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Information technology – UPnP Device Architecture –
Part 6-10: Heating, Ventilation and Air Conditioning Device Control Protocol –
Control Valve Service

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ISO/IEC 29341-6-10

Edition 1.0 2008-11

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

F

ICS 35.200

ISBN 2-8318-1007-5

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Part 6-10: Heating, Ventilation and Air Conditioning Device Control Protocol – Control Valve Service

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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.

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 WANPPPoEConnection: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

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1. Overview and Scope

This service definition is compliant with the UPnP Device Architecture version 1.0. It defines a service type referred to herein as ControlValve:1.

ControlValve:1 provides programmatic control and status information for modulating water control valves or modulating air dampers used in Heating Ventilation and Air-Conditioning (HVAC) applications.

ControlValve:1 enables the following functions:

- Analog (modulating) control of Control Valves and Air Dampers

ControlValve:1 does not address:

- On/Off control valves or dampers
- Fire or Smoke dampers

2. Service Modeling Definitions

2.1. Service Type

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

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

The shorthand ControlValve:1 is used herein to refer to this service type.

2.2. State Variables

Defines the state variables for the operating mode of the control valve / air damper, its target position, and its actual position. Additionally defines optional state variables for “soft” minimum and maximum positions.

NOTE: (Explanation of the meaning of positions): Table 1 below describes Allowed Value ranges of 0 to 100, which signify a control valve / air damper position in the range of 0% to 100%. In all such cases, a value of 0% corresponds to the FULLY CLOSED control valve position (minimum mechanical limit of the actuator), and a value of 100% corresponds to the FULLY OPEN control valve position (maximum mechanical limit of the actuator).

Table 1: State Variables

Variable Name	Req. or Opt. ¹	Data Type	Allowed Value ²	Default Value ²	Eng. Units
ControlMode	R	string	OPEN, CLOSED, AUTO	CLOSED	n/a
PositionTarget	R	ui1	>= 0, <= 100, += 1	0	Percent
PositionStatus	R	ui1	>= 0, <= 100, += 1	0	Percent
MinPosition	O	ui1	>= 0, <= 100, += 1	0	Percent
MaxPosition	O	ui1	>= 0, <= 100, += 1	100	Percent
<i>Non-standard state variables implemented by an UPnP vendor go here.</i>	<i>X</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>

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

² Values listed in this column are (all) required.

2.2.1. ControlMode

Determines the control mode. When ControlMode is OPEN, the device should motor to the 100% (fully open) position; when ControlMode is CLOSED, it should motor to the 0% (fully closed) position; and when ControlMode is AUTO the device position will be dependent on the value of the PositionTarget and the MinPosition and MaxPosition variables – described below.

2.2.2. PositionTarget

Determines the desired position of the device when ControlMode is AUTO. (See above Note “Explanation of the meaning of positions”)

2.2.3. PositionStatus

Measures the actual physical position of the device. (See above Note “Explanation of the meaning of positions”)

2.2.4. MinPosition

Determines the minimum position that the device may take when ControlMode is AUTO. (See above Note “Explanation of the meaning of positions”). MinPosition is the “soft” minimum position, which is typically > 0% - where 0% is the “hard” minimum position.

MinPosition is an optional state variable; if MinPosition is not implemented in the device, then the device must behave as if the value of MinPosition were to be 0%

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2.2.5. MaxPosition

Determines the maximum position of that the device may take when ControlMode is AUTO. (See above Note “Explanation of the meaning of positions”). MaxPosition is the “soft” maximum position, which is typically < 100% - where 100% is the “hard” maximum position.

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MaxPosition is an optional state variable; if MaxPosition is not implemented in the device, then the device must behave as if the value of MaxPosition were to be 100%

2.2.6. Relationships Between State Variables

The actual position (PositionStatus) of the device must follow the table below:

Table 2: Relationship Between State Variables

ControlMode	PositionTarget	PositionStatus
CLOSED	any	0% (i.e. “hard” minimum)
OPEN	any	100% (i.e. “hard” maximum)
AUTO	PositionTarget < MinPosition	MinPosition (i.e. “soft” minimum)
AUTO	MinPosition < PositionTarget < MaxPosition	PositionTarget
AUTO	PositionTarget > MaxPosition	MaxPosition (i.e. “soft” maximum)

If the values of ControlMode, PositionTarget, MinPosition or MaxPosition change, then the device should start to change its physical position towards the new value determined by the above table. Due to the physical running time of the motor /actuator, this process will take a certain period of time that depends on the vendor’s implementation. The value of the PositionStatus state variable should correspond to the actual physical device position.

NOTE: Vendors that implement control point strategies should bear in mind that due to friction, inertia, hysteresis and numerical rounding it is quite possible that the PositionStatus variable will take an indeterminate

time to reach the value of the corresponding PositionTarget variable. Indeed it is quite likely that PositionStatus variable might *never* achieve exactly the same value as the PositionTarget variable.

Relationships between standard state variable(s) defined herein and any non-standard state variable(s) is TBD.

2.3. Eventing and Moderation

Table 3: Event Moderation

Variable Name	Evented	Moderated Event	Max Event Rate ¹	Logical Combination	Min Delta per Event ²
PositionTarget	no				
PositionStatus	yes	yes	30	OR	10 * (Step)
ControlMode	yes	no			
MinPosition	no				
MaxPosition	no				
<i>Non-standard state variables implemented by an UPnP vendor go here.</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>

¹ Determined by N, where Rate = (Event)/(N secs).

² (N) * (allowedValueRange Step).

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2.4. Actions

Table 4: Actions

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Name	Req. or Opt. ¹
GetMode	R
SetMode	R
GetPosition	R
GetPositionTarget	R
SetPosition	R
GetMinMax	O
SetMinMax	O
<i>Non-standard actions implemented by an UPnP vendor go here.</i>	<i>X</i>

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

2.4.1. GetMode

Returns the current value of ControlMode

2.4.1.1. Arguments

Table 5: Arguments for GetMode

Argument	Direction	relatedStateVariable
CurrentControlMode	OUT ^R	ControlMode

^R = Return Value (RETVAl)