

**59/537/NP****NEW WORK ITEM PROPOSAL**

	Proposer China	Date of proposal 2009-5-19
	TC/SC TC59	Secretariat Germany
	Date of circulation 2009-07-24	Closing date for voting 2009-10-30

A proposal for a new work item within the scope of an existing technical committee or subcommittee shall be submitted to the Central Office. The proposal will be distributed to the P-members of the technical committee or subcommittee for voting on the introduction of it into the work programme, and to the O-members for information. The proposer may be a National Committee of the IEC, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Standardization Management Board or one of the advisory committees, or the General Secretary. Guidelines for proposing and justifying a new work item are given in ISO/IEC Directives, Part 1, Annex C (see extract overleaf). **This form is not to be used for amendments or revisions to existing publications.**

The proposal (to be completed by the proposer)

Title of proposal Guidelines for Networked Home Appliances		
<input checked="" type="checkbox"/> Standard <input type="checkbox"/> Technical Specification		
Scope (as defined in ISO/IEC Directives, Part 2, 6.2.1) This standard specifies the basic models, network requirements, hardware and software models, command requirements and functional specifications for home or similar electric appliances (also referred to as "networked home appliances") This standard is applicable to the networked home appliances in the home network or similar environments.		
Purpose and justification , including the market relevance, whether it is a proposed horizontal standard (Guide 108) ¹⁾ and relationship to Safety (Guide 104), EMC (Guide 107), Environmental aspects (Guide 109) and Quality assurance (Guide 102) . (attach a separate page as annex, if necessary) The purpose of the standard is to specify the conditions and requirements to ensure the interconnection and interoperability among networked home appliances, as well as to provide a standardized guideline for models and communication process, including adapter and command requirements of networked home appliances.		
Target date	for first CD .2010-05.....	for IS/ TS .2012-05.....
Estimated number of meetings 9	Frequency of meetings: 4 per year	Date and place of first meeting:
Proposed working methods	<input checked="" type="checkbox"/> E-mail	<input checked="" type="checkbox"/> Collaboration tools
Relevant documents to be considered EN 50523-1: Household Appliances Interworking ISO/IEC 7498-1: Information Technology-Open Systems Interconnection-Basic Reference Model IEC 62480: Multimedia Home Network-Network Interfaces for Network Adapter EN 50090-2: 1996 Home and Building Electronic Systems (HBES) Cenelec Workshop Agreement: CWA 50487 SmartHouse Code of Practice		
Relationship of project to activities of other international bodies n/a		
Liaison organizations		Need for coordination within ISO or IEC

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Preparatory work Ensure that all copyright issues are identified. Check one of the two following boxes <input checked="" type="checkbox"/> A draft is attached for comment* <input type="checkbox"/> An outline is attached * Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation. We nominate a project leader as follows in accordance with ISO/IEC Directives, Part 1, 2.3.4 (name, address, fax and e-mail): Mr. Kent Gu Haier Group, F3, Bldg J, Haier Industrial Park, No.1 Haier Rd, Qingdao, 266101, China. Fax:+86-532-8893 8270, Email: kentgu@126.com, or: itophomes@haier.com	
Concerns known patented items (see ISO/IEC Directives, Part 2) <input type="checkbox"/> Yes. If yes, provide full information as an annex <input checked="" type="checkbox"/> no	Name and/or signature of the proposer Chenguang GUO Secretary, Chinese NC of the IEC Fax:+86 10 82260660 E-mail:guocg@sac.gov.cn
Comments and recommendations from the TC/SC officers	
1) Work allocation <input type="checkbox"/> Project team <input checked="" type="checkbox"/> New working group <input type="checkbox"/> Existing working group no:	
2) Draft suitable for direct submission as <input checked="" type="checkbox"/> CD <input type="checkbox"/> CDV/ DTS	
3) General quality of the draft (conformity to ISO/IEC Directives, Part 2) <input checked="" type="checkbox"/> Little redrafting needed <input type="checkbox"/> Substantial redrafting needed <input type="checkbox"/> no draft (outline only)	
4) Relationship with other activities In IEC In other organizations	
5) Proposed horizontal standard <input type="checkbox"/> 1)	
Remarks from the TC/SC officers Comments on the draft and nomination of specialists for participation in a working group should be given.	

1) Other TC/SCs are requested to indicate their interest, if any, in this NP to the TC/SC secretary.

Approval criteria:

- Approval of the work item by a simple majority of the P-members voting;
- At least 4 P-members in the case of a committee with 16 or fewer P-members, or at least 5 P-members in the case of committees with more than 17 P-members, have nominated or confirmed the name of an expert and approved the new work item proposal.

Elements to be clarified when proposing a new work item

Title

Indicate the subject matter of the proposed new standard or technical specification.

Indicate whether it is intended to prepare a standard or a technical specification.

Scope

Give a clear indication of the coverage of the proposed new work item and, if necessary for clarity, exclusions.

Indicate whether the subject proposed relates to one or more of the fields of safety, EMC, the environment or quality assurance.

Purpose and justification

Give details based on a critical study of the following elements wherever practicable.

- The specific aims and reason for the standardization activity, with particular emphasis on the aspects of standardization to be covered, the problems it is expected to solve or the difficulties it is intended to overcome.
- The main interests that might benefit from or be affected by the activity, such as industry, consumers, trade, governments, distributors.
- Feasibility of the activity: Are there factors that could hinder the successful establishment or general application of the standard?
- Timeliness of the standard to be produced: Is the technology reasonably stabilized? If not, how much time is likely to be available before advances in technology may render the proposed standard outdated? Is the proposed standard required as a basis for the future development of the technology in question?
- Urgency of the activity, considering the needs of the market (industry, consumers, trade, governments etc.) as well as other fields or organizations. Indicate target date and, when a series of standards is proposed, suggest priorities.
- The benefits to be gained by the implementation of the proposed standard; alternatively, the loss or disadvantage(s) if no standard is established within a reasonable time. Data such as product volume or value of trade should be included and quantified.
- If the standardization activity is, or is likely to be, the subject of regulations or to require the harmonization of existing regulations, this should be indicated.

If a series of new work items is proposed, the purpose and justification of which is common, a common proposal may be drafted including all elements to be clarified and enumerating the titles and scopes of each individual item.

Relevant documents

List any known relevant documents (such as standards and regulations), regardless of their source. When the proposer considers that an existing well-established document may be acceptable as a standard (with or without amendments), indicate this with appropriate justification and attach a copy to the proposal.

Cooperation and liaison

List relevant organizations or bodies with which cooperation and liaison should exist.

Preparatory work

Indicate the name of the project leader nominated by the proposer

Guidelines for Networked Home Appliances

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Foreword

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Guidelines for Networked Home Appliances

1 Scope

This standard specifies the basic models, network requirements, hardware and software models, command requirements and functional specifications for home or similar electric appliances (hereinafter referred to as “networked home appliances” or “home appliances”)

This standard is applicable to the networked home appliances in the home network or similar environments.

2 Normative references

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

EN 50523-1: Household Appliances Interworking Part 1: Functional specification

ISO/IEC 7498-1: Information Technology-Open Systems Interconnection-Basic Reference Model

IEC 62480: Multimedia Home Network-Network Interfaces for Network Adapter

EN 50090-2-1: 1996 Home and Building Electronic Systems (HBES) Part 2-1 System Overview-Architecture

EN 50090-2-2: 1996 Home and Building Electronic Systems (HBES) Part 2-2 System Overview-General Technical Requirements

EN 50090-2-3: 1996 Home and Building Electronic Systems (HBES) Part 2-3 System Overview-General functional safety requirements for products intended to be integrated in HBES

Cenelec Workshop Agreement: CWA 50487 SmartHouse Code of Practice

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1 Home network

A home Local Area Network and information platform which integrates control network, communication network and multimedia network. It is a basic platform system to form a digital home by implementing the information sharing and devices interoperation in the home network or similar environments among information devices, communication devices, entertainment devices, household appliances, home automaton devices, lighting devices, security and surveillance devices, help and alarm service, health care devices as well as gas/water/heating/electricity meters.

3.1.2 Home gateway

A device situated in the home network and interconnected with the devices in the home network, can configure and manage the home network by means of protocol translation, device management and network management. The home network can also be connected to the outside networks like internet through the home gateway.

3.1.3 Sub gateway

A device in the home network, interconnected with the devices in the home sub-network, configures and manages the home sub-network and meanwhile serving as the interfaces between home network and devices in the home sub-network, make them get services from the home network.

3.1.4 Control terminal

A home networked device that can generate or get the device registry, and can register, control, manage and share resource among devices in the home network by friendly human-machine interfaces.

3.1.5 Transport medium

A physical carrier on which signals are transported.

3.1.6 Network address

Address in a form of digit, is allocated in the network when a device joined the network, thus to identify and facilitate access to the device.

3.1.7 Networked home appliances

Home or similar electric appliances used in the home network or similar environment that can share information, interconnect and interoperate. In this standard they are particularly referred to as “White Goods”, also named as “Household appliances” or “home appliances”, unless otherwise specified.

3.1.8 Adapter for home appliances

An interface unit that can realize the function of communication for the networked home appliances. It can be physically an individual device separated from the home appliance or can be combined with the home appliance as a whole.

3.1.9 Internal adapter

A built-in adapter in the home appliance.

3.1.10 External adapter

An individual adapter separated from the home appliance that is connected with the home appliance through an external interface.

3.1.11 Device description file

A kind of data structure file that describes self function and command of the home appliance. By resolving the device description file, the control terminal can understand the network function and operation command accordingly. There is a description file for each particular type of home appliance, specifying the parameters for control and status as well as the methods of how to read and configure these parameters.

3.2 Abbreviations

EMC Electromagnetic Compatibility

HG Home Gateway

ID Identification

PAN Personal Area Network

PDA Personal Digital Assistant

4 The architecture of home network and reference model of home appliances

4.1 Home network architecture and reference model

A home network system adopts a multiple levels network topology, which consists of two network segments, that is home network and home sub-network.

Home network can access to the outside network through a HG while home sub-network can be connected to the home network through a home control sub-network gateway. The devices in a home sub-network can intercommunicate and further access to outside networks by sub-gateways and HG.

The typical architecture of home network system and reference model is shown in Figure 1 below.

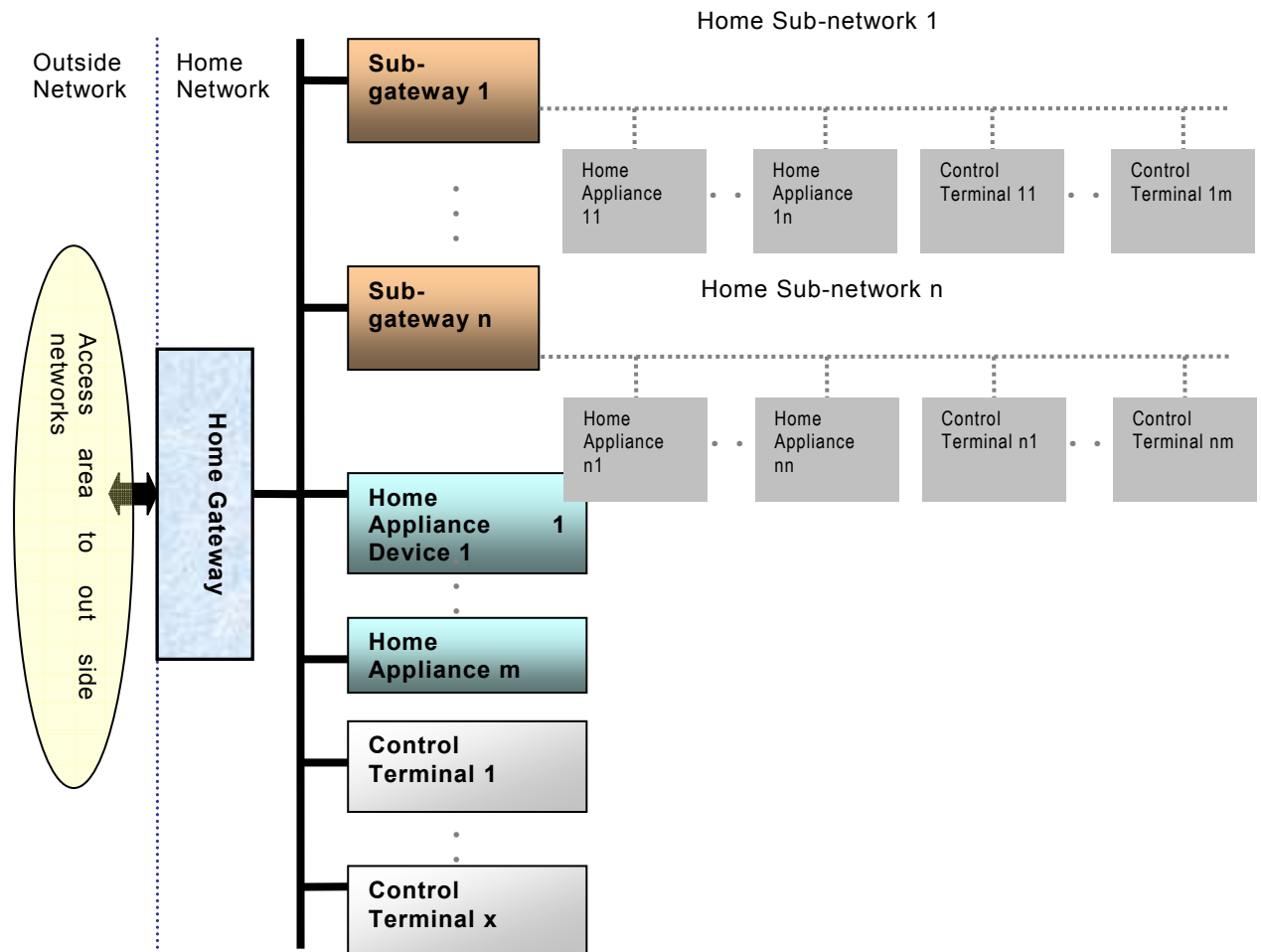


Figure 1 Home network architecture and reference model

Home network connects the HG, control terminals and home terminal devices.

HG can be connected with outside networks, serving as the interfaces among the devices located in home network and sub networks, and provides the functions of configuration and management for the home network.

The home network can support linkage of either wired or wireless.

The home sub network is an optional segment, which is classified as the logical concept from the home network.

Home sub network gateway is a device in the home network, supporting the protocols in both home sub network and home network. It can be incorporated into the HG in a logical form. It interconnects with devices in the sub networks, provides configuration and management for the home sub network, meanwhile serve as the interface between the home network and devices in the home sub networks.

The home sub network can also support transport media of either wired or wireless.

4.2 Application models of networked home appliances

In practice the home appliances can serve as the terminal devices, control terminals and even some functions of the HG. The following models illustrate some typical applications of networked home appliances.

4.2.1 Application model A

The home appliance shall be controlled and managed by the control terminal under this model.

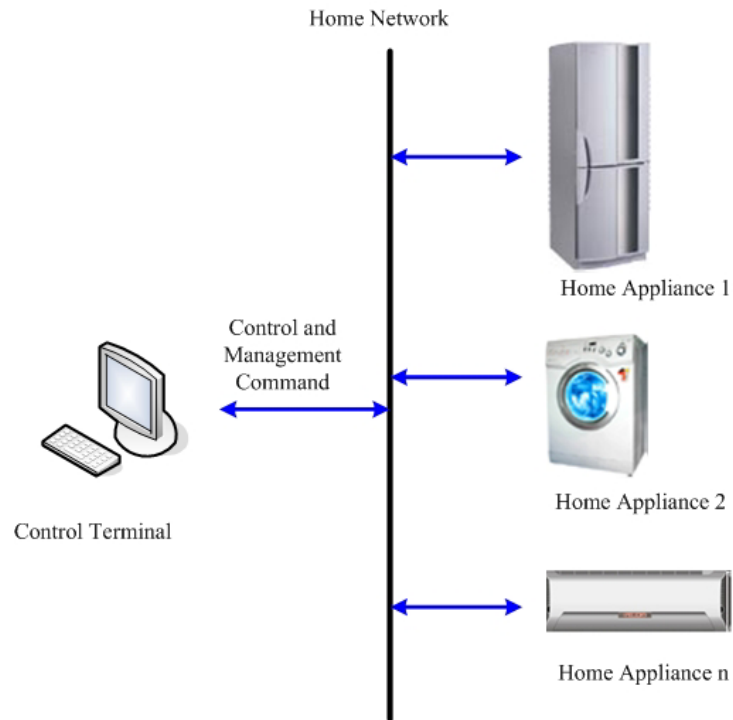


Figure 2 Application model A

4.2.2 Application model B

In this case the home appliance can play a role as the control and management center to control and manage other devices in the home network.

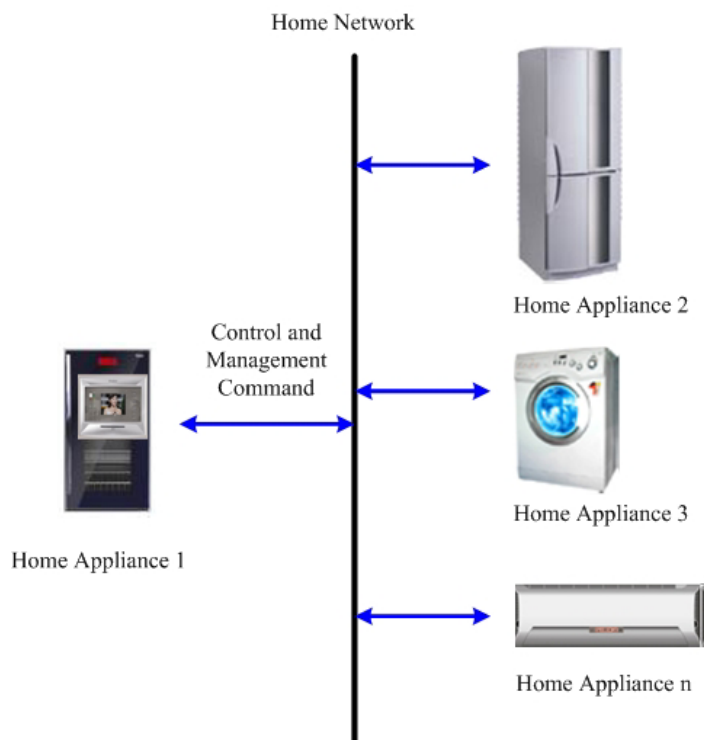


Figure 3 Application model B

4.2.3 Application model C

The user can use other devices like PDA or computer which serve as the terminal device and control terminal, from the outside networks, to access the home network via the HG.

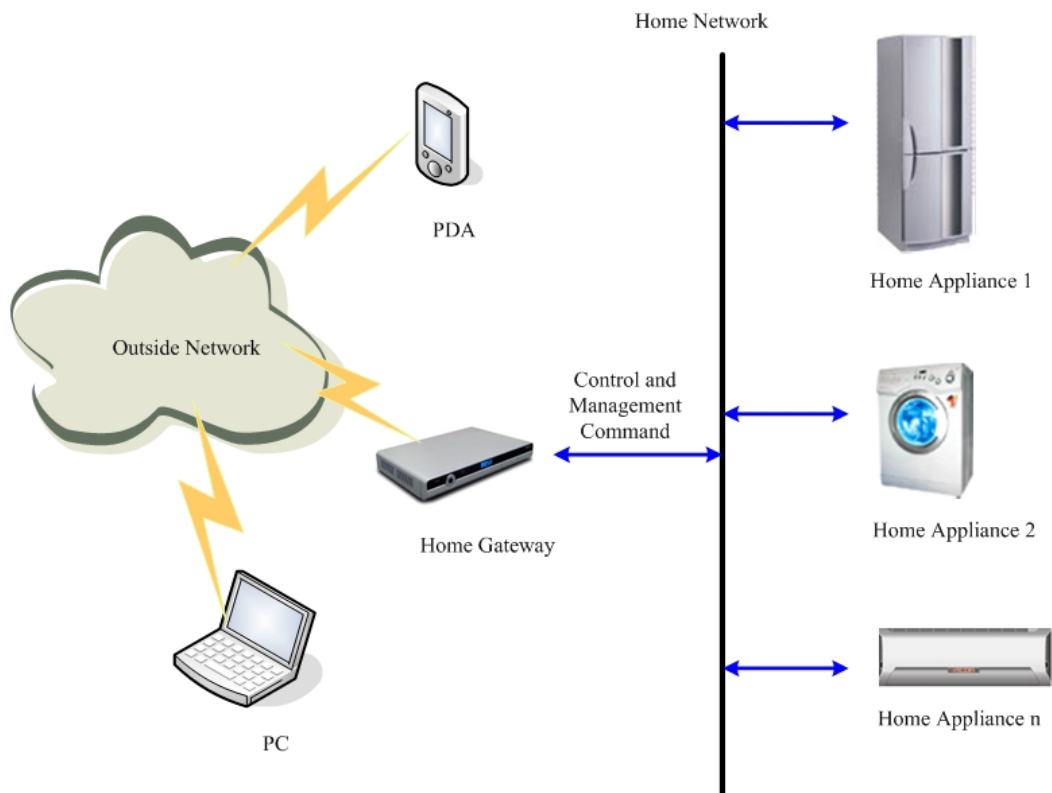


Figure 4 Application model C

4.3 General model of home appliances

The model mainly consists of human-machine interactive module, control module, implementation module and communication module, which is shown in Figure 5 below.

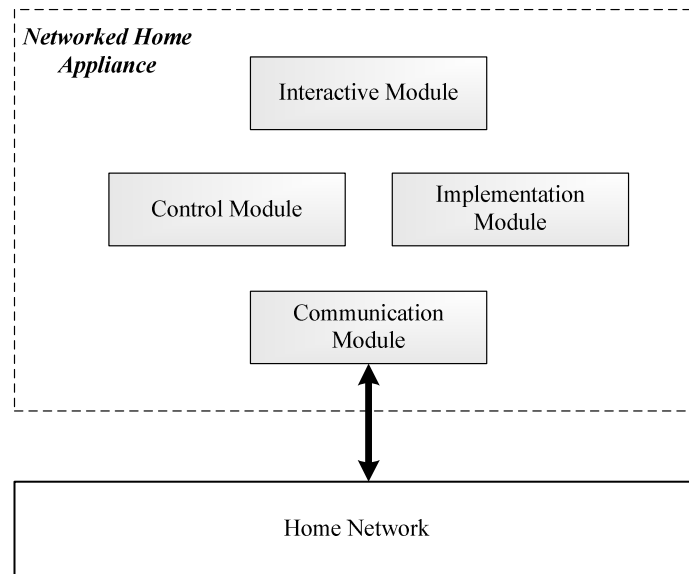


Figure 5 General model of home appliance

4.3.1 Communication module

Provides the communication service between home appliance and home network.

4.3.2 Control module

Provides various control services for the home appliances.

4.3.3 Implementation module

Sends out the command to implement the basic functional services like heating, washing etc.

4.3.4 Interactive module

All the interactive services can be realized through this module between user and home appliances, by means of keyboard, monitor, voice, or through the network to process the local or remote interaction. For example, computer, telephone or PDA can all become the tools for interaction.

4.4 Types of home appliances

Home appliances can be categorised as follows:

- **Basic appliances.** Such appliances have distinctive, unique characteristic elements which identify them completely. Basic appliances are Washing Machines, Tumble Dryers, Dishwashers, Microwave ovens, Refrigerators, Freezers, Water Heaters, etc. At the network level, a basic appliance has a single network address.
- **Complex appliances.** Such appliances consist of the integration of functional elements available in Basic Appliances in such a way that it is not possible to identify the separate Basic Appliances. Examples of complex appliances are Refrigerator-Freezers, Washer-Dryers, Microwave/Electric Ovens. At the network level, a complex appliance has a single network address.
- **Combis.** Such appliances result from the combination of Basic appliances and/or Complex Appliances which are each individually controlled and monitored, and the addition of further common functions such as a user interface, common commands (e.g. START or STOP for the entire Combi), common load management, common time management, common identification. Examples of Combis are Washing centres, Cooking centres, Cooling devices with independent cavities. At the network level, a Combi has

several addresses, one per individual element, as well as one to address the common part.

- **Unions.** Such appliances are the union of Basic appliances and/or Complex Appliances which are each individually controlled and monitored with no addition of common functions. Examples of such appliances are multiple functional gateways, multiple hobs. At the network level, a union has several addresses, one per individual element.

5 Functional requirements for networked home appliances

5.1 Network management requirements

Network management can be implemented through the control terminals which should be in the form of home gateway as a centralized management device.

5.1.1 Address and identifier

5.1.1.1 Network identifier

There is maybe not only one network in the home network system. Each network shall be assigned an identifier which is used to identify each network for communication among home appliances from different networks in the home.

5.1.1.2 Network address

The network addresses are required for communication among home appliances in home network. Sometimes a complex device may need several addresses while several home appliances may need only one address, though only one address is necessary for each device in most cases.

5.1.1.3 Device ID

Device ID is a serial number that is assigned to each home appliance by the manufacturer, which is a unique identifier to identify the device with respect of manufacturers and types. The device ID is different from network address. The former is used to identify the device when the device is not in the network.

The ID of the home appliance shall consist of version number, manufacturer number, product serial number and reserved bits.

The length of the ID shall be 128 bits. See table 1 for the ID structure.

4 Bits	54 Bits	64 Bits	6 Bits
Version	Manufacturer code	Product serial number	Reserved

Table 1 Structure of device ID

Version: current version is 00

Manufacturer code: to be designated by the standardization organization.

Serial number: the unique number defined by the manufacturer which includes the type, model, serial number of the product.

Reserved bits: reserved for future development.

5.1.2 The ability of connecting to the network

The home appliance shall have the ability of connecting to the home networks. Following the technology requirements and guideline provided by the manufactures, the home appliances can be connected to the corresponding network systems, and get the network identifier and address. A kind of "home network certified" indication shall be found on the home appliance.

Generally there are two ways for connection to the networks.

Automatic connection: When the home appliance is powered-on, it can be automatically connected to the home network without any manual operations. The

automatic connecting application can be made by either the home appliance or the network system.

Manual connection: In this case, the connection application shall be made manually or by manual interference to finish the whole connecting procedure.

5.1.2.1 Control terminal of broadcast mode

Requirements for home appliance

- a) When the control terminal is powered-on and ready for operation, it shall request periodically itself or by manual operation to broadcast the query information from new home appliances, in order to request the new home appliance to register in the home network.
- b) The home appliance then responds to the request for registration.
- c) When the control terminal receives the response from the home appliance, it shall confirm it and add this new device into the registry to complete the process.

The application flow is illustrated in Figure 6 as follows.

- a) Start the process of registration for home appliance manually (optional).
- b) Control terminal sends the broadcast query for new device to the home appliance.
- c) New home appliance responds to the control terminal
- d) Control terminal requests the new device ID.
- e) Home appliance sends the device ID to control terminal
- f) Control terminal assigns the address to home appliance.
- g) Home appliance changes the network information.
- h) Home appliance sends the acknowledgement information to control terminal
- i) Control terminal changes the registration of the home appliance.

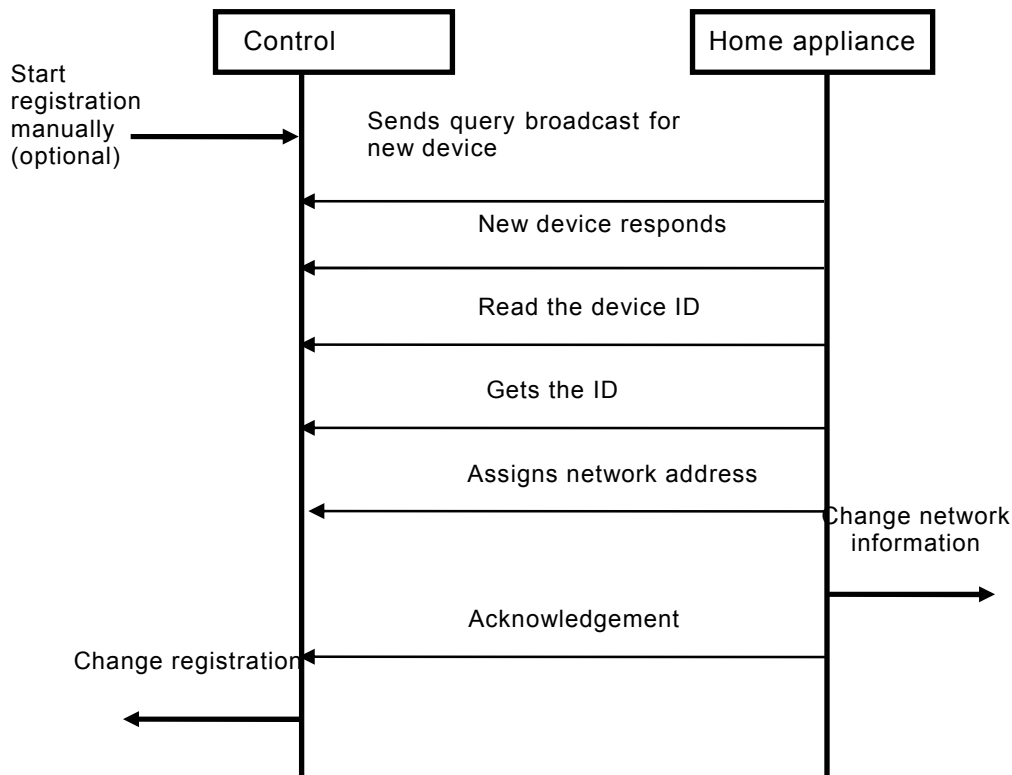


Figure 6 Network manager invokes the device registration manually or automatically

5.1.2.2 Terminal device of request mode

Requirements for home appliances:

- a) Control terminal shall be able to receive the request for registration from the home appliance, when it is powered-on and ready for operation.
- b) Control terminal shall add the home appliance to the registry to complete the process.

The application flow is illustrated in Figure 7 as follows.

- a) Home appliance is powered-on.
- b) User start to register manually (optional).
- c) Home appliance sends the broadcast to control terminal to request for registration.
- d) Control terminal responds to the request.
- e) Control terminal reads the new device ID from the home appliance.
- f) Home appliance sends the device ID to control terminal.
- g) Control terminal assigns the network address to home appliance.
- h) Home appliance changes the network information.
- i) Home appliance sends confirmation to control terminal.
- j) Control terminal changes the registration information.

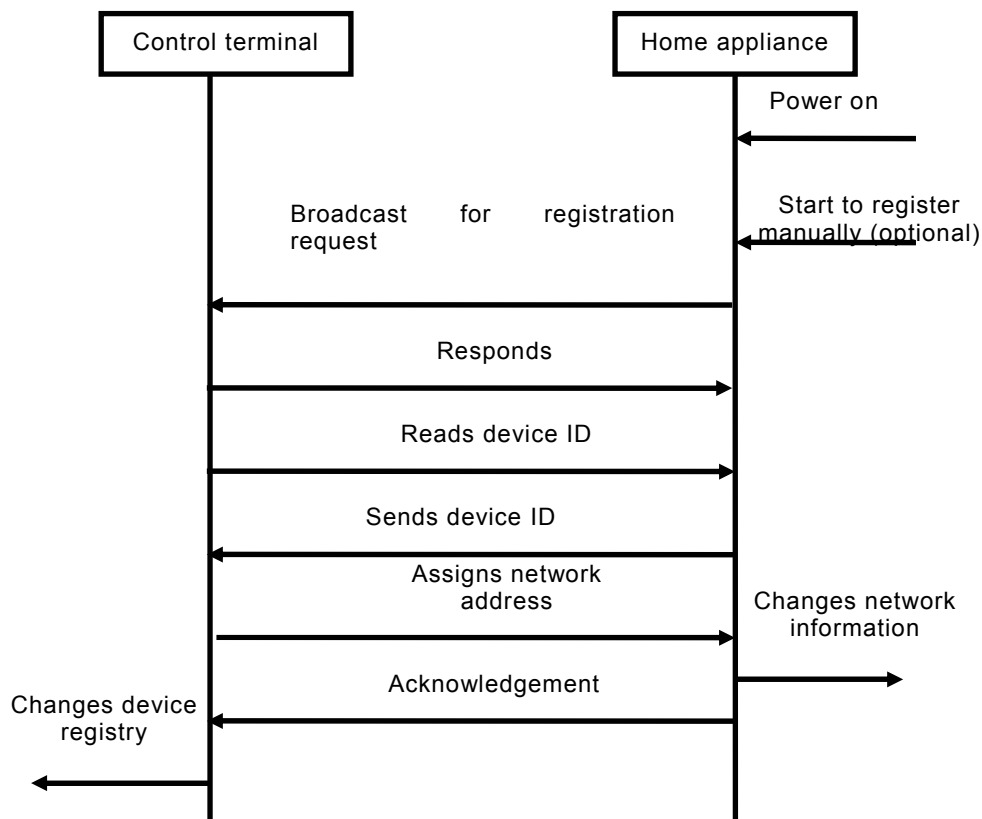


Figure 7 Manual or automatic registration

5.1.3 The ability to disconnect from the network

The home appliance shall have the ability to disconnect from the home networks. It can disconnect from the home network and clear all the corresponding network information. The status of disconnecting shall be indicated on the home appliance accordingly.

- a) Automatic disconnecting: If the home appliance already in the network can not make normal communication with the home network within time limit T_{6212} , it shall then automatically remove the network configuration.
- b) Manual disconnecting: The home appliances already in the network can be disconnected by the manual operation, and the network shall remove the corresponding network configuration.

Note: The value of T_{6212} is to be defined by the manufacturer.

5.1.3.1 control terminal invokes the de-installation

Requirements for home appliances

- a) Control terminal can invoke the de-installation request actively.
- b) Home appliance shall respond the request and feedback it to the control terminal.
- c) Control terminal shall be able to receive the response and remove the appliance configuration from the registry
- d) Control terminal shall also be able to finish de-installation if it gets the information that the registered device is not online within a specified time limit.

The application flows is shown in Figure 8.

- a) Start the de-installation of home appliance through control terminal manually.
- b) Control terminal sends the command of de-installation to home appliance.
- c) Home appliance sends acknowledgement to control terminal.
- d) Home appliance changes network information.
- e) Control terminal changes the device registry.

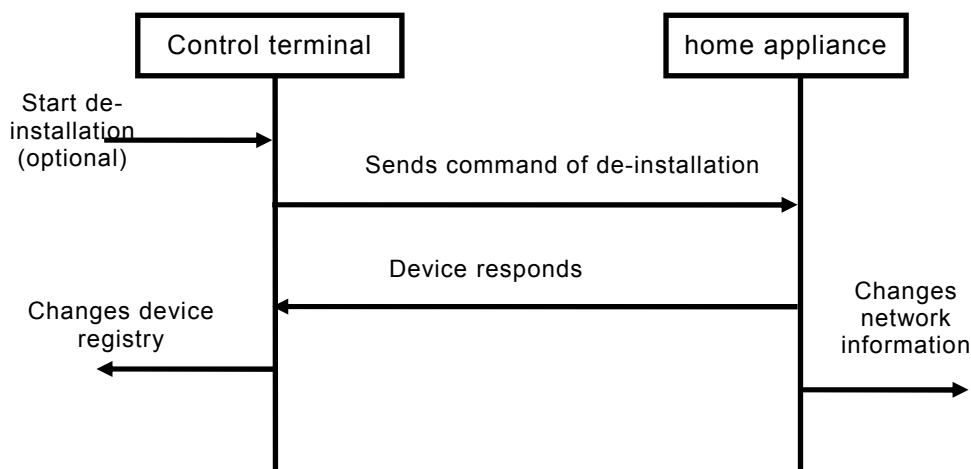


Figure 8 Network manager invokes de-installation automatically or manually

5.1.3.2 Terminal device of request mode

Requirements for home appliances.

- a) Home appliance shall be able to start the de-installation request actively.
- b) Control terminal shall be able to receive the request sent from home appliance when it is in the status of normal operation.
- c) Control terminal shall receive the request of de-installation and remove the device configuration of home appliance.

The application flow is shown in Figure 9.

- a) Start the de-installation manually on the home appliance.

- b) Home appliance sends the de-installation request to control terminal.
- c) Control terminal confirms and accepts the request.
- d) Home appliance sends the acknowledgement to control terminal.
- e) Home appliance changes the network information.
- f) Control terminal changes the registry of hone appliance.

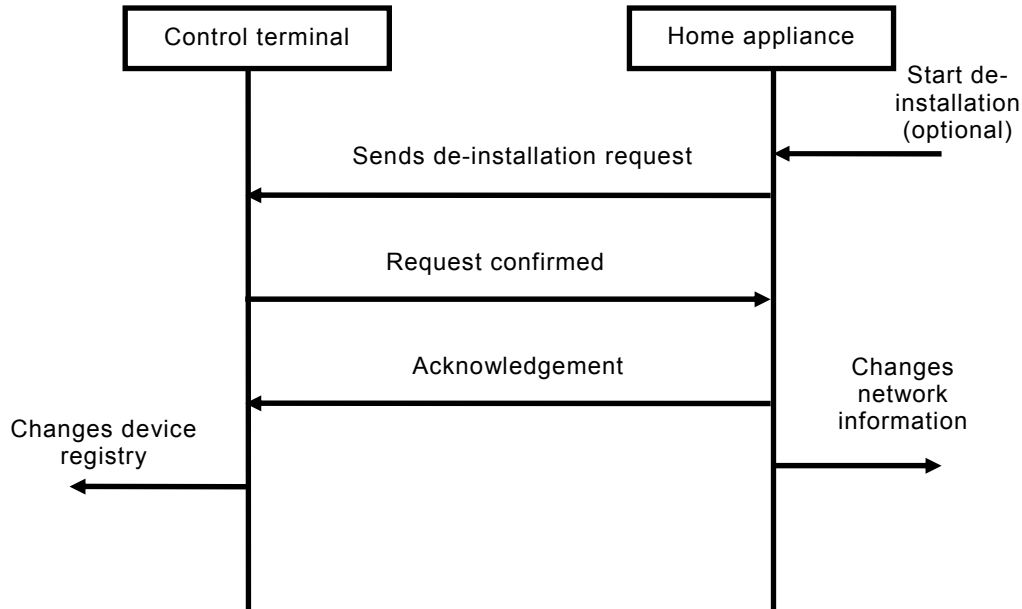


Figure 9 Device invokes the de-installation automatically or manually

5.1.4 The ability to re-connect the network

If the home appliance disconnects from the home network for reasons like power-off, it shall have the ability to complete re-installation in the network.

See figure 10 for the application flow.

- a) Home appliance sends the request to control terminal for reconnection
- b) Control terminal responds and send back the acknowledgement.
- c) Control terminal changes the device registry and completes reconnection.

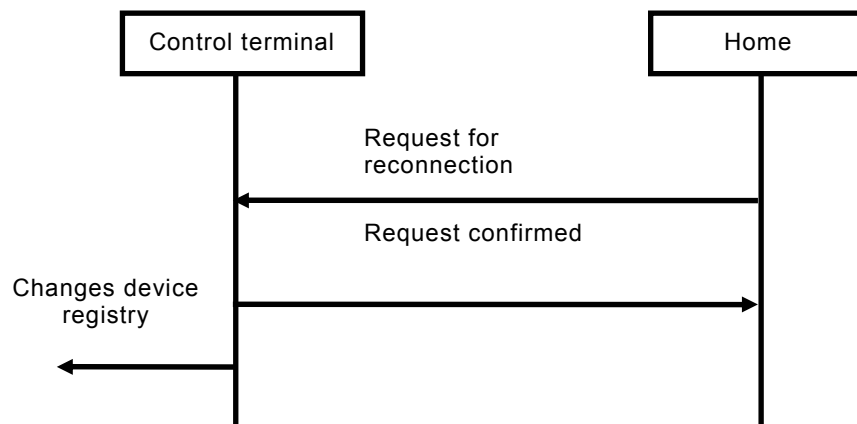


Figure 10 Device completes re-connection

5.1.5 The ability to check the network status

Home appliance shall have the ability to check the connection status, either in normal communication status or in abnormal status. When something abnormal takes place in connection between home appliance and home network, the corresponding indication shall be shown in the home appliance.

The flow below illustrates how to check that the network connection is OK. See Figure 11

- a) Home appliance sends the request to check the communication route
- b) Control terminal acknowledges the request within the time limit.
- c) Route check is completed. The network status is OK.

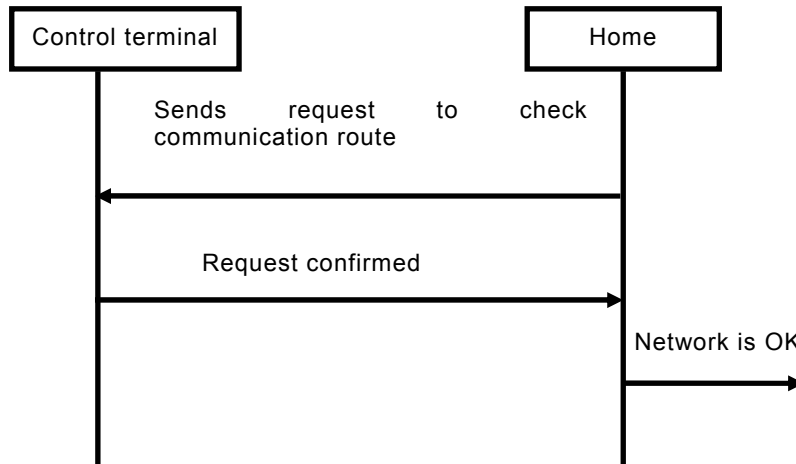


Figure 11 Connections status checked is OK

The flow below illustrates how to check that the network connection is abnormal. See Figure 12

- a) Home appliance sends the request to check the communication route
- b) Control terminal gives no response within the time limit, request not confirmed.
- c) Home appliance sends the request once again.
- d) Still no response from the control terminal when time is out.
- e) The network check is over, and shows that the status is abnormal.

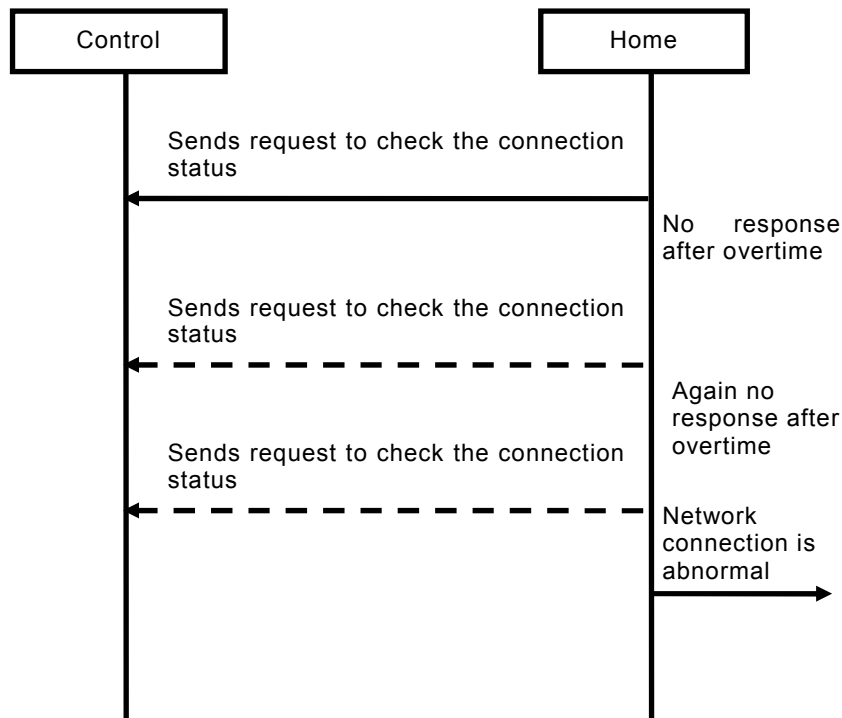


Figure 12 Connection checked is abnormal

5.2 Communication control function of home appliances

Home appliance shall have the ability to set up conversation with other home appliances in the home network. Home appliance can also receive the message input from other appliances or send out the message of itself through the network.

5.2.1 Control

Home appliances can be controlled in the home network by control terminal which can get the control command by resolving the device registry and device description file. The control terminal sends the control command as per the communication protocol specified, to home appliance, in order to control and manage all the home appliances connected in the home network.

When the home appliance is in the process of control, if what the appliance received is in wrong format or the control terminal can not receive the acknowledgement information from the home appliance within the time limit, then control terminal shall send the command again in accordance with the protocol.

The application flow is shown in Figure 13.

- Control terminal sends the control command to home appliance
- Home appliance executes the command
- Home appliance at the same time sends the acknowledgement to control terminal.

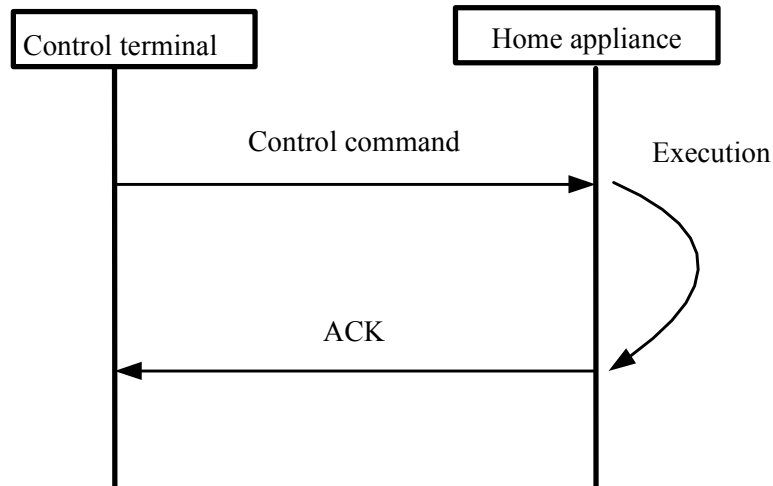


Figure 13 Control terminal sends control command to home appliance

5.2.2 Status of home appliances

The control terminal shall support the query of status for home appliance, which can be done by the following procedures.

- With resolving the device registry and device description file, control terminal can acquire the query command and send it to home appliance in the home network in accordance with the communication protocol. The home appliance shall then send the current status to control terminal to update the information of home appliance.
- If the status of home appliance changes, it shall report it to control terminal actively in order to keep control terminal get the updated status of home appliance.

The application flow is shown in Figure 14.

- Control terminal sends the query command to home appliance.
- Home appliance executes the command.
- Home appliance sends the status to control terminal.

Home appliance reports the current status which is shown in Figure 15.

- The status of home appliance has changed.
- Home appliance sends the status to control terminal.

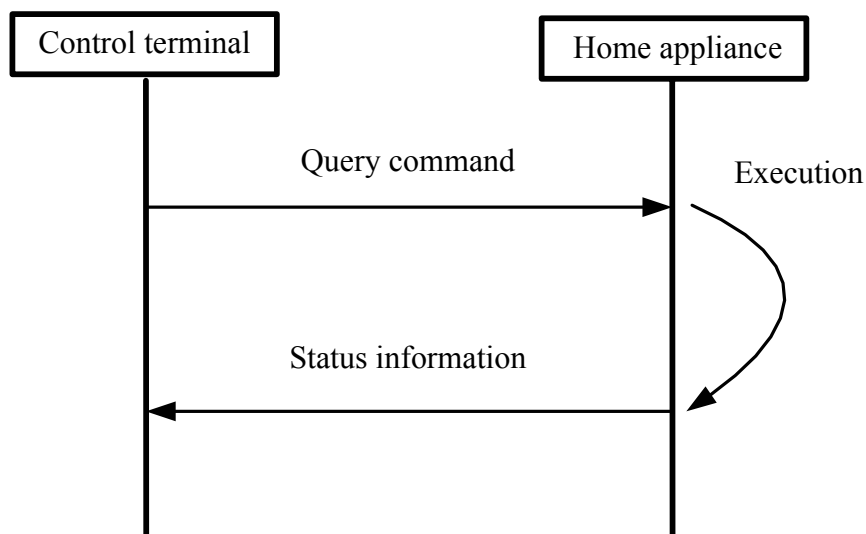


Figure 14 Control terminal sends query command to home appliance

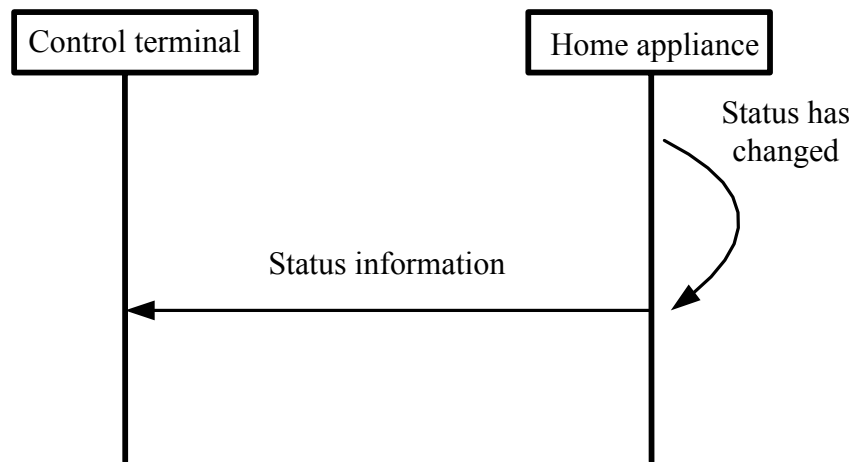


Figure 15 Home appliance reports current status to control terminal

5.2.3 Malfunction feedback

The malfunction feedback can be processed by either of the following ways.

- Control terminal shall receive the malfunction information sent from home appliance actively. It shall send out the alarm by various ways like email, telephone, according to the configuration of the end-users.
- Control terminal shall check out the malfunction of home appliance periodically. Once the malfunction information is received, it shall send out the alarm by various ways like email, telephone, according to the configuration of the end-users.

Home appliance sends malfunction info to control terminal, which is shown in Figure 16.

- Malfunction has taken place.
- Home appliance feedbacks the malfunction to control terminal.
- Control terminal sends the acknowledgement to home appliance.
- Control terminal sends out the alarm.

Control terminal checks out the malfunction from home appliance, which is shown in Figure 17.

- Malfunction happened in the home appliance.
- Control terminal sends the query command to home appliance.
- Home appliance reports the malfunction information to control terminal.
- Control terminal sends out alarm when it receives the malfunction information.

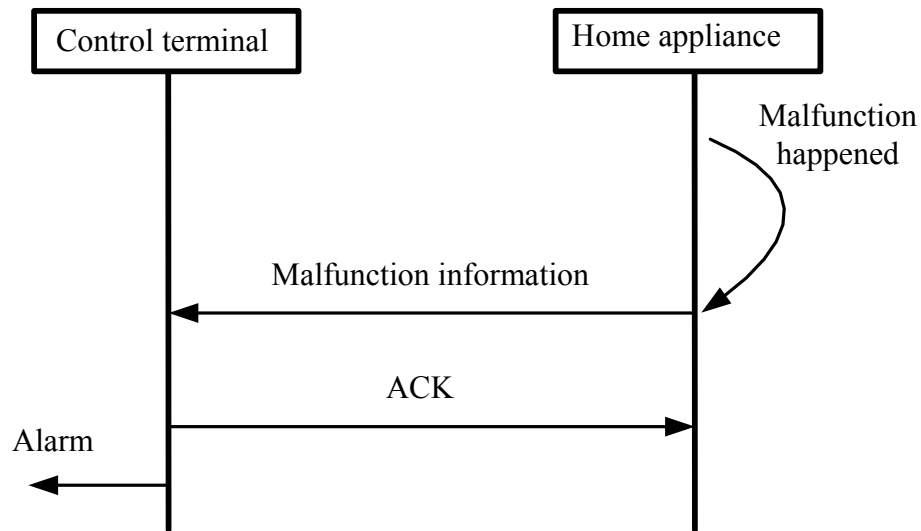


Figure 16 Home appliance sends the malfunction to control terminal

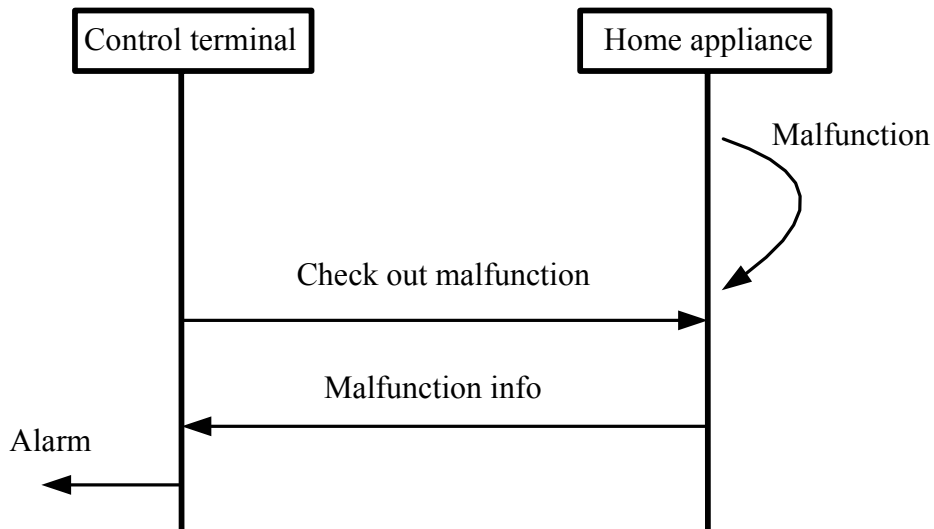


Figure 17 Control terminal checks out the malfunction from home appliance

5.2.4 Interaction

The interlock or interaction can be set up among different types of home appliances. When the values set in one or several home appliances are reached, some operation shall be triggered. For instance, if the temperature sensor checked the indoor temperature is 30°C, then control terminal shall start the air conditioner automatically to cool down.

The application flow is shown in Figure 18.

- The value set on home appliance 1 is triggered.
- Home appliance 1 resolves the command triggered.
- Home appliance 1 sends the command of de-installation to home appliance 2.
- Home appliance 2 executes the command.
- Home appliance 2 at the same time sends the acknowledgement to home appliance 1.

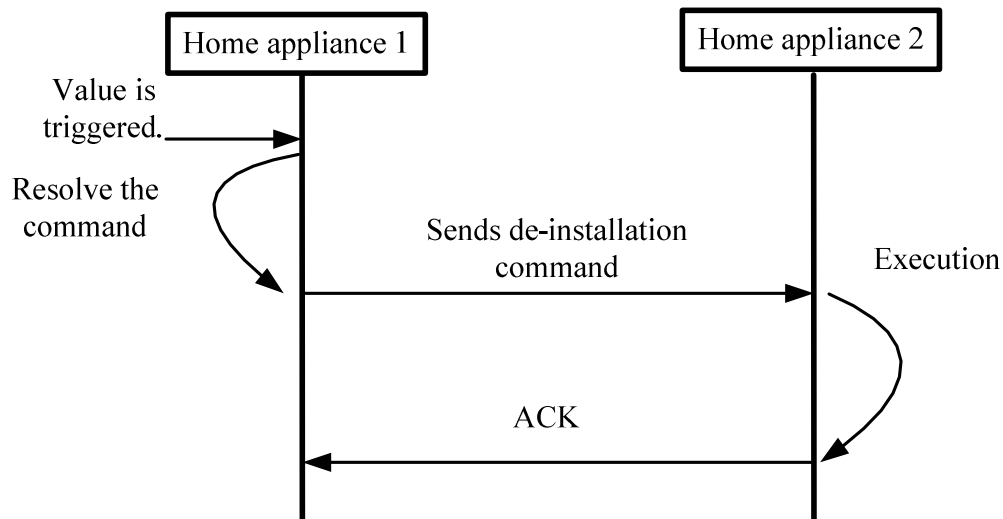


Figure 18 Interaction among home appliances

5.3 Network levels to be accessed

The requirements for home appliance:

- Home appliance can only allow the local operation by users without supporting access to home network.
- Home appliance can support both local operation and access to home network, but does not support access to outside networks.
- Home appliance can support local operation, access to both home network and outside networks.
- Home appliance can provide various services according to different network levels to be accessed.

5.4 Command priority

As there are too many information to be transported in the home network, the command of the home appliance shall be classified by priority.

For instance, the following commands are arranged from high to low.

- Malfunction related commands
- Management commands
- General commands

Generally, command received locally is of high priority than remote commands.

5.5 Human-machine interface

Home appliance can reserve all the original human-machine interfaces, for example, buttons, keyboard, and monitor.

Home appliance can support the centralized control interfaces including mobile or fixed control terminals. The interfaces can be created automatically or can be customized by users.

Home appliance can also be interacted remotely through computer, mobile phones, and fixed lines.

5.6 Storage function

Home appliance shall have the ability to store the data and can keep the memory after power failure. The data stored can be modified when necessary, which includes basic and extended storage functions.

- Basic storage. Including ID of home appliance, network address.
- Extended storage. Including executing information and parameters.

5.7 Power supply requirements for home appliances

In general, the power supply for home appliance is classified into three types, that is, powered by bus, powered by local battery (incl. solar panel) and powered by mains, which is shown in Figure 19.

To make sure, that a cable is not thermally overloaded, the power supply shall have a short circuit and/or overload current limitation.

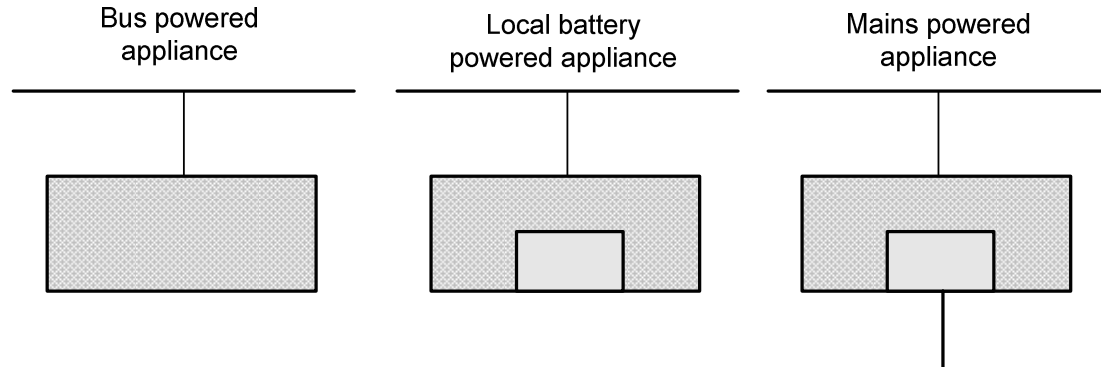


Figure 19 Power supply

5.8 Energy saving requirements

- a) No additional power consumption should be made when the communication function is added to the home appliance.
- b) Energy saving can be realized through controlling switches or other equipments of home appliance in the network that are centralized controlled or remotely controlled.
- c) Home appliance can also be connected with a meter, to monitor and analyze the real-time power consumption, and manage the operation of home appliance by software, hence to meet the requirement of energy saving.

5.9 Other requirements

- a) Home appliance shall be compliant with all the specified functions and performance when it is in normal operation, and shall not impact the usage of other adjacent devices.
- b) The specification and performance shall not be in degradation when the home appliance is networked.
- c) Home appliance shall at least meet the requirements of the performance, industry safety requirement and EMC specified in the country accordingly.
- d) The detailed requirements of safety and EMC are not involved in this standard.
- e) Home appliance shall be used in the environment of home.

6 Device description file

6.1 General

Various types of networked devices may exist in home network, which shall require compatibility and extendibility for the home network. Compatibility means devices from different manufacturers can be compatible in home network while extendibility requires that new type of devices can also be connected into the network when necessary.

Home appliance shall be able to describe its function and content of service to gateway, control terminal and other home appliance in the network. Each kind of home appliance shall have a device description file of its own, which shall be in accordance with unified specification. The details of device description file are not

established in this document, which are to be specified in further standard --- *Specification of device description file of networked home appliances*.

The form of device description file should be a binary file or XML file, where appropriate. Each type of home appliance shall have a device description file depicting self-function and command, which can be stored in the device memory, network adapter, outside network server or other storage media. The only identifier of device description file is a device ID. When home appliance is connected to the home network, home gateway and control terminal shall discover the description file accordance with its device ID, thus to resolve the specific function and parameters of home appliance accordingly.

6.2 Component of description file

Description file shall be composed of file header, functional description and resource description.

File header
Functional description (functional parameters and data)

Table 2 Component of description file

File header consists of the fixed information of the device like file version, size, device name, manufacturer, product type, product model, device ID, functional quantity, functional address, parameter quantity, parameter address and extended resources.

Functional description consists of function name, operation command and parameters, operation return and parameter, operation mode.

Human-machine interactive description is for the purpose of ease usage of device and its function.

6.2.1 General requirements of file header

The header should include, but not limited to, the following.

- Normative file version: the standard document version on which the file is based.
- File type: the code of file to be complied.
- File size: in the unit of word.
- Country code: the code of the country or region the manufacturer belongs to.
- Manufacturer code: representing the manufacturer.
- File version: the current version of device description file.
- Product type
- Device ID
- Function quantity
- Parameter quantity

6.2.2 Functional description

It is composed by a preset functional blocks in the description file. A functional block shall be composed by a group of parameters which specify the commands and parameters. Each functional block and parameter may have an index number.

The parameters of functional blocks can be classified as standardized, non-standardized, proprietary items, or mandatory and optional items, or interoperable and non-interoperable items.

- **Standardised** items are items commonly agreed by all manufacturers and described in a clear and complete way in this specification. They may be implemented only in the common and agreed way described in this specification.
- **Non-standardised** items are items commonly agreed by all manufacturers, not described in a complete way in this specification, providing the possibility for different manufacturer implementations. They must be defined in a complete way by each appliance manufacturer and their complete description must be included in publicly available documents provided directly by the appliance manufacturer. These manufacturer definitions must comply with any commonly agreed characteristics described in the specification.
- **Proprietary** items are items not commonly agreed by all manufacturers, and not described in this specification. They provide the possibility for implementing proprietary manufacturer functionality, thus it is not mandatory for each manufacturer to include their complete description in any publicly available document.

Mandatory and Optional items:

- **Mandatory** items are the standardised and non-standardised items included in this specification which must be implemented for all appliances of a specific appliance type.
- **Optional** items are the standardised and non-standardised items included in this specification which may be implemented by all appliances of a specific appliance type.

Interoperable and Non-interoperable items:

- **Interoperable** items are all standardised and non-standardised items included in this specification. They may be used in an interoperable way by all appliances.
- **Non-interoperable** items are proprietary items. They may not be used in an interoperable way by all appliances.

6.2.3 Human-machine interaction

In addition to the self functional description, the home appliance can also add the human-machine interactive description, in order to create the human-machine interface in the control terminal. The detailed human-machine resources shall be specified in the resource description.

7 Requirements for network adapters in home appliances

7.1 General

Home appliance can access to the networks by a communication adapter which can be interacted with by communication interface. Network interface is a node of home network, which accesses to network by network interface to implement various services and application of home appliance in the network.

Network adapter shall have the following functions.

- a) Connects with home network as a node, to deal with the communication protocols and make home appliance accept the protocols.
- b) Connects with the home appliance with the communication interface, deals with the information from home network and send them to home appliance, and also sends the information of home appliance to home network.
- c) Information input and output.

The communication protocol model to be carried out by the network adapter is shown in Figure 20 below.

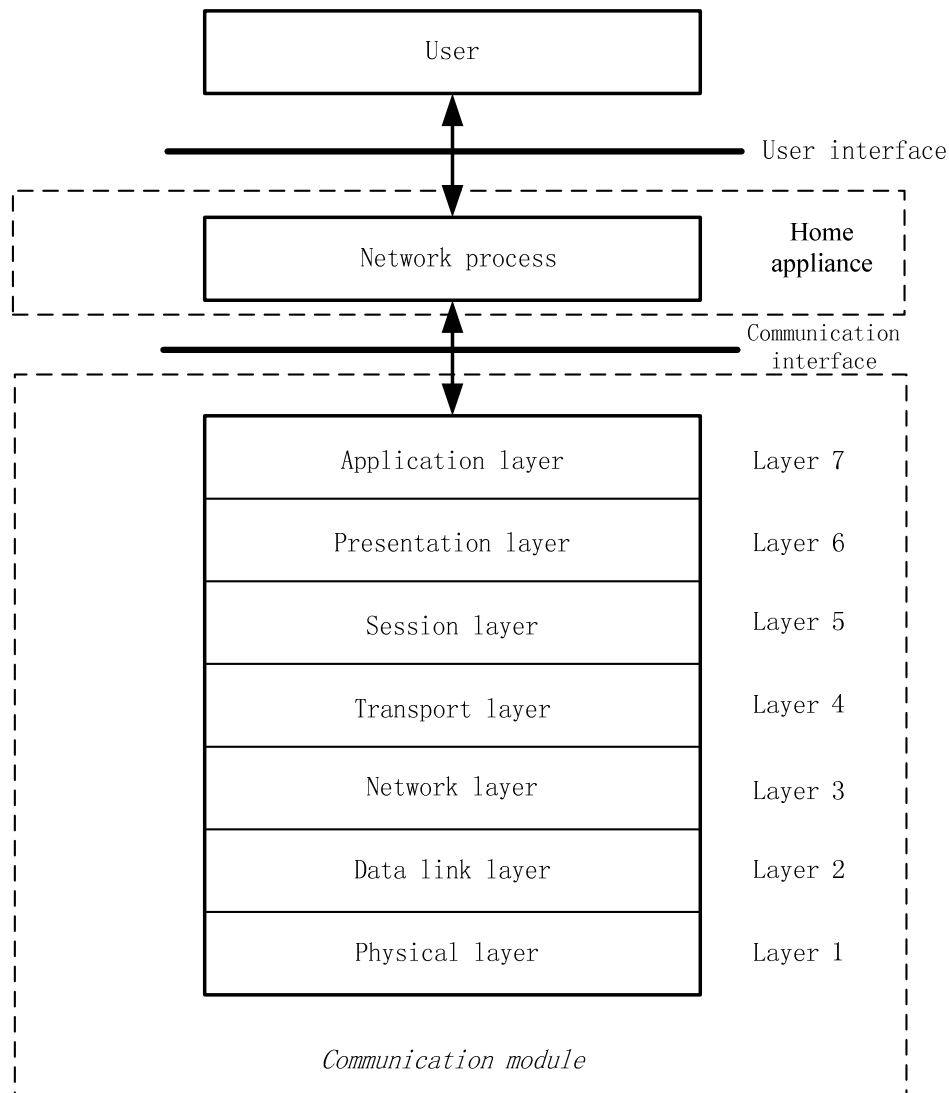


Figure 20 Communication protocol reference model of network adapter

7.2 Media requirement and communication protocols

7.2.1 Choice of media

In general there are two groups of transport media for networking, namely wired or wireless. Listed by the frequency of the traditional use they are: communication cables, infrared, wireless, and power line cables. The infrared is also in the wireless group while power line cables and communication cables can be grouped as the wired. Within these groups power line and infrared are the media with the lowest differentiation of transmission characteristics while communication cables and wireless offer a wide variety. Some applications are so demanding that the choice of media is limited due to their transmission characteristics. For other applications the products needed only support a limited set of media.

The table below lists the pros and cons of a specific medium. These points need to be considered together with the media by the application-specific equipment planned to be used as well as the building phase for the home network.

Medium	Advantages	Disadvantages
wireless	Flexible. Many technologies with different speed and distance. Widely available and simple to use. Avoid the disruption of installation.	Shared resource subject to congestion. Limited range at the most frequencies. Limited penetration of some building materials and damp. Open medium that needs protection for many applications. Information security risk, both easy to intercept and the traffic indicates presence or absence of user in the home. EMC and physiological effects need to be considered. A number of people have prejudices against wireless technologies especially in the home.
infrared	simple, secure	Does not compete with RF PAN solutions. Does not penetrate walls.
power line	Already cabled to all power outlets. Directly applicable for the low data rates. Used by home control applications.	May not provide sufficient reliability for "mission/life critical" applications. In general electromagnetic hazards increase with increasing speed of transmission.
communication cables (includes: coaxial and balanced pairs, optical fibers)	Secure, safe, and reliable. Easy to install during building and refurbishing phase. As data rate requirements increase the advantages outweigh the disadvantages of installation in a lived in home.	Unless ducts readily available laborious and disruptive to install in an inhabited home. With unshielded cables, EMC effects have to be considered specially.

Table 3 Comparison of some media

7.2.2 Communication protocols applicable to the low speed control network

The communication protocol includes but is not limited to the following

- a) Wireless: Zigbee, Bluetooth, IrDA,...
- b) Wired: LonWorks, X-10, CEBus, Echonet, Konnex ...

7.2.3 Home appliance supports unicast, multicast and broadcast.

Unicast	Message sent to only single home appliance
Multicast	Message sent to a group of home appliances
Broadcast	Message sent to all home appliances in the network.

Table 4 Unicast, multicast and broadcast

7.3 Communication interface of home appliance adapters

7.3.1 Requirements for hardware of adapter

- The adapter can be connected with home appliance in the form of built-in or external device.
- The adapter can be powered by home appliance.
- The installation of adapter should not affect the normal performance of home appliance.
- A dual-route communication shall be supported between home appliance and adapter.

Refer to Annex A for the some reference details.

7.3.2 Requirements for software of adapters

7.3.2.1 Communication format

Asynchronous serial mode is used for the communication, and byte rate is either 2400 bps or 9600 bps. The communication format should include at least frame header, frame length, frame type, data type, data information, check sum, which is shown in table 5.

B7	B6	B5	B4	B3	B2	B1	B0
Frame header (2 bytes)							
Frame length (1 byte)							
Frame type		Data type					
Valid information (0~252 bytes)							
Check sum (1 byte)							

Table 5 Frame format

- Frame header: indicates one frame's starting. The length is 2 bytes.
- Frame length: indicates the number of bytes used by the whole frame which includes the frame style, data type, valid information and check sum. The length of frame length domain is 1 byte, with value ranged from 2 to 253.
- Frame style: defines the frame's function and uses 2 bytes. Refer to table 7 for details.
- Data type: defines function of the frame, with data length 6 bytes. See Table 7.

- e) Valid information: the information required by home appliance, its length is 0~252 bytes. In the devices file, it defines the control commands, including control command, status command, configuration command, status information, alarm command and malfunction information, etc.
- f) Check sum: indicates the check sum of the frame length, frame style and valid information, which is added by their bytes.

Frame type	Data type	Description
Communication command frame	Control frame	To configure the home appliance
	Status frame	To read the status of home appliance
	Invalid(failed) frame	The response frame when the control frame is invalid.
	Report frame	To return the information automatically from home appliance.
	Malfunction alarm frame	To return the alarm information automatically from home appliance.
	ACK frame	To confirm the communication command.
	Stop alarm frame	To send a stop alarm information.
	Others	
Communication management frame	Reading device ID command frame	To read device ID.
	Device ID response frame	To respond the device ID.
	Link test command frame	Used for link test
	Link test reply frame	Used for link response.
	Reading device communication speed frame	To read the communication speed rate of device.
	Communication speed response frame	To respond the communication speed rate of device.
	Others	

Table 6 Data type

7.4 Communication process

7.4.1 Process of communication management frame

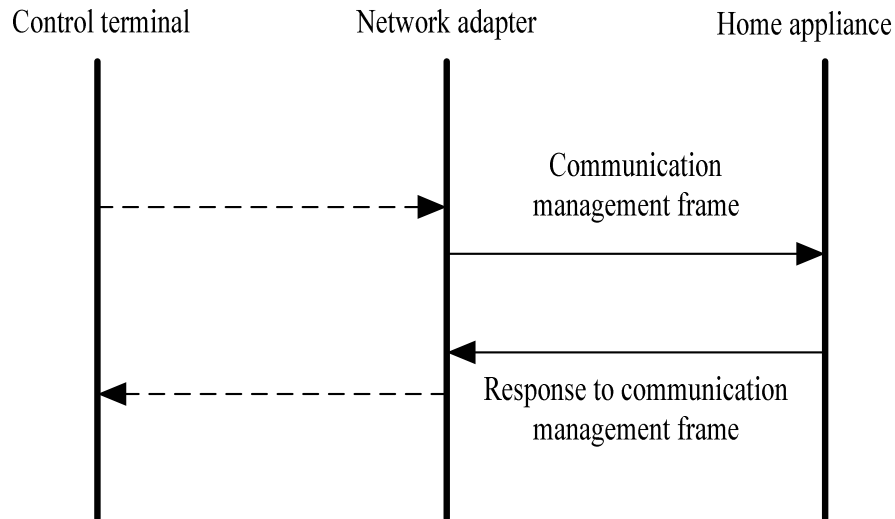


Figure 21 Process for communication management frame

- a) Reading device ID command: this command is used at the moment when the home appliance is powered on or restarts, and it is transmitted from adapter to home appliance.
- b) Link test command: this command is used to test if the communication of home appliance is OK. The testing device transmits the command to the adapter, then forwards it to home appliance. Link testing responses frame can be returned after the home appliance correctly receives the command, and then be transmitted to testing device by the communication module. If the module can not receive the response frame correctly, it will send communication failure alarm frame. Sending or responding of this command does not include valid information domain.
- c) Command frame of reading communication speed: this command is sending from the adapter to home appliance when a new home appliance is initialized to work. If the communication speed has already been known by the adapter, this command is not necessary. The command is sent at 9600bps by default. If there is no response, then 2400bps is used. No valid information is included in the command when it is sent from adapter to home appliance. One byte of valid information frame known as the speed code is returned from home appliance to the adapter.

7.4.2 Process of control command frame

When the control information is received, control terminal shall pack it and send the package to the adapter by wireless (or wired) way. The adapter receives the control information from the upper-layer devices and sends it to control board of home appliance. After the control frame is received by the control board, the control information package is unpacked in the same format as the above control frame. If the control frame is correct, a corresponding status frame shall be returned to the adapter. If there is any error in the check sum of the control frame, the corresponding

status frame will not be sent. A valid frame shall respond when the control frame can not be carried out or there is any control logical error in it.

After the control board of home appliance receives a correct control frame, it picks up the frame style and valid information, configures the device and carries out the corresponding operations, and then packs the current status frame. This status frame will be sent to the adapter in a limited time. If the adapter shall not receive the status frame in a certain time, it shall assume there is error taking place in the communication process and shall send the alarm frame to indicate the communication failure.

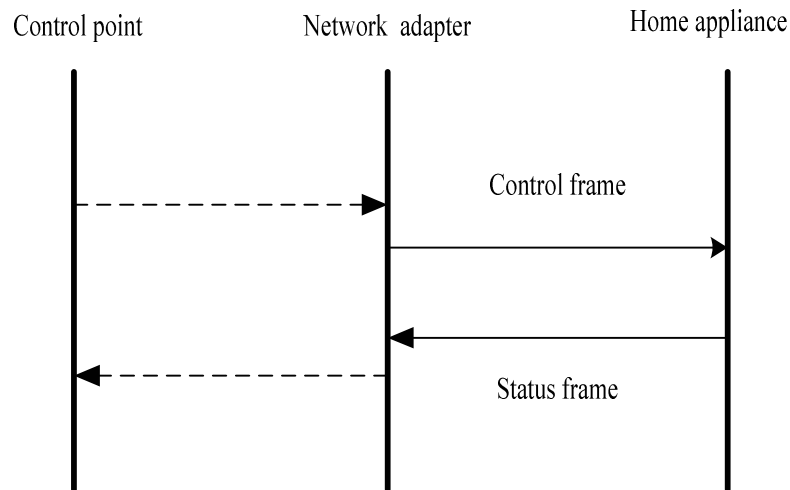


Figure 22 Process of control command frame

7.4.3 Process of status releasing frame

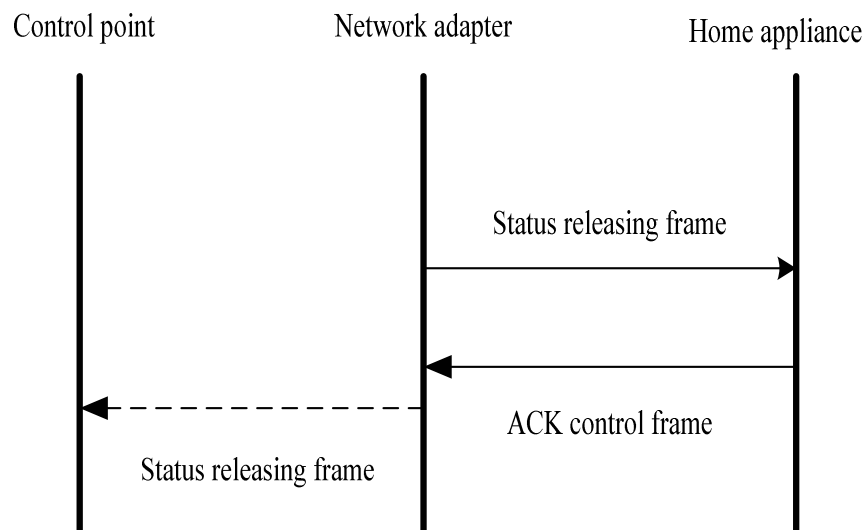


Figure 23 Process of status releasing frame

When a home appliance needs to send some message to the network adapter, it will pack the report information in accordance with the format of the status releasing frame, and send it to the adapter. The adapter shall send ACK control frame to the

home appliance in a certain interval after it receives the report frame. In this process, the home appliance will send the report frame repeatedly by a certain interval until it receives the ACK control frame.

7.4.4 Process of malfunction alarm

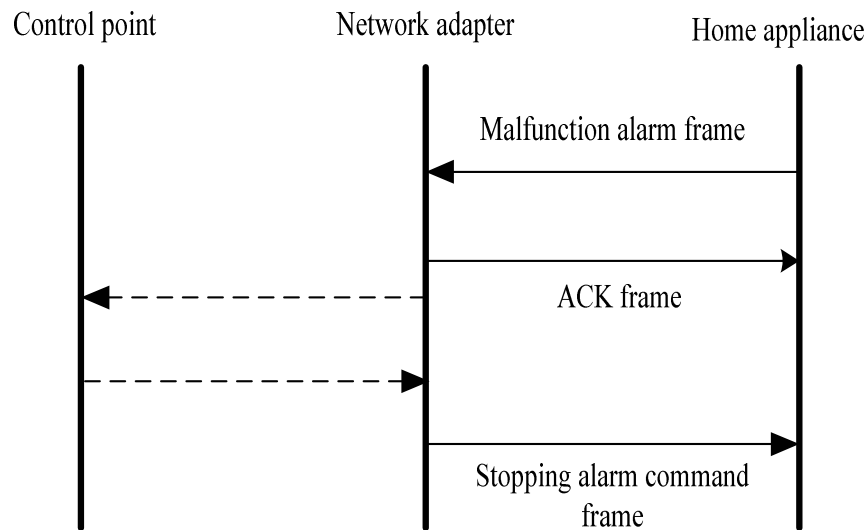


Figure 24 Process of malfunction alarm

If a home appliance has some alarm information to send to the adapter, it shall pack the alarm information in the format of the alarm frame, and send it to the adapter. The communication module shall send ACK frame to the home appliance in a certain interval after it receives the alarm frame. The home appliance shall send the alarm frame continuously until it receives the ACK frame. If the alarm is not cancelled in a certain interval after ACK frame is received (the stop alarm command frame is not received), then it shall then send alarm frame continuously.

After the upper devices or the control terminal received the alarm information, it needs to send the stop alarm command to the home appliance. The home appliance stops sending alarm information to the control terminal after it receives the stop-alarm frame. The home appliance shall stop alarming immediately if it receives the stop-alarm command during the process.

7.4.5 Other notes

7.4.5.1 Interval

The interval between the home appliance receiving the control command frame and it starts to return the correct status releasing frame shall be within a specified time limit.

7.4.5.2 Interval of repeated sending

Interval of sending the control command frame and the status releasing frame should be within a specified time limit.

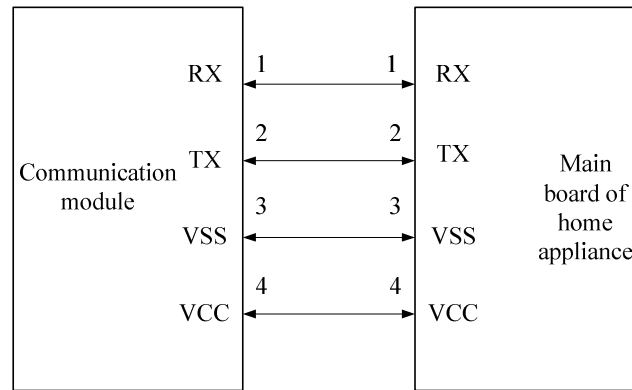
7.4.5.3 Times of repeated sending

The times of repeated sending the control command frame and status frame should be three.

Annex A (Informative) Hardware interface between adapters and home appliances

A.1 Hardware between adapter and home appliance

The adapter and home appliance device which is monitor or main control board according to the type of home appliance, shall be connected by four-wire line, that is, TX, RX, Ground and Power. Module voltage, module current, signal receiving level, sending level and interface type shall be indicated clearly on the home appliance and its adapter.



1 RX signal receiving 2 TX signal sending

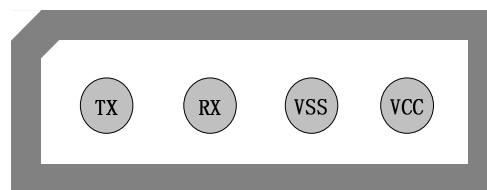
3 VSS Ground 4 VCC Power 5V

Figure A.1 Connection between communication module and home appliance

A.2 The hardware interface between home appliance and its external adapter

There should be appropriate protection for the external connector in case that the home appliance is not installed the built-in adapter. The connection shall be secure and safe when adapter is plugged into the interface.

The end of adapter to be connected with the home appliance should be a clamping slot shape. The external adapter connector shall be a male socket, while home appliance connector shall be a female socket. There is a communication interface in the adapter. The definition of the socket is shown in Figure A.2 below.



1 RX signal reception 2 TX signal transmission

3 VSS Ground 4 VCC power 5V

Figure A.2 Definition of socket in adapter

A.3 Other requirements

The length of communication wire: As it links the electrical control board of home appliance and adapter, the length should be as shorter as possible in order to guarantee the effective transmission.

Since the internal design of home appliance may differ, the length varies, but anyway it should not exceed 1.5 meters.

Installation of module: the installation of adapter shall be reliable and secure. It may be installed in a specific box when necessary to make sure the adapter should not lose during transport of home appliance.

Wire connector: the network interface should use the compatible terminal and connector, with pin span 2.5mm.

As for home appliances like washing machines and electric water heaters, the electric control board should be water-proof protected. The reserved connector should match with the compatible terminal.

Annex B (Informative) Reference examples of network commands

The network commands of some common used home appliances are given below, as the informative reference, for the purpose of design and production by manufacturers.

B.1 Refrigerators and freezers

Ser.	Control function	
1	Enquiry command	
2	Working mode	Normal control
		Quick-freezing control
		Artificial intelligence
3	Locked	
	Unlocked	
4	Cooling compartment closed	
	Cooling compartment open	
5	Partial freezing compartment closed	
	Partial freezing compartment open	
6	Cooling compartment controller setting	
7	Freezing compartment controller setting	
8	Partial-freezing compartment controller setting	
9	Time setting	

Table B.1 Control commands list of refrigerators and freezers

Ser.	Meaning of alarms
1	Evaporation sensor error in cooling compartment
2	Environment sensor error
3	Environment sensor error in cooling compartment
4	Freezing sensor error
5	Partial-freezing sensor error
6	Sensor error in cooling& warming compartment
7	Over freezing alarm
8	Over cooling alarm

Table B.2 Alarm command list of refrigerator errors

B.2 Air conditioners

Ser.	Control functions	
1	Enquiry command	
2	Switch on	
	Switch off	
3	Auxiliary heating Yes	
	Auxiliary heating No	
4	Reserved	
	Reserved	
5	Health mode Yes	
	Health mode No	
6	Human feel Cancelled	
	Human feel Set	
7	Temperature	
8	Powerful/Quite	No
		Powerful
		Quite
6	Timing	No
		On
		Off
		On/off
	Off-time setting	Switch off time
	On-time setting	Switch on time
7	Wind speed	High
		Medium
		Low
		Automatic
8	Mode	Automatic
		Cooling
		Heating
		Wind
		Dehumidification
9	Power failure compensation No	
	Power failure compensation Yes	
10	Humidification No	
	Humidification Yes	
11	Refreshed wind (with oxygen) No	
	Refreshed wind (with oxygen) Yes	
12	Natural wind No	
	Natural wind Yes	
13	Horizontal shutter	Automatic horizontal shutter Yes

		Automatic horizontal shutter No
		Health upper blow
		Health down blow
14	Vertical shutter No	
	Vertical shutter Yes	
15	Group control command	

Table B.3 Command list of air conditioners

Ser.	Meanings of command
1	Indoor temperature
2	Indoor thermal exchange temperature
3	Indoor auxiliary thermal exchange temperature
4	Outdoor temperature
5	Outdoor auxiliary thermal exchange temperature
6	Compressor temperature
7	Indoor duct temperature sensor error
8	Overload protection for indoor heating
9	Freeing protection of indoor cooling
10	Indoor/external board communication error
11	Communication error between board and indoor component
12	Module error
13	No load
14	Overheating of compressor
15	CT current abnormal
16	Outer-loop sensor error
17	External heat exchange sensor error
18	Over voltage
19	Low voltage protection
20	Pressure protection
21	External evaporating sensor error
22	Overload for cooling
23	EEPROM error
24	External return air sensor error
25	Compressor sensor error
26	Indoor evaporating temperature
27	Drainage error
28	AC phase 3 error
29	Humidity sensor error

30	Indoor fan error
31	Outdoor fan error
32	Pressure protection
33	Electric expansion valve error
34	Dust mesh needs cleaning
35	Water shortage protection
36	Water full protection
37	Indoor temperature sensor error

Table B.4 Alarm command list of air conditioners**B.3 Washing machines**

Ser.	Control functions	
1	Enquiry	
2	Switch on	
	Switch off	
3	Start	
	Pause	
4	Program	Standard
		Heavy duty
		Gentle and small
		Quick-wash
5	Process	Wash/rinse/spin
		Wash
		Wash & rinse
		Rinse & dry
		Spin
		Soak/wash/rinse/spin
6	Reserve to wash	
7	Water level setting	
8	Buzzer	No
		Low
		Medium
		High
9	Child lock	
10	Unlock	
11	Drying setting	
12	Drying cancelled	

Table B.5 Control command list of washing machines

Ser.	Meaning of command
1	Water inflow time out
2	Drainage time out
3	Cover open alarm
4	Unbalance alarm
5	Reserved cover open
6	Water level sensor error

Table B.6 Alarm command list of washing machines

B.4 Water heaters

Ser.	Control function	
1	Enquiry command	
2	Switch on	
	Switch off	
3	Temperature setting	
	Current time setting	
	On-time setting for timer 1	
	Off-time setting for timer 1	
	On-time setting for timer 2	
	Off-time setting for timer 2	
4	Operation modes	Instant heating
		Energy saving
		Night power
		Timing 1
		Timing 2

Table B.7 Control command list of water heaters

Ser.	Meaning of commands
1	Electricity leakage alarm
2	Overheating alarm when heating without water inside.
3	Sensor error protection
4	Self-check failed
5	No heating error
6	Irreversible protection of whole error protection.

Table B.8 Alarm command list of water heaters

B.5 Microwave ovens

Ser.	Control functions	
1	Enquiry command	
2	Child lock on	
	Child lock off	
3	Microwave mode	
	Roasting mode	
4	Power levels	Level 1
		Level 2
		Level 3
		Level 4
		Level 5
		Level 6
5	Time setting	
6	Recipes download transmission	
	Start recipes download	
7	Switch on	
	Switch off	
8	Status	Start
		Pause
		Cancel

Table B.9 Control command list of microwave ovens

Ser.	Meaning of commands
1	Fuse broken
2	Sensor error
3	Temperature error

Table B.10 Alarm command list of microwave ovens