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## Entity Sensor Management Information Base

### Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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### Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for extending the Entity MIB (RFC 2737) to provide generalized access to information related to physical sensors, which are often found in networking equipment (such as chassis temperature, fan RPM, power supply voltage).

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## 1. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

## 2. Overview

There is a need for a standardized way of obtaining information related to the physical sensors which are commonly found in networking equipment. Information such as the current value of the sensor, the current operational status, and the data units precision associated with the sensor, should be represented in a consistent manner for any type of sensor.

Physical sensors are represented in the Entity MIB with `entPhysicalEntry` and an `entPhysicalClass` value of 'sensor(8)'. The information provided in the ENTITY-SENSOR-MIB module (defined in this document) defines a sparse augmentation of the `entPhysicalTable`, for entries which represent physical sensors.

### 2.1. Terms

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119. [RFC2119]

### 2.2. Relationship to the Entity MIB

The MIB objects defined in this document provide a sparse augmentation to the `entPhysicalTable` in the Entity MIB, for entries in which the associated `entPhysicalClass` object is equal to 'sensor(8)'. An agent is expected to maintain an `entPhySensorEntry` with the same `entPhysicalIndex` value for each `entPhysicalEntry` representing a physical sensor. Therefore, implementation of the `entityPhysicalGroup` is required for agents that implement the Entity Sensor MIB.

### 2.3. Relationship to General Thresholding Mechanisms

There are no specialized sensor value thresholding mechanisms defined in this MIB module. Instead, it is recommended that a generalized thresholding MIB, such as the mechanisms defined by the Alarm and Events groups of the Remote Network Monitoring MIB [RFC2819], be used for this purpose.

### 3. MIB Structure

The Entity Sensor MIB contains a single group called the `entitySensorValueGroup`, which allows objects to convey the current value and status of a physical sensor.

The `entitySensorValueGroup` contains a single table, called the `entPhySensorTable`, which provides a small number of read-only objects:

`entPhySensorType`

This object identifies the type of data units associated with the sensor value.

`entPhySensorScale`

This object identifies the (power of 10) scaling factor associated with the sensor value.

`entPhySensorPrecision`

This object identifies the number of decimal places of precision associated with the sensor value.

`entPhySensorValue`

This object identifies the current value of the sensor.

`entPhySensorOperStatus`

This object identifies the current operational status of the sensor (as it's known to the agent).

`entPhySensorUnitsDisplay`

This object provides a textual description of the data units represented by the `entPhySensorType` and `entPhySensorScale` objects.

`entPhySensorValueTimeStamp`

The object identifies the value of `sysUpTime` at the time the agent last updated the information in the entry. This object is only relevant if the agent uses a polling implementation strategy, (i.e., the associated `entPhySensorValueUpdateRate` object is greater than zero).

#### entPhySensorValueUpdateRate

This object indicates the nature of the agent implementation of the entPhySensorEntry, and contains the (possibly estimated) number of milliseconds that elapse between polling updates of the information in the associated entry. The value zero indicates that the agent always return current data for the entry (as opposed to the data as it was at the last polling interval).

## 4. Definitions

ENTITY-SENSOR-MIB DEFINITIONS ::= BEGIN

### IMPORTS

```
MODULE-IDENTITY, OBJECT-TYPE,
Integer32, Unsigned32, mib-2
    FROM SNMPv2-SMI
MODULE-COMPLIANCE, OBJECT-GROUP
    FROM SNMPv2-CONF
TEXTUAL-CONVENTION, TimeStamp
    FROM SNMPv2-TC
entPhysicalIndex, entityPhysicalGroup
    FROM ENTITY-MIB
SnmpAdminString
    FROM SNMP-FRAMEWORK-MIB;
```

### entitySensorMIB MODULE-IDENTITY

```
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ORGANIZATION      "IETF Entity MIB Working Group"
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DESCRIPTION

"This module defines Entity MIB extensions for physical sensors.

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REVISION "200212160000Z"

DESCRIPTION

"Initial version of the Entity Sensor MIB module, published as RFC 3433."

::= { mib-2 99 }

entitySensorObjects OBJECT IDENTIFIER  
::= { entitySensorMIB 1 }

-- entitySensorNotifications OBJECT IDENTIFIER  
-- ::= { entitySensorMIB 2 }

entitySensorConformance OBJECT IDENTIFIER  
::= { entitySensorMIB 3 }

--  
-- Textual Conventions  
--

EntitySensorDataType ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An object using this data type represents the Entity Sensor measurement data type associated with a physical sensor value. The actual data units are determined by examining an object of this type together with the associated EntitySensorDataScale object.

An object of this type SHOULD be defined together with objects of type EntitySensorDataScale and EntitySensorPrecision. Together, associated objects of these three types are used to identify the semantics of an object of type EntitySensorValue.

Valid values are:

other(1):	a measure other than those listed below
unknown(2):	unknown measurement, or arbitrary, relative numbers
voltsAC(3):	electric potential
voltsDC(4):	electric potential
amperes(5):	electric current
watts(6):	power
hertz(7):	frequency
celsius(8):	temperature
percentRH(9):	percent relative humidity
rpm(10):	shaft revolutions per minute
cmm(11),:	cubic meters per minute (airflow)
truthvalue(12):	value takes { true(1), false(2) }

"

```
SYNTAX INTEGER {
    other(1),
    unknown(2),
    voltsAC(3),
    voltsDC(4),
    amperes(5),
    watts(6),
    hertz(7),
    celsius(8),
    percentRH(9),
    rpm(10),
    cmm(11),
    truthvalue(12)
}
```

EntitySensorDataScale ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An object using this data type represents a data scaling factor, represented with an International System of Units (SI) prefix. The actual data units are determined by examining an object of this type together with the associated EntitySensorDataType object.

An object of this type SHOULD be defined together with objects of type EntitySensorDataType and EntitySensorPrecision. Together, associated objects of these three types are used to identify the semantics of an object of type EntitySensorValue."

REFERENCE

"The International System of Units (SI),

National Institute of Standards and Technology,  
Spec. Publ. 330, August 1991."

```
SYNTAX INTEGER {  
    yocto(1),      -- 10^-24  
    zepto(2),      -- 10^-21  
    atto(3),       -- 10^-18  
    femto(4),      -- 10^-15  
    pico(5),       -- 10^-12  
    nano(6),       -- 10^-9  
    micro(7),      -- 10^-6  
    milli(8),      -- 10^-3  
    units(9),      -- 10^0  
    kilo(10),      -- 10^3  
    mega(11),      -- 10^6  
    giga(12),      -- 10^9  
    tera(13),      -- 10^12  
    exa(14),       -- 10^15  
    peta(15),      -- 10^18  
    zetta(16),     -- 10^21  
    yotta(17)     -- 10^24  
}
```

EntitySensorPrecision ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An object using this data type represents a sensor  
precision range.

An object of this type SHOULD be defined together with  
objects of type EntitySensorDataType and  
EntitySensorDataScale. Together, associated objects of  
these three types are used to identify the semantics of an  
object of type EntitySensorValue.

If an object of this type contains a value in the range 1 to  
9, it represents the number of decimal places in the  
fractional part of an associated EntitySensorValue fixed-  
point number.

If an object of this type contains a value in the range -8  
to -1, it represents the number of accurate digits in the  
associated EntitySensorValue fixed-point number.

The value zero indicates the associated EntitySensorValue  
object is not a fixed-point number.

Agent implementors must choose a value for the associated  
EntitySensorPrecision object so that the precision and

accuracy of the associated EntitySensorValue object is correctly indicated.

For example, a physical entity representing a temperature sensor that can measure 0 degrees to 100 degrees C in 0.1 degree increments, +/- 0.05 degrees, would have an EntitySensorPrecision value of '1', an EntitySensorDataScale value of 'units(9)', and an EntitySensorValue ranging from '0' to '1000'. The EntitySensorValue would be interpreted as 'degrees C \* 10'."

SYNTAX Integer32 (-8..9)

EntitySensorValue ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An object using this data type represents an Entity Sensor value.

An object of this type SHOULD be defined together with objects of type EntitySensorDataType, EntitySensorDataScale and EntitySensorPrecision. Together, associated objects of those three types are used to identify the semantics of an object of this data type.

The semantics of an object using this data type are determined by the value of the associated EntitySensorDataType object.

If the associated EntitySensorDataType object is equal to 'voltsAC(3)', 'voltsDC(4)', 'amperes(5)', 'watts(6)', 'hertz(7)', 'celsius(8)', or 'cmm(11)', then an object of this type MUST contain a fixed point number ranging from -999,999,999 to +999,999,999. The value -1000000000 indicates an underflow error. The value +1000000000 indicates an overflow error. The EntitySensorPrecision indicates how many fractional digits are represented in the associated EntitySensorValue object.

If the associated EntitySensorDataType object is equal to 'percentRH(9)', then an object of this type MUST contain a number ranging from 0 to 100.

If the associated EntitySensorDataType object is equal to 'rpm(10)', then an object of this type MUST contain a number ranging from -999,999,999 to +999,999,999.

If the associated EntitySensorDataType object is equal to 'truthvalue(12)', then an object of this type MUST contain either the value 'true(1)' or the value 'false(2)'.



If the associated EntitySensorDataType object is equal to 'other(1)' or unknown(2)', then an object of this type MUST contain a number ranging from -1000000000 to 1000000000."

SYNTAX Integer32 (-1000000000..1000000000)

EntitySensorStatus ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An object using this data type represents the operational status of a physical sensor.

The value 'ok(1)' indicates that the agent can obtain the sensor value.

The value 'unavailable(2)' indicates that the agent presently cannot obtain the sensor value.

The value 'nonoperational(3)' indicates that the agent believes the sensor is broken. The sensor could have a hard failure (disconnected wire), or a soft failure such as out-of-range, jittery, or wildly fluctuating readings."

SYNTAX INTEGER {  
     ok(1),  
     unavailable(2),  
     nonoperational(3)  
 }

--

-- Entity Sensor Table

--

entPhySensorTable OBJECT-TYPE

SYNTAX SEQUENCE OF EntPhySensorEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains one row per physical sensor represented by an associated row in the entPhysicalTable."

::= { entitySensorObjects 1 }

entPhySensorEntry OBJECT-TYPE

SYNTAX EntPhySensorEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Information about a particular physical sensor.

An entry in this table describes the present reading of a sensor, the measurement units and scale, and sensor operational status.

Entries are created in this table by the agent. An entry for each physical sensor SHOULD be created at the same time as the associated entPhysicalEntry. An entry SHOULD be destroyed if the associated entPhysicalEntry is destroyed."

```
INDEX { entPhysicalIndex }      -- SPARSE-AUGMENTS
 ::= { entPhySensorTable 1 }
```

```
EntPhySensorEntry ::= SEQUENCE {
    entPhySensorType      EntitySensorDataType,
    entPhySensorScale     EntitySensorDataScale,
    entPhySensorPrecision EntitySensorPrecision,
    entPhySensorValue     EntitySensorValue,
    entPhySensorOperStatus EntitySensorStatus,
    entPhySensorUnitsDisplay SnmpAdminString,
    entPhySensorValueTimeStamp TimeStamp,
    entPhySensorValueUpdateRate Unsigned32
}
```

```
entPhySensorType OBJECT-TYPE
```

```
SYNTAX      EntitySensorDataType
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

```
DESCRIPTION
```

"The type of data returned by the associated entPhySensorValue object.

This object SHOULD be set by the agent during entry creation, and the value SHOULD NOT change during operation."

```
::= { entPhySensorEntry 1 }
```

```
entPhySensorScale OBJECT-TYPE
```

```
SYNTAX      EntitySensorDataScale
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

```
DESCRIPTION
```

"The exponent to apply to values returned by the associated entPhySensorValue object.

This object SHOULD be set by the agent during entry creation, and the value SHOULD NOT change during operation."

```
::= { entPhySensorEntry 2 }
```

**entPhySensorPrecision OBJECT-TYPE**

SYNTAX EntitySensorPrecision

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The number of decimal places of precision in fixed-point sensor values returned by the associated entPhySensorValue object.

This object SHOULD be set to '0' when the associated entPhySensorType value is not a fixed-point type: e.g., 'percentRH(9)', 'rpm(10)', 'cmm(11)', or 'truthvalue(12)'.

This object SHOULD be set by the agent during entry creation, and the value SHOULD NOT change during operation."

::= { entPhySensorEntry 3 }

**entPhySensorValue OBJECT-TYPE**

SYNTAX EntitySensorValue

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The most recent measurement obtained by the agent for this sensor.

To correctly interpret the value of this object, the associated entPhySensorType, entPhySensorScale, and entPhySensorPrecision objects must also be examined."

::= { entPhySensorEntry 4 }

**entPhySensorOperStatus OBJECT-TYPE**

SYNTAX EntitySensorStatus

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The operational status of the sensor."

::= { entPhySensorEntry 5 }

**entPhySensorUnitsDisplay OBJECT-TYPE**

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"A textual description of the data units that should be used in the display of entPhySensorValue."

::= { entPhySensorEntry 6 }

## entPhySensorValueTimeStamp OBJECT-TYPE

SYNTAX           TimeStamp  
 MAX-ACCESS       read-only  
 STATUS           current

## DESCRIPTION

"The value of sysUpTime at the time the status and/or value of this sensor was last obtained by the agent."

::= { entPhySensorEntry 7 }

## entPhySensorValueUpdateRate OBJECT-TYPE

SYNTAX           Unsigned32  
 UNITS            "milliseconds"  
 MAX-ACCESS       read-only  
 STATUS           current

## DESCRIPTION

"An indication of the frequency that the agent updates the associated entPhySensorValue object, representing in milliseconds.

The value zero indicates:

- the sensor value is updated on demand (e.g., when polled by the agent for a get-request),
- the sensor value is updated when the sensor value changes (event-driven),
- the agent does not know the update rate.

"

::= { entPhySensorEntry 8 }

--

-- Conformance Section

--

## entitySensorCompliances OBJECT IDENTIFIER

::= { entitySensorConformance 1 }

## entitySensorGroups OBJECT IDENTIFIER

::= { entitySensorConformance 2 }

## entitySensorCompliance MODULE-COMPLIANCE

STATUS   current

## DESCRIPTION

"Describes the requirements for conformance to the Entity Sensor MIB module."

MODULE   -- this module

MANDATORY-GROUPS { entitySensorValueGroup }

```
MODULE ENTITY-MIB
    MANDATORY-GROUPS { entityPhysicalGroup }

    ::= { entitySensorCompliances 1 }

-- Object Groups

entitySensorValueGroup OBJECT-GROUP
    OBJECTS {
        entPhySensorType,
        entPhySensorScale,
        entPhySensorPrecision,
        entPhySensorValue,
        entPhySensorOperStatus,
        entPhySensorUnitsDisplay,
        entPhySensorValueTimeStamp,
        entPhySensorValueUpdateRate
    }
    STATUS current
    DESCRIPTION
        "A collection of objects representing physical entity sensor
        information."
    ::= { entitySensorGroups 1 }

END
```

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The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights which may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.

## 6. Acknowledgements

This memo is a product of the Entity MIB working group. It is based on an existing proprietary MIB module written by Cliff Sojourner.

## 7. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [RFC2737] McCloghrie, K. and A. Bierman, "Entity MIB (Version 2)", RFC 2737, December 1999.
- [RFC3414] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", STD 62, RFC 3414, December 2002.
- [RFC3415] Wijnen, B., Presuhn, R. and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", STD 62, RFC 3415, December 2002.

## 8. Informative References

- [RFC2819] Waldbusser, S., "Remote network Monitoring Management Information Base", RFC 2819, May 2000.
- [RFC3410] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

## 9. Security Considerations

There is one managed object in this MIB that may contain sensitive information. This is:

entPhySensorValue

This object may expose the values of particular physical sensors for a device.

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec), there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB.

It is recommended that the implementors consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model STD 62, RFC 3414 [RFC3414] and the View-based Access Control Model STD 62, RFC 3415 [RFC3415] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to only the objects, and those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

## 10. Authors' Addresses

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