ISO/IEC 29341-6-17

Edition 1.0 2008-11

INTERNATIONAL STANDARD

Information technology – UPnP Device Architecture –
Part 6-17: Heating, Ventilation and Air Conditioning Device Control Protocol –
User Operating Mode Service

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

ISO/IEC 29341-6-17

Edition 1.0 2008-11

INTERNATIONAL STANDARD

Information technology – UPnP Device Architecture –
Part 6-17: Heating, Ventilation and Air Conditioning Device Control Protocol –
User Operating Mode Service

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **F**

CONTENTS

LIST OF TABLES

INFORMATION TECHNOLOGY – UPNP DEVICE ARCHITECTURE –

Part 6-17: Heating, Ventilation and Air Conditioning Device Control Protocol – User Operating Mode Service

FOREWORD

1) ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards. Their preparation is entrusted to technical committees; any ISO and IEC member body interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with ISO and IEC also participate in this preparation.

2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

3) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO member bodies.

4) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

5) In order to promote international uniformity, IEC and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.

6) ISO and IEC provide no marking procedure to indicate their approval and cannot be rendered responsible for any equipment declared to be in conformity with an ISO/IEC publication.

7) All users should ensure that they have the latest edition of this publication.

8) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/IEC publications.

9) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

IEC and ISO draw attention to the fact that it is claimed that compliance with this document may involve the use of patents as indicated below.

ISO and IEC take no position concerning the evidence, validity and scope of the putative patent rights. The holders of the putative patent rights have assured IEC and ISO that they are willing to negotiate free licences or licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of the putative patent rights are registered with IEC and ISO.

Intel Corporation has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Intel Corporation
Standards Licensing Department
5200 NE Elam Young Parkway
MS: JFS-98
USA – Hillsboro, Oregon 97124

Microsoft Corporation has informed IEC and ISO that it has patent applications or granted patents as listed below:

6101499 / US; 6687755 / US; 6910068 / US; 7130895 / US; 6725281 / US; 7089307 / US; 7069312 / US;
10/783 524 /US

Information may be obtained from:

Microsoft Corporation
One Microsoft Way
USA – Redmond WA 98052

Philips International B.V. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Philips International B.V. – IP&S
High Tech campus, building 44 3A21
NL – 5656 Eindhoven

NXP B.V. (NL) has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

NXP B.V. (NL)
High Tech campus 60
NL – 5656 AG Eindhoven

Matsushita Electric Industrial Co. Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Matsushita Electric Industrial Co. Ltd.
1-3-7 Shiromi, Chuoh-ku
JP – Osaka 540-6139

Hewlett Packard Company has informed IEC and ISO that it has patent applications or granted patents as listed
below:

5 956 487 / US; 6 170 007 / US; 6 139 177 / US; 6 529 936 / US; 6 470 339 / US; 6 571 388 / US; 6 205
466 / US

Information may be obtained from:

Hewlett Packard Company
1501 Page Mill Road
USA – Palo Alto, CA 94304

Samsung Electronics Co. Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Digital Media Business, Samsung Electronics Co. Ltd.
416 Maetan-3 Dong, Yeongtang-Gu,
KR – Suwon City 443-742

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights
other than those identified above. IEC and ISO shall not be held responsible for identifying any or all such patent
rights.

ISO/IEC 29341-6-17 was prepared by UPnP Implementers Corporation and adopted, under the PAS procedure, by
joint technical committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of
ISO and IEC.

The list of all currently available parts of the ISO/IEC 29341 series, under the general title *Universal plug and play
(UPnP) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be
obtained from the address given on the second title page.

ORIGINAL UPNP DOCUMENTS
(informative)

Reference may be made in this document to original UPnP documents. These references are retained in order to maintain consistency between the specifications as published by ISO/IEC and by UPnP Implementers Corporation. The following table indicates the original UPnP document titles and the corresponding part of ISO/IEC 29341:

UPnP Document Title	ISO/IEC 29341 Part
UPnP Device Architecture 1.0	ISO/IEC 29341-1
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaServer:1 Device	ISO/IEC 29341-3-3
UPnP AVTransport:1 Service	ISO/IEC 29341-3-10
UPnP ConnectionManager:1 Service	ISO/IEC 29341-3-11
UPnP ContentDirectory:1 Service	ISO/IEC 29341-3-12
UPnP RenderingControl:1 Service	ISO/IEC 29341-3-13
UPnP MediaRenderer:2 Device	ISO/IEC 29341-4-2
UPnP MediaServer:2 Device	ISO/IEC 29341-4-3
UPnP AV Datastructure Template:1	ISO/IEC 29341-4-4
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11
UPnP ContentDirectory:2 Service	ISO/IEC 29341-4-12
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13
UPnP ScheduledRecording:1	ISO/IEC 29341-4-14
UPnP DigitalSecurityCamera:1 Device	ISO/IEC 29341-5-1
UPnP DigitalSecurityCameraMotionImage:1 Service	ISO/IEC 29341-5-10
UPnP DigitalSecurityCameraSettings:1 Service	ISO/IEC 29341-5-11
UPnP DigitalSecurityCameraStillImage:1 Service	ISO/IEC 29341-5-12
UPnP HVAC_System:1 Device	ISO/IEC 29341-6-1
UPnP HVAC_ZoneThermostat:1 Device	ISO/IEC 29341-6-2
UPnP ControlValve:1 Service	ISO/IEC 29341-6-10
UPnP HVAC_FanOperatingMode:1 Service	ISO/IEC 29341-6-11
UPnP FanSpeed:1 Service	ISO/IEC 29341-6-12
UPnP HouseStatus:1 Service	ISO/IEC 29341-6-13
UPnP HVAC_SetpointSchedule:1 Service	ISO/IEC 29341-6-14
UPnP TemperatureSensor:1 Service	ISO/IEC 29341-6-15
UPnP TemperatureSetpoint:1 Service	ISO/IEC 29341-6-16
UPnP HVAC_UserOperatingMode:1 Service	ISO/IEC 29341-6-17
UPnP BinaryLight:1 Device	ISO/IEC 29341-7-1
UPnP DimmableLight:1 Device	ISO/IEC 29341-7-2
UPnP Dimming:1 Service	ISO/IEC 29341-7-10
UPnP SwitchPower:1 Service	ISO/IEC 29341-7-11
UPnP InternetGatewayDevice:1 Device	ISO/IEC 29341-8-1
UPnP LANDevice:1 Device	ISO/IEC 29341-8-2
UPnP WANDevice:1 Device	ISO/IEC 29341-8-3
UPnP WANConnectionDevice:1 Device	ISO/IEC 29341-8-4
UPnP WLANAccessPointDevice:1 Device	ISO/IEC 29341-8-5
UPnP LANHostConfigManagement:1 Service	ISO/IEC 29341-8-10
UPnP Layer3Forwarding:1 Service	ISO/IEC 29341-8-11
UPnP LinkAuthentication:1 Service	ISO/IEC 29341-8-12
UPnP RadiusClient:1 Service	ISO/IEC 29341-8-13
UPnP WANCableLinkConfig:1 Service	ISO/IEC 29341-8-14
UPnP WANCommonInterfaceConfig:1 Service	ISO/IEC 29341-8-15
UPnP WANDSLLinkConfig:1 Service	ISO/IEC 29341-8-16
UPnP WANEthernetLinkConfig:1 Service	ISO/IEC 29341-8-17
UPnP WANIPConnection:1 Service	ISO/IEC 29341-8-18
UPnP WANPOTSLinkConfig:1 Service	ISO/IEC 29341-8-19
UPnP WANPPPConnection:1 Service	ISO/IEC 29341-8-20
UPnP WLANConfiguration:1 Service	ISO/IEC 29341-8-21
UPnP Printer:1 Device	ISO/IEC 29341-9-1
UPnP Scanner:1.0 Device	ISO/IEC 29341-9-2
UPnP ExternalActivity:1 Service	ISO/IEC 29341-9-10
UPnP Feeder:1.0 Service	ISO/IEC 29341-9-11
UPnP PrintBasic:1 Service	ISO/IEC 29341-9-12
UPnP Scan:1 Service	ISO/IEC 29341-9-13
UPnP QoS Architecture:1.0	ISO/IEC 29341-10-1
UPnP QosDevice:1 Service	ISO/IEC 29341-10-10
UPnP QosManager:1 Service	ISO/IEC 29341-10-11
UPnP QosPolicyHolder:1 Service	ISO/IEC 29341-10-12
UPnP QoS Architecture:2	ISO/IEC 29341-11-1
UPnP QOS v2 Schema Files	ISO/IEC 29341-11-2

UPnP Document Title	ISO/IEC 29341 Part
UPnP QosDevice:2 Service	ISO/IEC 29341-11-10
UPnP QosManager:2 Service	ISO/IEC 29341-11-11
UPnP QosPolicyHolder:2 Service	ISO/IEC 29341-11-12
UPnP RemoteUIClientDevice:1 Device	ISO/IEC 29341-12-1
UPnP RemoteUIServerDevice:1 Device	ISO/IEC 29341-12-2
UPnP RemoteUIClient:1 Service	ISO/IEC 29341-12-10
UPnP RemoteUIServer:1 Service	ISO/IEC 29341-12-11
UPnP DeviceSecurity:1 Service	ISO/IEC 29341-13-10
UPnP SecurityConsole:1 Service	ISO/IEC 29341-13-11

1.   Overview and Scope

This service definition is compliant with the UPnP Device Architecture version *1.0*.

This service definition enables the following functions:

- Changing and reading the user operating modes of an HVAC system

2. Service Modeling Definitions

2.1. ServiceType

The following service type identifies a service that is compliant with this template:

urn:schemas-upnp-org:service:HVAC_UserOperatingMode:1

2.2. State Variables

Table 1 State Variables

Variable Name	Req. or Opt.[1]	Data Type	Allowed Value[2]	Default Value[2]	Eng. Units
ModeTarget	R	string	see table	Auto	N/a
ModeStatus	R	string	see table	none	none
Name	O	string		Zero length string	N/a
Non-standard state variables implemented by an UPnP vendor go here.	*X*	*TBD*	*TBD*	*TBD*	*TBD*

[1] R = Required, O = Optional, X = Non-standard.

[2] Values listed in this column are required. To specify standard optional values or to delegate assignment of values to the vendor, you must reference a specific instance of an appropriate table below.

Table 2 AllowedValueList for ModeTarget

Value	Req. or Opt. [1]
Off	*R*
HeatOn	*Either HeatOn or CoolOn or both is required*
CoolOn	*Either HeatOn or CoolOn or both is required*
AutoChangeOver	*O*
AuxHeatOn	*O*
EconomyHeatOn	*O*
EmergencyHeatOn	*O*
AuxCoolOn	*O*
EconomyCoolOn	*O*
BuildingProtection	*O*
EnergySavingsMode	*O*
Vendor-defined	*R*
Vendor-defined	*O*

[1] R = Required, O = Optional, X = Non-standard.

Table 3 AllowedValueList for ModeStatus

Value	Req. or Opt. [1]
Off	*R*
InDeadBand	*R*
HeatOn	*Either HeatOn or CoolOn or both is required*
CoolOn	*Either HeatOn or CoolOn or both is required*
AutoChangeOver	*O*
AuxHeatOn	*O*
EconomyHeatOn	*O*
EmergencyHeatOn	*O*
AuxCoolOn	*O*
EconomyCoolOn	*O*
BuildingProtection	*O*
EnergySavingsHeating	*O*
EnergySavingsCooling	*O*
Vendor-defined	*R*
Vendor-defined	*O*

[1] R = Required, O = Optional, X = Non-standard.

2.2.1. ModeTarget

Exposes the target operating mode of an HVAC system. Mode values are established by the manufacturer

2.2.2. ModeStatus

Exposes the current operating mode of an HVAC system. Mode values are established by the vendor

2.2.3. Name

This optional variable may be used to capture a friendly name or location for this service.

2.2.4. Relationships Between State Variables

ModeTarget provides a variable for a Control Point to request a new mode. ModeStatus is the current mode value. They may be different.

AutoChangeOver target mode enables the Modestatus to change between heating and cooling depending on demand.

2.3. Eventing and Moderation

Table 4 Eventing & Moderation

Variable Name	Evented	Moderated Event	Max Event Rate[1]	Logical Combination	Min Delta per Event[2]
Name	Yes	No	none	none	On-change
ModeTarget	Yes	No	none	none	On-Change
ModeStatus	Yes	No	none	none	On-change
Non-standard state variables implemented by an UPnP vendor go here.	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*

[1] Determined by N, where Rate = (Event)/(N secs).
[2] (N) * (allowedValueRange Step).

2.3.1. Event Model

Table 5 Event Model

Variable Name	UI requirements	Async Requirements	Func. Vs max rate tradeoffs	Est of Max rate	Reason not evented
Name	Needed for UI			On set-up only	N/a
ModeTarget	Needed for UI			Very low	N/a
ModeStatus	Needed for UI			Very low	N/a

2.4. Actions

Table 6 Action list

Name	Req. or Opt. [1]
SetModeTarget	*R*
GetModeTarget	*R*
GetModeStatus	*R*
GetName	O
SetName	O
Non-standard actions implemented by an UPnP vendor go here.	X

[1] R = Required, O = Optional, X = Non-standard.

2.4.1. SetModeTarget

Changes the operating mode of the HVAC fan or blower.

2.4.1.1. Arguments

Table 7 Arguments for SetModeTarget

Argument	Direction	relatedStateVariable
NewModeTarget	*In*	ModeTarget

2.4.1.2. Dependency on State (if any)

None

2.4.1.3. Effect on State (if any)

Target mode changes to NewTarget

2.4.1.4. Errors

errorCode	errorDescription	Description
700	Mode not available	The requested mode is not available

2.4.2. GetModeTarget

Provides Mode information to control points or other devices

2.4.2.1. Arguments

Table 8 Arguments for GetModeTarget

Argument	Direction	relatedStateVariable
CurrentModeTarget	*Out^R*	ModeTarget

R- Return Value

2.4.2.2. Dependency on State (if any)

Depends on ModeTarget

2.4.2.3. Effect on State (if any)

None

2.4.2.4. Errors

errorCode	errorDescription	Description
None		

2.4.3. GetModeStatus

Gets the current mode status

2.4.3.1. Arguments

Table 9 Arguments for GetModeStatus

Argument	Direction	relatedStateVariable
CurrentModeStatus	*Out*^{R}	ModeStatus

R- Return Value

2.4.3.2. Dependency on State (if any)

Depends on ModeStatus.

2.4.3.3. Effect on State

None.

2.4.3.4. Errors

errorCode	errorDescription	Description
none		

2.4.4. GetName

Provides the Name value to a control point or other UPnP device

2.4.4.1. Arguments

Table 10 Arguments for GetName

Argument	Direction	relatedStateVariable
CurrentName	*Out*^{R}	Name

^{R} Return Value

2.4.4.2. Dependency on State (if any)

Depends on Name

2.4.4.3. Effect on State

None

2.4.4.4. Errors

errorCode	errorDescription	Description
none		

2.4.5. SetName

Provides a new value for the Name variable.

2.4.5.1. Arguments

Table 11 Arguments for SetName

Argument	Direction	relatedStateVariable
NewName	*In*	Name

2.4.5.2. Dependency on State (if any)

None

2.4.5.3. Effect on State

Changes Name

2.4.5.4. Errors

errorCode	errorDescription	Description
none		

2.4.6. Non-Standard Actions Implemented by a UPnP Vendor

To facilitate certification, non-standard actions implemented by UPnP vendors should be included in this service template. The UPnP Device Architecture lists naming requirements for non-standard actions (see the section on Description).

2.4.7. Relationships Between Actions

None.

2.4.8. Common Error Codes

The following table lists error codes common to actions for this service type. If an action results in multiple errors, the most specific error should be returned.

Table 12: Common Error Codes

errorCode	errorDescription	Description
401	Invalid Action	See UPnP Device Architecture section on Control.
402	Invalid Args	See UPnP Device Architecture section on Control.
404	Invalid Var	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
600-699	TBD	Common action errors. Defined by UPnP Forum Technical Committee.
701-799		Common action errors defined by the UPnP Forum working committees.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.5.   Theory of Operation

This service allows a Control Point to set and observe the operating mode of a HVAC system. Reserved operating modes are:

- Off – System not active.

- InDeadBand – System active but not currently heating or cooling.

- Heating – controlling to a heating setpoint.

- Cooling – controlling to a cooling setpoint.

- AutoChangeOver – Heating or cooling depending on demand and setpoints.

- Emergency Heat – Often used with Heat Pumps to provide heat from a secondary source.

- AuxHeatOn – see Emergency heat.

- AuxCooling- Used when a secondary cooling mechanism is available.

- EconomyHeatOn – controlling to a heating setpoint that is less than the current heating temperature setpoint. The delta value is implementation dependent.

- EconomyCoolingOn - controlling to a cooling setpoint that is more than the current cooling temperature setpoint. The delta value is implementation dependent.

- BuildingProtection – controlling to a default temperature that is intended to keep the water pipes and fixtures from freezing.

- EnergySavings – controlling to default temperatures that are–less (for heating) or more (for cooling) than normal at-home temperatures.

Different vendors and different geographies employ different modes of operation. This service allows vendors to implement a subset of the total set of reserved mode values.

3. XML Service Description

```xml
<?xml version="1.0"?>
<scpd xmlns="urn:schemas-upnp-org:service-1-0">
  <specVersion>
    <major>1</major>
    <minor>0</minor>
  </specVersion>
  <actionList>
    <action>
    <name>SetModeTarget</name>
      <argumentList>
        <argument>
          <name>NewModeTarget</name>
          <direction>in</direction>
          <relatedStateVariable>ModeTarget</relatedStateVariable>
        </argument>
      </argumentList>
    </action>

    <action>
    <name>GetModeTarget</name>
      <argumentList>
        <argument>
          <name>CurrentModeTarget</name>
          <direction>out</direction>
          <retval/>
          <relatedStateVariable>ModeTarget</relatedStateVariable>
        </argument>
      </argumentList>
    </action>

    <action>
    <name>GetModeStatus</name>
      <argumentList>
        <argument>
          <name>CurrentModeStatus</name>
          <direction>out</direction>
          <retval/>
          <relatedStateVariable>ModeStatus</relatedStateVariable>
        </argument>
      </argumentList>
    </action>

    <action>
    <name>GetName</name>
      <argumentList>
        <argument>
          <name>CurrentName</name>
          <direction>out</direction>
          <retval/>
          <relatedStateVariable>Name</relatedStateVariable>
        </argument>
      </argumentList>
    </action>

    <action>
    <name>SetName</name>
      <argumentList>
        <argument>
          <name>NewName</name>
          <direction>in</direction>
          <relatedStateVariable>Name</relatedStateVariable>
```