

2009

# Protocol Implementation Conformance Statement

## BACnet Version of Room Pressure Monitor

This document gives the brief product description and the complete over view of the PICS statement.

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2/23/2009



## Index

<b>1. Document Introduction.....</b>	<b>3</b>
<b>2. Product Description as per Annex A PICS (normative).....</b>	<b>3</b>
<b>3. BACnet Requirements .....</b>	<b>4</b>
3.1 BACnet Standardized Device Profile (Annex L) .....	4
3.2 BACnet Interoperability Building Blocks (BIBBs) (Annex K).....	4
3.3 Standard Object Types Supported .....	5
3.3.1 Analog Input (as per Clause 12.2, Table 12-2) .....	6
3.3.2 Analog Value (as per Clause 12.4, Table 12-4) .....	7
3.3.3 Binary Input (as per Clause 12.6, Table 12-6) .....	7
3.3.4 Binary Value (as per Clause 12.8, Table 12-10) .....	8
3.3.5 Device (as per Clause 12.11, Table 12-13) .....	9
3.3.6 Event enrollment (as per Clause 12.12, Table 12-14) .....	10
3.3.7 Multi-State Input (as per Clause 12.18, Table 12-21) .....	11
3.3.8 Multi-State Value (as per Clause 12.20, Table 12-23) .....	11
3.3.9 Notification Class (as per Clause 12.21, Table 12-24) .....	12
3.4 Data Link Layer Option .....	12
3.5 Segmentation Capability .....	12
3.6 Device Address Binding .....	13
3.7 Networking Options .....	13
3.8 Character Sets Supported.....	13
3.9 RPM Supported Services .....	14

## 1. Document Introduction

This document contains the Protocol Implementation Conformance Statement (PICS) and BACnet® Interoperability Building Blocks (BIBBs) for the Room Pressure Monitor (RPM) as required by the American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 135-2004, BACnet protocol. BACnet interoperability building blocks are collections of one or more BACnet services. This document includes a listing of the BIBBs currently supported by the FEC.

RPM shall be native BACnet –Application Specific controller with MS/TP capabilities.

## 2. Product Description as per Annex A PICS (normative)

RPM shall find its applications in Monitoring pressure of hospital rooms such as operating rooms, isolation rooms and housing contagious patients. This system shall be interfaced to differential capacitive pressure sensors, which shall sense the differential pressure that shall be displayed on a Graphics LCD (128x128 dots). Current equivalent to the differential pressure shall be transmitted as per the standards (4-20mA). Apart from Current mode two different voltage output modes shall be available, [0-5V, 0-10V] corresponding to the differential pressure. The hardware front-end design shall have capacitive sensors, and hence capacitance variation to frequency conversion mechanism shall be employed to sense the pressure in RPM. Capacitance variation proportional to differential pressure is detected which is then displayed and transmitted as current or voltage.

The detailed product functionality is as below,

- ◆ Digitize the pressure signal obtained using RC oscillator method. In this approach, frequency output of RC oscillator changes with capacitor variation. This frequency signal is fed to external counter pin of microcontroller [PIC24HJ256GP610]. A reference RC oscillator is also designed to nullify the effect of stray capacitance and temperature variation. Counter counts the number of events / pulses in a particular time interval and then translates that to equivalent pressure.
- ◆ Signal conditioning / filtering algorithms to avoid fluctuations in the reading due to noise & surges. Moving window algorithm is implemented for better filtering. Based on practical testing, window size shall be programmable during calibrating the unit at factory.
- ◆ Generate PWM output proportional to input pressure signal, which in-turn is used to generate 4-20mA current output or 0-5V, 0-10V DC output equivalent to pressure input.
- ◆ A Touch screen LCD [128x128], monochrome is used to make the system more user friendly. The pressure shall be displayed in inches of WC, Pascal or mm WC. No keyboards or switches are employed to accept input from the user; instead all functionality is build around the user interface. During alarm conditions when the pressure exceeds the setpoint either above or below setpoint the display shall indicate the alarm condition as well as show the alarm disable button.

- ◆ Two Red & Green LEDs are used to indicate the Alarm & normal condition apart from the RGB backlight
- ◆ RS485 forms the physical layer which is used to interface RPM to BACnet backbone.
- ◆ The unit contains a SMPS with the working ranges of 85VAC to 265VAC or 18VAC to 30 VAC to offer.

### 3. BACnet Requirements

#### 3.1 BACnet Standardized Device Profile (Annex L)

- BACnet Operator Workstation (B-OWS)
- BACnet Building Controller (B-BC)
- BACnet Advanced Application Controller (B-AAC)
- BACnet Application Specific Controller (B-ASC)
- BACnet Smart Sensor (B-SS)
- BACnet Smart Actuator (B-SA)

#### 3.2 BACnet Interoperability Building Blocks (BIBBs) (Annex K)

Table below lists all the BIBBs that are required for the BACnet Application Specific Controller (B-ASC) profile for RPM and the support for these BIBBs within the system. The BIBBs that are not required are also listed. This table is formed from

Application Services (B-ASC)	Designation
<b>Required for B-ASC Profile</b>	
Data Sharing - Read Property – B	DS-RP-B
Data Sharing - Write Property – B	DS-WP-B
Device Management - Dynamic Device Binding – B	DM-DDB-B
Device Management - Dynamic Object Binding – B	DM-DOB-B
Device Management - Device Communication Control – B	DM-DCC-B
<b>Not Required for B-ASC Profile but supported in RPM</b>	
Data Sharing - Write Property Multiple – B	DS-WPM-B
Data Sharing - Read Property Multiple – B	DS-RPM-B
Device Management - Reinitialize Device – B	DM-RD-B
Alarm and Event-Notification Internal-B	AE-N-I-B
Alarm and Event-Alarm Summary-B	AE-ASUM-B
Device Management - Time Synchronization – B	DM-TS-B
Device Management-Dynamic Device Binding-A	DM-DDB-A
Device Management – UTC Time Synchronization – B	DB-UTC-B

### **3.3 *Standard Object Types Supported***

The following is a list of the standard object types as defined by ASHRAE. The objects checked are currently supported by this product. See the section in this document for the supported object type for details.

- Accumulator**
- Analog Input**
- Analog Output**
- Analog Value**
- Averaging**
- Binary Input**
- Binary Output**
- Binary Value**
- Calendar**
- Command**
- Device**
- Event Enrollment**
- File**
- Group**
- Life Safety Point**
- Life Safety Zone**
- Loop**
- Multistate Input**
- Multistate Output**
- Multistate Value**
- Notification Class**
- Program**
- Pulse Converter**
- Schedule**
- Trend Log**

### 3.3.1 Analog Input (as per Clause 12.2, Table 12-2)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Present_Value	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	REAL
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Device_Type	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Status_Flags	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetStatusFlags
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Reliability	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetReliability
Out_Of_Service	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BOOLEAN
Update_Interval	Yes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Unsigned
Units	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEngineeringUnits
Min_Pres_Value	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	REAL
Max_Pres_Value	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	REAL
Resolution	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	REAL

### 3.3.2 Analog Value (as per Clause 12.4, Table 12-4)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Present_Value	Yes*	<input checked="" type="checkbox"/>	<input type="checkbox"/>	REAL
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Status_Flags	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetStatusFlags
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Reliability	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetReliability
Out_Of_Service	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BOOLEAN
Units	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEngineeringUnits

\*Instance 1 is not writable

### 3.3.3 Binary Input (as per Clause 12.6, Table 12-6)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Present_Value	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetBinaryPV
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Device_Type	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Status_Flags	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetStatusFlags
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Reliability	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetReliability
Out_Of_Service	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BOOLEAN
Polarity	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetPolarity
Inactive_Text	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Active_Text	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString

### 3.3.4 Binary Value (as per Clause 12.8, Table 12-10)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Present_Value	Yes*	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetBinaryPV
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Status_Flags	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetStatusFlags
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Reliability	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetReliability
Out_Of_Service	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BOOLEAN
Inactive_Text	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Active_Text	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString

\*Instance 1,2,7 and 8 are not writable.

### 3.3.5 Device (as per Clause 12.11, Table 12-13)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	Yes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
System_Status	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetDeviceStatus
Vendor_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Vendor_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned16
Model_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Firmware_Revision	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Application_Software_Version	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Location	Yes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Description	Yes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Protocol_Version	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Protocol_Revision	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Protocol_Services_Supported	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetServicesSupported
Protocol_Object_Types_Supported	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectTypesSupported
Object_List	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetARRAY[N]of BACnetObjectIdentifier
Max_APDU_Length_Accepted	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Segmentation_Supported	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetSegmentation
Local_Time	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Time
Local_Date	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Date
APDU_Timeout	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Number_Of_APDU_Retries	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Max_Master	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Unsigned(1..127)
Max_Info_Frames	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Unsigned
Device_Address_Binding	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	List of BACnetAddressBinding
Database_Revision	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Daylight_Savings_Status	Yes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BOOLEAN
UTC_Offset	Yes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	INTIGER

### 3.3.6 Event enrollment (as per Clause 12.12, Table 12-14)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Event_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventType
Notify_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetNotifyType
Event_Parameters	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventParameter
Object_Property_Reference	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetDeviceObjectPropertyReference
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Event_Enable	Yes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventTransitionBits
Acked_Transitions	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventTransitionBits
Notification_Class	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Event_Time_Stamps	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetARRAY[3] of BACnetTimeStamp

### 3.3.7 Multi-State Input (as per Clause 12.18, Table 12-21)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Present_Value	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Device_Type	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Status_Flags	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetStatusFlags
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Reliability	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetReliability
Out_Of_Service	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BOOLEAN
Number_Of_States	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
State_Text	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetARRAY[N]of CharacterString

### 3.3.8 Multi-State Value (as per Clause 12.20, Table 12-23)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Present_Value	Yes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Status_Flags	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetStatusFlags
Event_State	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventState
Reliability	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetReliability
Out_Of_Service	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BOOLEAN
Number_Of_States	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
State_Text	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	BACnetARRAY[N] of CharacterString

\*Instance 3 is not writable.

### 3.3.9 Notification Class (as per Clause 12.21, Table 12-24)

Dynamically Creatable:  YES  NO

Dynamically Deletable:  YES  NO

Property Identifier	Writable	Conformance Code		Property Data Type
		Required	Optional	
Object_Identifier	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectIdentifier
Object_Name	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CharacterString
Object_Type	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetObjectType
Description	No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	CharacterString
Notification_Class	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Unsigned
Priority	Yes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetARRAY[3] of Unsigned
Ack_Required	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BACnetEventTransitionBits
Recipient_List	Yes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	List of BACnetDestination

### 3.4 Data Link Layer Option

- BACnet Internet Protocol (IP) (Annex J)
- BACnet IP (Annex J), Foreign Device
- ISO 8802-3, Ethernet (Clause 7)
- ANSI/ATA 878.1, 2.5 MB ARCNET network (Clause 8)
- ANSI/ATA 878.1, RS-485 ARCNET network (Clause 8), baud rates:
- Master-Slave/Token-Passing (MS/TP) master (Clause 9), baud rates: Auto (default), 9600, 19,200, 38,400, 76,800
- MS/TP slave (Clause 9), baud rates: Auto (default), 9600, 19,200, 38,400, 76,800
- Point-To-Point, EIA 232 (Clause 10), baud rates:
- Point-To-Point, modem (Clause 10), baud rates:
- LonTalk® protocol (Clause 11), medium:
- Other:

### 3.5 Segmentation Capability

- Segmented requests supported : Window Size: N/A
- Segmented responses supported : Window Size: N/A

### 3.6 Device Address Binding

*Is static device binding supported? (Required for two-way communication between MS/TP slaves and other devices)*

YES  NO

### 3.7 Networking Options

- Router, Clause 6:
- Annex H, BACnet Tunneling Router over IP
- BACnet/IP Broadcast Management Device (BBMD)  
Does the BBMD support registrations by Foreign Devices?  YES  NO

### 3.8 Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

- ANSI X3.4
- IBM®/Microsoft® Double-Byte Character Set (DBCS)
- ISO 8859-1
- ISO 10646 Universal Character Set-2 (UCS-2)
- ISO 10646 (UCS-4)
- Japanese Industrial Standard (JIS) C 6226

### 3.9 RPM Supported Services

Table below lists all the BACnet standard application services. The checked services are supported by the RPM.

Application Service	Initiates Requests	Executes Requests
ConfirmedEventNotification Service	<input checked="" type="checkbox"/>	<input type="checkbox"/>
UnconfirmedEventNotification Service	<input checked="" type="checkbox"/>	<input type="checkbox"/>
GetAlarmSummary Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ReadProperty Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ReadPropertyMultiple Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
WriteProperty Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
WritePropertyMultiple Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DeviceCommunicationControl Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ReinitializeDevice Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Timesynchronization Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
UTCTimesynchronization Service	<input type="checkbox"/>	<input checked="" type="checkbox"/>
who-Is	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Who-Has	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-Am	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I-Have	<input checked="" type="checkbox"/>	<input type="checkbox"/>