# ISO/IEC 29341-6-2

Edition 1.0 2008-11

# INTERNATIONAL STANDARD

## Information technology – UPnP Device Architecture – Part 6-2: Heating, Ventilation and Air Conditioning Device Control Protocol – Zone Thermostat Device



ISO/IEC 29341-6-2:2008(E)

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# CONTENTS

FOREWORD ..... 3
ORIGINAL UPNP DOCUMENTS (informative) ..... 5
**1. Overview and Scope** ..... 7
**2. Device Definitions** ..... 8
2.1. Device Type ..... 8
2.2. Device Model ..... 8
2.2.1. Description of Device Requirements ..... 8
2.2.2. Relationships Between Services ..... 9
2.3. Theory of Operation ..... 9
**3. XML Device Description** ..... 10
**4. Test** ..... 12

# LIST OF TABLES

Table 1: Device Requirements ..... 8

--`,,```,,,,````-`-`,,`,,`,`,,`---

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## Part 6-2: Heating, Ventilation and Air Conditioning Device Control Protocol – Zone Thermostat Device

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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.

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# 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 |

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| 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 |

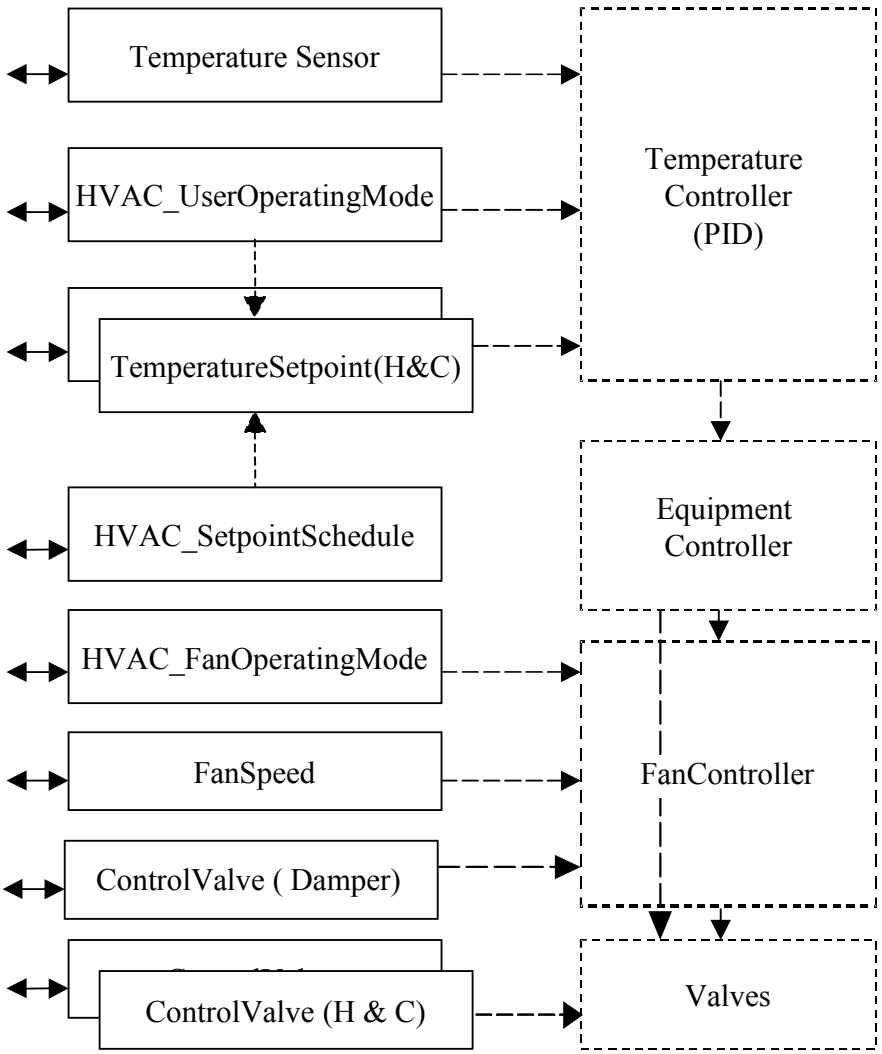
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# 1. Overview and Scope

The HVAC_ZoneThermostat is intended to be a sub device of the HVAC_System device. Any number of HVAC_ZoneThermostats may be included in the system device.

HVAC_ZoneThermostat is a zone level controller for heating and/or cooling. It provides the following functionality:

- The ability to set or get zone level operating and fan modes.
- Temperature in the zone.
- Zone level Heating and/or cooling temperature setpoints.
- Optional fan speed control.
- Optional zone level daily schedule for events and heating and cooling setpoints.




Solid lines indicate interfaces exposed via UPnP
Dotted lines indicate interfaces and services not directly visible via UPnP

**Figure 1 HVAC_ZoneThermostat:1 Functional Diagram**

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# 2. Device Definitions

## 2.1. Device Type

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

**urn:**schemas-upnp-org:device**:*HVAC_ZoneThermostat:1***

## 2.2. Device Model

Products that expose devices of the type **urn:schemas-upnp-org:device:***HVAC_ZoneThermostat:1* must implement minimum version numbers of all required embedded devices and services specified in the table below.

**Table 1: Device Requirements**

| DeviceType | Root | Req. or Opt.[1] | ServiceType | Req. or Opt.[1] | Service ID[2] |
|---|---|---|---|---|---|
| HVAC_ZoneThermostat:1 | Root | R | | | |
| | | | HVAC_UserOperatingMode:1 | R | ZoneUserMode |
| | | | HVAC_FanOperatingMode:1 | O | ZoneFanMode |
| | | | FanSpeed:1 | O | ZoneFanSpeed |
| | | | ControlValve:1 | O | HeatingValve |
| | | | ControlValve:1 | O | CoolingValve |
| | | | ControlValve:1 | O | AirDamper |
| | | | TemperatureSetpoint:1 | This device is required to include either a heating or cooling setpoint or both | HeatingSetpoint |
| | | | TemperatureSetpoint:1 | This device is required to include either a heating or cooling setpoint or both | CoolingSetpoint |
| | | | TemperatureSensor:1 | O | ZoneTemperature |
| | | | HVAC_SetpointSchedule:1 | O | ZoneSchedule |
| *Non-standard devices embedded by a UPnP vendor go here.* | *TBD* | *X* | *TBD* | *TBD* | *TBD* |

[1] R = Required, O = Optional, X = Non-standard.
[2] Prefixed by urn:**upnp-org**:**serviceId**: .

### 2.2.1. Description of Device Requirements

The HVAC_ZoneThermostat is intended to be a sub device of the HVAC_System device. Any number of HVAC_ZoneThermostats may be included in the system device. Each time a ZoneThermostat is added the System device must go bye-bye and then re-advertise its existence via normal UPnP protocols.

In the ZoneThermostat devices these services allow the user to select modes for zone operation. One zone can be set to cool while another can be set to heat. The system modes and the zone modes may be different.

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At least one TemperatureSetpoint service must be present – heating or cooling. Both may be present for ZoneThermostats that support both heating and cooling.

### 2.2.2. Relationships Between Services

TemperatureSensor may be internally wired to a PID controller

Some user operating modes provide a TemperatureSetpoint variable. Example: EnergySavings mode typically implies an "above freezing" TemperatureSetpoint.

FanSpeed and ControlValves variables may be determined by internal PID, equipment and fan controllers.

## 2.3. Theory of Operation

A HVAC system includes all the heating and cooling equipment necessary to independently condition a whole house or a region of a house. Large homes may include several independent systems. Small homes may only have one system. Individual systems may be zoned.

A forced air system may typically include a furnace with heat exchangers and a fan or a blower, an air conditioning compressor unit, filters, duct work, temperature sensors, temperature setpoints, mode controls and in zoned systems electrically controllable valve or dampers.

Hydronic systems are usually zoned and may typically include a boiler, cooler, pumps, valves, radiators, temperature sensors, temperature setpoints and mode controls.

This device, HVAC_ZoneThermostat, is a container for the HVAC control elements related to a particular zone. It is not necessarily a recognizable single physical device. All the elements are not necessarily exposed. This DCP is targeted at user control and does not expose lower level operational details.

The controls and interfaces for each zone may be contained in a single physical device or distributed among other devices. This DCP illustrates them in a single device called a HVAC_ZoneThermostat. Other DCP's may use the same services but show them used in other containers.

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# 3. XML Device Description

```
<?xml version="1.0"?>
<root xmlns="urn:schemas-upnp-org:device-1-0">
  <specVersion>
    <major>1</major>
    <minor>0</minor>
  </specVersion>
  <URLBase>base URL for all relative URLs</URLBase>
  <device>
    <deviceType>urn:schemas-upnp-
org:device:HVAC_ZoneThermostat:1</deviceType>
    <friendlyName>short user-friendly title</friendlyName>
    <manufacturer>manufacturer name</manufacturer>
    <manufacturerURL>URL to manufacturer site</manufacturerURL>
    <modelDescription>long user-friendly title</modelDescription>
    <modelName>model name</modelName>
    <modelNumber>model number</modelNumber>
    <modelURL>URL to model site</modelURL>
    <serialNumber>manufacturer's serial number</serialNumber>
    <UDN>uuid:UUID</UDN>
    <UPC>Universal Product Code</UPC>
    <iconList>
      <icon>
        <mimetype>image/format</mimetype>
        <width>horizontal pixels</width>
        <height>vertical pixels</height>
        <depth>color depth</depth>
        <url>URL to icon</url>
      </icon>
      XML to declare other icons, if any, go here
    </iconList>
    <serviceList>
      <service>
        <serviceType>urn:schemas-upnp-org:service:
HVAC_UserOperatingMode:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:ZoneUserMode</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-org:service:
HVAC_FanOperatingMode:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:ZoneFanMode</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-
org:service:ControlValve:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:HeatingValve</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
<service>
        <serviceType>urn:schemas-upnp-
org:service:ControlValve:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:CoolingValve</serviceId>
```

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```
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-
org:service:ControlValve:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:AirDamper</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
        <serviceType>urn:schemas-upnp-org:service:FanSpeed:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:ZoneFanSpeed</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-org:service:
TemperatureSetpoint:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:HeatingSetpoint</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-org:service:
TemperatureSetpoint:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:CoolingSetpoint</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-org:service:
TemperatureSensor:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:ZoneTemperature</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
<service>
        <serviceType>urn:schemas-upnp-org:service:HVAC_SetpointSchedule:1
</serviceType>
        <serviceId>urn:upnp-org:serviceId:ZoneSchedule</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>

      Declarations for other services defined by a UPnP Forum working
      committee (if any) go here
      Declarations for other services added by UPnP vendor (if any) go here
    </serviceList>
    <deviceList>
      Description of embedded devices defined by a UPnP Forum working
      committee (if any) go here
      Description of embedded devices added by UPnP vendor (if any) go here
    </deviceList>
    <presentationURL>URL for presentation</presentationURL>
  </device>
</root>
```

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# 4. Test

Testing of the UPnP functions Addressing, Discovery, Description, Control (Syntax) and Eventing are performed by the UPnP Test Tool v1.1 based on the following documents:

- UPnP Device Architecture v1.0
- The Device Definitions in chapter 2 of this document
- The XML Device Description in chapter 3 of this document
- The UPnP Test Tool device template test file: ***HVAC_ZoneThermostat1.xml***
- The template documents for the services referenced by this device, together with their respective UPnP Test Tool service template test files.

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