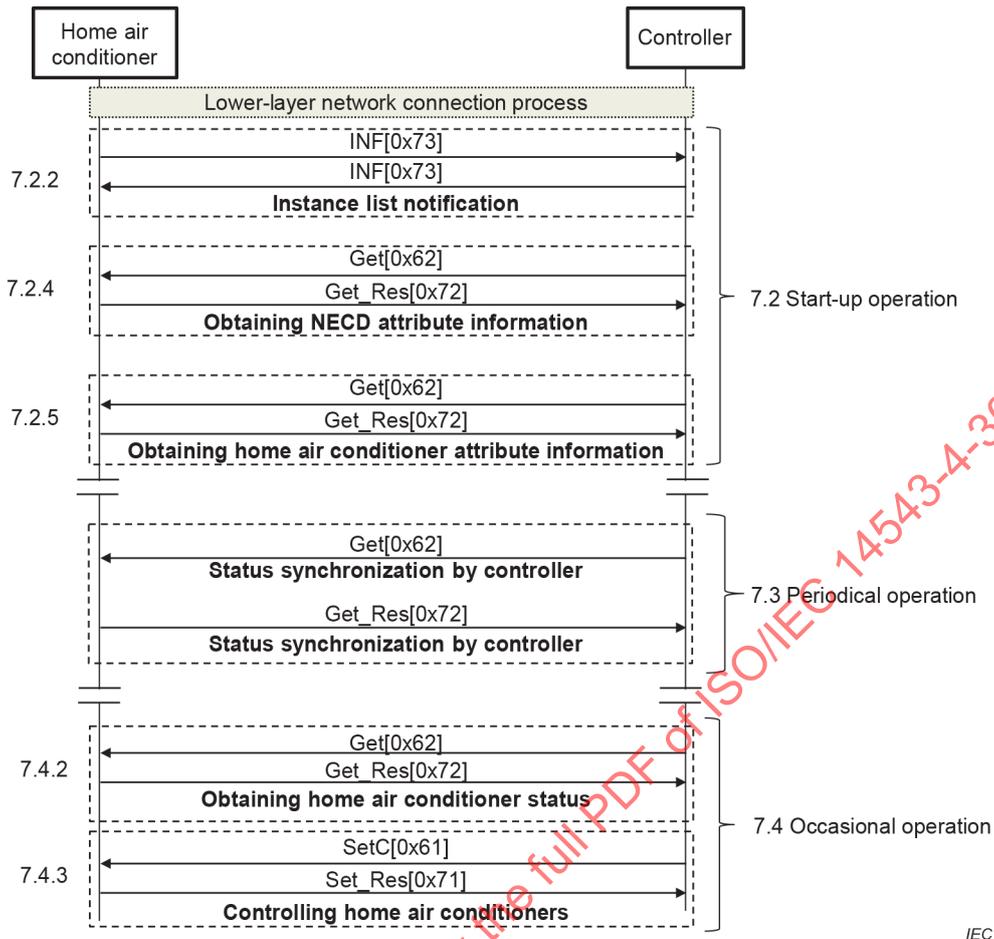
Figure 4 – Example of normal operation sequences

7.2   Start-up operation

7.2.1   General

Subclauses 7.2.2 to 7.2.5 describe the operations on home air conditioners and controllers at their start-up.

7.2.2   Start-up processing of NECD nodes

After establishing the connection of lower-layer network, home air conditioners and controllers notify each instance list.

Instance list notification may include

a) one node and one instance,

b) one node and multiple instances of a class,

c) one node and instances of multiple different classes.

In any case, controllers shall be able to recognize the devices to be managed on receiving an instance list notification.

1) Target property of node profile object

   • 0xD5: Instance list notification

7.2.3 Search processing

Controllers shall have a process to search home air conditioners in preparation of cases that controllers fail to receive the instance list notifications sent from home air conditioners at start-up. Controllers shall send a read request (Get[0x62]) via multicast with DNOJ as home air conditioner, with instance code as 0x00, and with NPC as operation status (0x80). Alternatively, controllers can send a read request (Get[0x62]) via multicast with DNOJ as node profile object (0x0EF001) and with NPC as its self-node instance list S (0xD6).

1) Target property of home air conditioner object

- 0x80: Operation status

7.2.4 Obtaining NECD attribute information

After receiving instance list notifications from home air conditioners or after completing the search of home air conditioners, controllers request NECD attribute information necessary for NECD communication. Controllers can re-obtain the NECD attribute information if necessary.

It is recommended that controllers confirm the standard version information and properties installed on the home air conditioners based on the NECD attribute information, and then should issue requests to the installed properties.

1) Target properties of home air conditioner object

- 0x82: Standard version information

- 0x9D: Status change announcement property map

- 0x9E: Set property map

- 0x9F: Get property map

2) Sequence

Figure 5 shows an example of the sequence for obtaining NECD attribute information.

a) Controller requests four target properties (in any combination or in any order) by read requests (Get[0x62]), after receiving an instance list notification from the target home air conditioner.

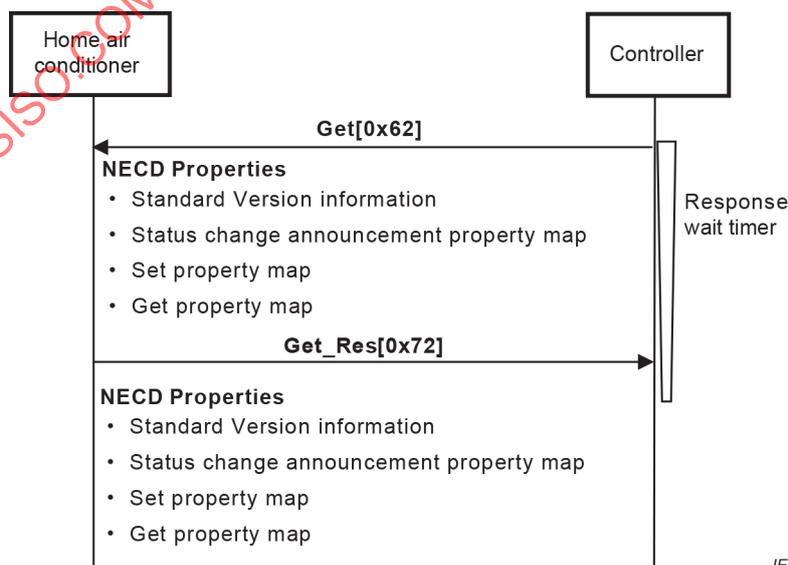b) The home air conditioner shall return the requested property values (Get_Res[0x72]).

Figure 5 – Example of sequence for obtaining NECD attribute information

7.2.5   Obtaining home air conditioner attribute information

Controllers request home air conditioner attribute information after obtaining NECD attribute information from them. Controllers may only request necessary home air conditioner properties. Controllers can obtain these properties individually or in a batch, and can obtain multiple times if necessary.

It is recommended that controllers carry out the following processes as a start-up operation when connecting to home air conditioners.

- Controllers should obtain the identification number of the home air conditioners, in case they remotely control home air conditioners (refer to Clause 8). It is recommended that the home air conditioners that accept remote control should have the property of identification number of the device object. Note that home air conditioners that install only one device object in a single node can be identified with the identification number of the node profile object.

- In addition to the above, controllers should check the initial settings of the home air conditioners which are used by the controller.

7.3   Periodical operation

There is no periodical operation from home air conditioners to controllers.

Discrepancies may arise between the status information retained by controllers and home air conditioners due to the operation by accessory remote controllers or the operation by smartphones and the like from outside the homes, or the functions that home air conditioners have.

Therefore, if discrepancy in operation status needs to be avoided in executing functions by controllers (e.g. displaying the operation status of the home air conditioner), it is recommended to periodically check the necessary information.

The details are described in 9.4.

7.4   Occasional operation

7.4.1   General

Controllers should take into consideration the following matter in operating home air conditioners.

- Home air conditioners may not execute the received write requests in case that the property value of fault status property is "Fault occurred" or the property value of operation status property is "OFF", when receiving the write requests.

In addition to the above, refer to 9.2 for detailed precautions.

7.4.2   Obtaining home air conditioner status

Home air conditioners shall return the same number of properties for read requests with up to four of any target properties shown below. For requests with five or more properties, the number of processable properties depends on the home air conditioner implementation. Refer to 9.3 for controller operations in such cases.

1) Target properties of home air conditioner object

- 0x80: Operation status

- 0x8F: Operation power-saving

- 0xB0: Operation mode setting

- 0xB3: Set temperature value

- 0xBB: Measured value of room temperature

- 0xA0: Air flow rate setting

- 0x88: Fault status

2) Sequence

Refer to Figure 6 for the operation sequence to obtain the status of home air conditioners.

a) A controller sends read requests (Get[0x62]) via unicast to the target properties (in any combination or in any order) to obtain status of the home air conditioner.

b) The home air conditioner returns read responses (Get_Res[0x72]) to the controller.
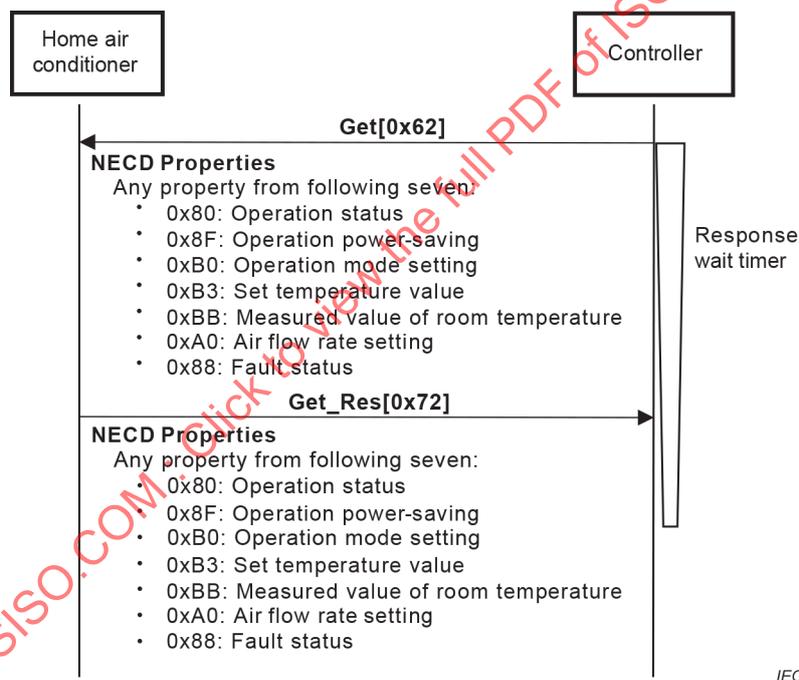

Figure 6 – Sequence to obtain status of home air conditioners

7.4.3 Controlling home air conditioners

Home air conditioners shall return the same number of properties for write requests with up to four of any target properties shown below. Clause 9 describes considerations from the controller's point of view in sending write requests to home air conditioners. For requests with five or more properties, the number of processable properties depends on the home air conditioner implementation. Refer to 9.3 for controller operations in such cases.

Note that home air conditioners may operate differently if receiving a write request with multiple properties, due to the different hardware configurations or due to the device status. Therefore, controllers should send write requests with multiple properties after verifying the home air conditioner's behaviours caused by such requests.

1) Target properties of home air conditioner object

- 0x80: Operation status
- 0x8F: Operation power-saving
- 0xB0: Operation mode setting
- 0xB3: Set temperature value
- 0xA0: Air flow rate setting

2) Sequence

Refer to Figure 7 for controlling home air conditioners by controllers.

a) A controller sends write requests (SetC[0x61]) to target properties (in any combination or in any order) to a home air conditioner.

b) The home air conditioner returns Set_Res[0x71] if being requested with the setting values that are within the value range defined for home air conditioners. The home air conditioner returns SetC_SNA[0x51] or Set_Res[0x71] if the setting values are out of the value range.
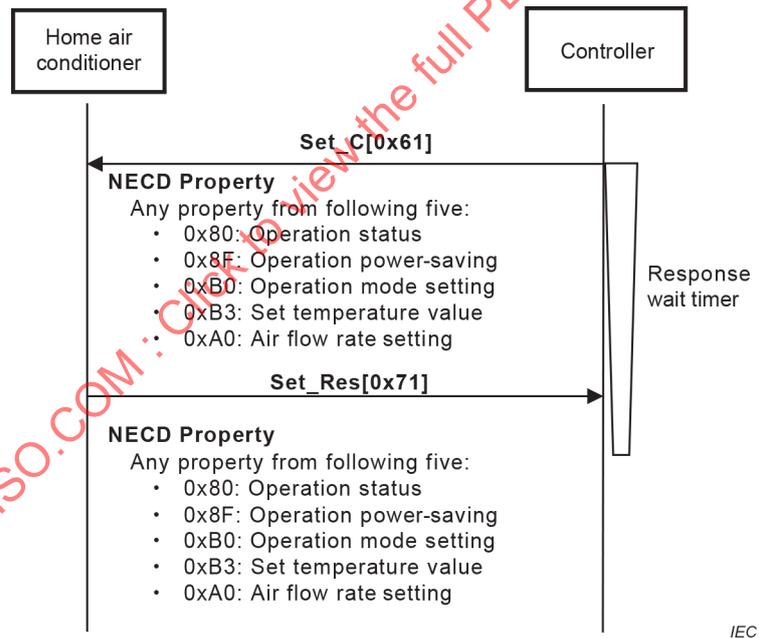

Figure 7 – Sequence to control home air conditioners

7.5   Operation during fault status

If a home air conditioner falls into fault status with some cause, it shall notify the fault status "Fault occurred" to controllers. When the home air conditioner has recovered from the fault status, it shall notify the recovered status "No fault has occurred" to controllers.

Controllers can verify the fault status of home air conditioners using fault status property (0x88), manufacturer's fault code property (0x86), and fault description property (0x89). Examples of reading fault status are described in 9.5.

Controller's operation is not specified while home air conditioners are in fault status.

1) Target properties of device object super class and home air conditioner object

- 0x86: Manufacturer's fault code (optional)
- 0x88: Fault status
- 0x89: Fault description (optional)

Both of the manufacturer's fault code (0x86) and fault description (0x89) are optional, and there are two ways to implement manufacturer's fault code. Subclause 9.5 describes an example of obtaining detailed information on fault status using manufacturer's fault code and fault description.

8   Remote control

8.1   General

In case home air conditioners are remotely controlled from outside the homes, controllers should take special care. Clause 8 describes the special considerations on this "Remote control". Figure 8 shows the concept of remote control.
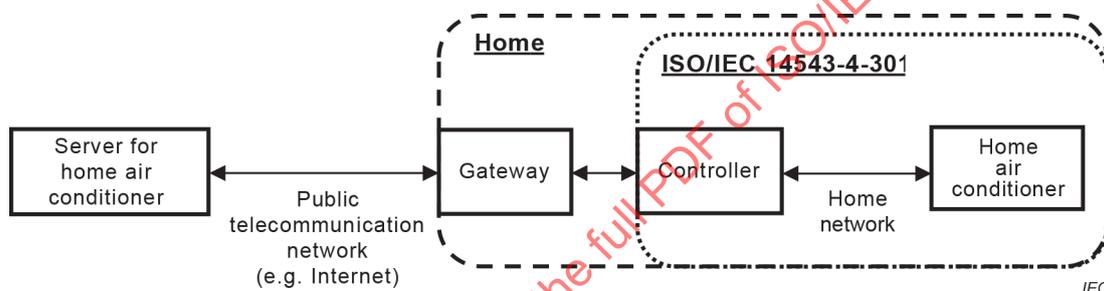
Figure 8 – Remote control

When remote commands are sent to the home via the public telecommunication network, a gateway function is required. Note that the communications on the public telecommunication network, the gateway function, communication between the gateway function and controller, and server for home air conditioner are out of scope and therefore implementation-dependent. The gateway function and controller may be implemented in one physical unit. In this case, the communication between the gateway function and controller is internal.

8.2   Processes to be carried out by controllers on remote control

In case controllers remotely control devices, the controllers shall send write requests to home air conditioners with multiple properties (i.e. OPC is more than 1) and shall put remote control setting property (0x93) at the first position of the write properties. In advance of the write requests, controllers should uniquely identify home air conditioners by reading the identification number (0x83) of the node profile object or the home air conditioner object. Home air conditioners shall return the same number of properties of the write requests with up to four of any properties including remote control setting property. In case receiving requests with five or more properties, the number of processable properties depends on home air conditioner's implementation.

1) Target properties of home air conditioner object

- 0x80: Operation status

- 0x8F: Operation power-saving

- 0xB0: Operation mode setting

- 0xB3: Set temperature value

- 0xA0: Air flow rate setting

- 0x83: Identification number (optional)

- 0x93: Remote control setting (optional)

2) Sequence

Refer to remote control sequences shown in Figure 9 and Figure 10.

a) A controller sends a write request (SetC[0x61]) with multiple properties (i.e. OPC is 2 or more) to the properties (in any order) of the target home air conditioner, placing remote control setting property at the first position.

b) The home air conditioner returns a response (Set_Res[0x71]) if the requested set values are within the value range defined for home air conditioners. The home air conditioner returns SetC_SNA[0x51] or Set_Res[0x71] if the set values are out of the value range.

c) The controller sends a read request (Get[0x62]) with all properties set in a), other than remote control property, of the home air conditioner via unicast.

d) The home air conditioner returns a response (Get_Res[0x72]) to the controller.
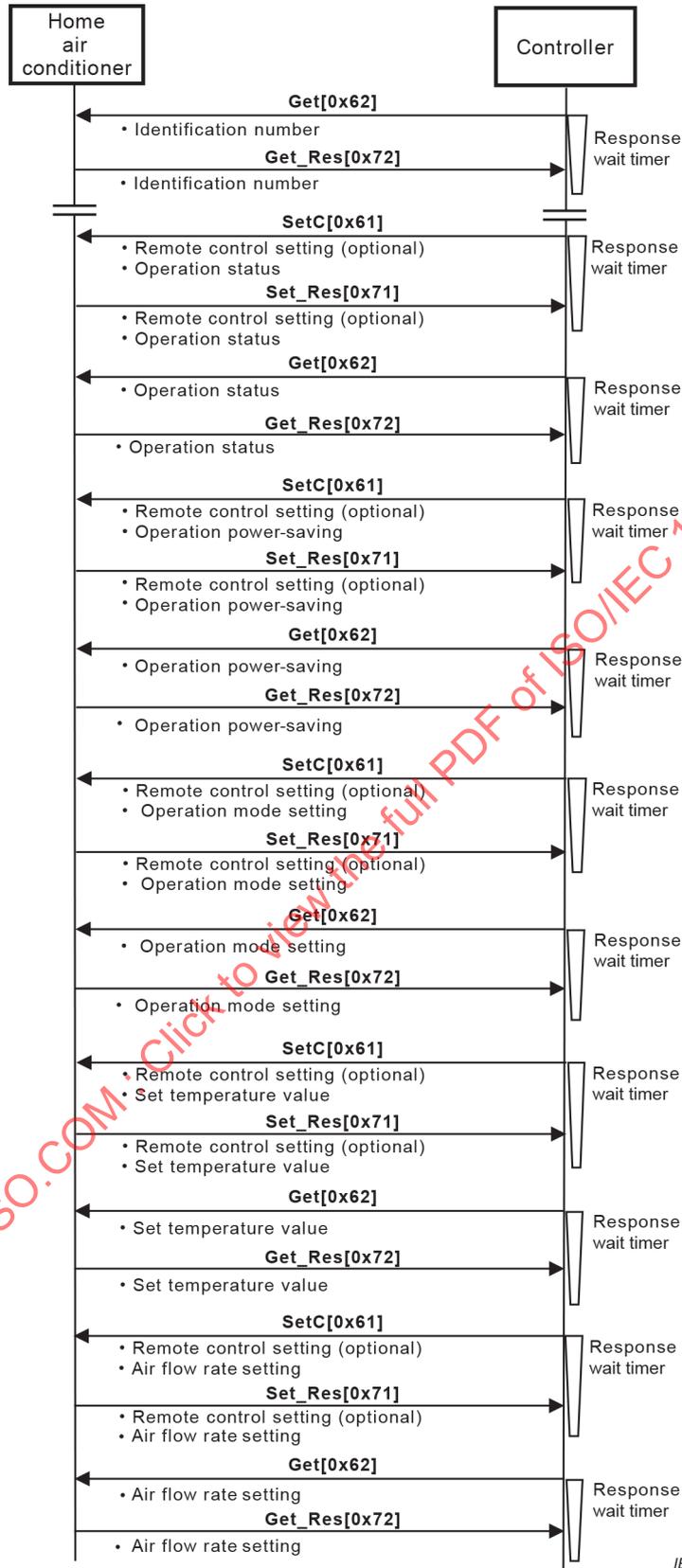
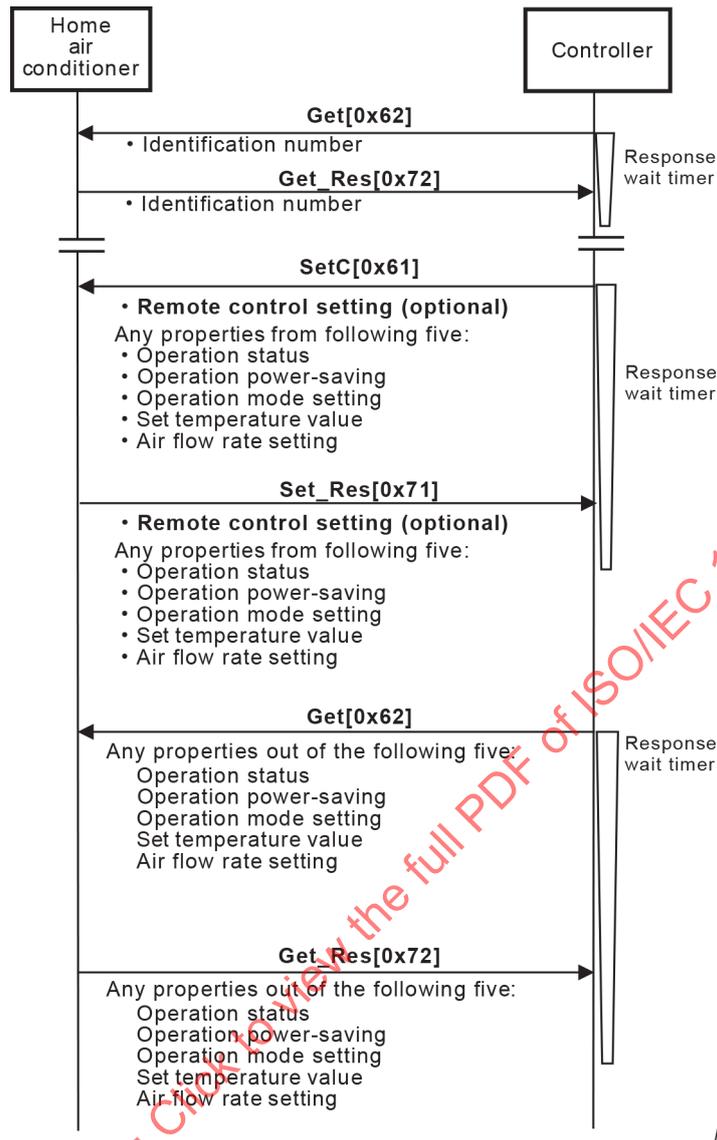**Figure 9 – Remote control sequence (properties are written one by one)**

Figure 10 – Remote control sequence (properties are written in a batch)

9   Considerations on controllers

9.1   General

When controllers monitor and control home air conditioners, controllers should take into consideration restrictions specific to home air conditioner implementations.

The descriptions in Clause 9 are recommendations for developing controllers.

9.2   Restrictions by home air conditioner implementations

1) When sending a write request to home air conditioners, it is recommended to confirm that their operation status is "ON" in advance of sending the request (excluding write requests to operation status).

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2) In order to enhance the convenience, home air conditioners commonly have property values of "Automatic" for operation mode setting property, "Automatic air flow rate control function used" for air flow rate setting property, and "Power saving mode" for operation power-saving property. The values in set temperature value property and air flow rate setting property may be changed automatically when the properties of the above three are set as above "Automatic" modes. The affected properties and the values to be used are different for different manufacturers.

3) There is a difference between manufacturers in handling the affected properties and values when switching from an automatic mode to non-automatic mode, whether the affected property values revert to the original values or not. Therefore, in order to preserve consistent control, controllers should retain the original status values and rewrite these properties when exiting from automatic modes.

4) On some home air conditioners, the setting values in some properties are changed or become inconsistent with set values, in correspondence to writing to a certain property. The following are examples.

- Temperature settings: separate temperature settings are used in "Cooling" and "Heating" modes. Some home air conditioners have another temperature setting for "Automatic" mode.

- Operation mode "Automatic": Some home air conditioners use a temperature setting in "Automatic" mode that is different from the temperature settings in "Cooling" mode and "Heating" mode. This means that the value of set temperature value property is changed automatically if operation mode is set to "Automatic" mode. There is a difference between manufacturers in handling the value in set temperature value property: whether the value of set temperature value property reverts to the original value or not, when exiting from "Automatic" mode.

- Power-saving mode: Some home air conditioners may change the values of set temperature value property and air flow rate control property, etc. when "Power-saving" mode is set. Some home air conditioners may exit from "Power-saving" mode (i.e. change to "Normal" mode) if a certain value of set temperature value property or air flow rate setting property is set during "Power-saving" mode.

- Air flow direction: the actual status of vertical air flow direction may be different from the value of vertical air flow direction property for some time just after setting "Heating" mode. (Actual direction becomes upward to prevent cold wind at the start of heating operation.)

5) Home air conditioners are sold with accessory remote controllers. When a person operates a home air conditioner by the accessory remote controller, discrepancies may arise on properties that do not notify their status change. Controllers should periodically obtain the necessary information as described in 9.4.

6) In case controllers display a home air conditioner's temperature setting, controllers should not display the temperature setting during "Air circulation" mode or "Dehumidification" mode. Note that the value of set temperature value property may become "Temperature indeterminable" (0xFD) due to the internal behaviour of the home air conditioner even in "Cooling" mode or "Heating" mode.

7) In case home air conditioners receive write requests with multiple properties from controllers, some home air conditioners execute operations in the order of the properties that appear in the write request message. Therefore, controllers should take into consideration the order of properties when sending a write request with multiple properties. For example, in case writing to three properties of operation status, operation mode setting, and set temperature value, the actual behaviour of the home air conditioner becomes more likely as the expectation of the controller if those three properties are stored in the above order in a write request message.

8) The accuracy of values measured by sensors, such as measured value of room temperature, may vary depending on the installation environment or operation status of the home air conditioner.