

# **IPSO Smart Object Guideline**

Smart Objects Starter Pack 1.0

Internet Protocol for Smart Objects (IPSO) Alliance

Technical Guideline

IPSO Smart Object Committee

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IPSO Alliance

# Introduction

The availability of Internet Protocol (IP) on constrained devices with memory sizes of 16 kilobytes or less, including IPV6 and 6LowPAN, has made possible a new kind of interoperability for connected devices and Smart Objects.

The IETF specify a set of standard protocols for IP-enabled networks in Constrained Resource Environments (CoRE), including the Constrained resource Application Protocol [2] (CoAP, RFC 7252) applicable to low power and low connection bandwidth devices. CoAP is an application protocol for machines and connected devices, as http is for web browsers, but designed specifically for machine interaction and operation over networks of constrained devices.

IPSO Smart Object Guidelines provide a common design pattern, an object model, that can effectively use the IETF CoAP protocol to provide high level interoperability between Smart Object devices and connected software applications on other devices and services.

The common object model is based on the Lightweight M2M (LWM2M 1.0) specification from the Open Mobile Alliance. OMA LWM2M [1] is a device management and service architecture specification based on IETF CoAP, and provides a simple and flexible object template (object model) for constrained device management.

The object model from OMA LWM2M is reused to define application level IPSO Smart Objects. This enables the OMA Name Authority (OMNA) to be used to register new objects, and enables existing LWM2M compliant device libraries and server software to be used as an infrastructure for IPSO Smart Objects.

The object model can optionally be used with any protocol, for example http, that supports the web standard content types and REST methods defined in [1].

This first IPSO Smart Object Guideline describes 18 Smart Object types, including a temperature sensor, a light controller, an accelerometer, a presence sensor, and other common sensor and actuator types representing a variety of use case domains. It is intended as a “starter pack” and example of how IPSO Smart Objects can be built to address some application specific use cases.

This first object set is intended to be used as a starting place from which to build more objects and object sets, in order to address vertical application segments and new functional requirements for Smart Objects. The IPSO Alliance is committed to making it easy for people to create new objects based on their use case needs, while promoting reusable and cross-domain standards to as great an extent as is practical.

# IPSO Smart Object Summary

IPSO Smart Objects are based on the object model specified in OMA LightWeight M2M [1] Chapter 6, Identifiers and Resources.

An IPSO Smart Object is a specified collection of reusable resources (See Table 2, Reusable Resources) that has a well-known object ID (See Table 1, Smart Objects) and which represents a particular type of physical sensor, actuator, connected object or other data source. The reusable resources, which make up the Smart Object, represent static and dynamic properties of the connected physical object and the embedded software contained therein.

This document defines a set of IPSO Smart Objects, which conform to the OMA LWM2M Object Model, and which can be used as data objects, or web objects, to represent common sensors, actuators, and data sources.

Although OMA LWM2M is based on the IETF CoAP [2] protocol, these objects may be used with other transport protocols (e.g. HTTP [3] with REST [4]) by supporting the Content-Types and access methods defined in [1].

Table 1 Summarizes the Objects defined by this Technical Guideline.

Table 1 Smart Objects defined by this Technical Guideline

| **Object** | **Object ID** | **Multiple Instances?** |
| --- | --- | --- |
| **IPSO Digital Input** | 3200 | Yes |
| **IPSO Digital Output** | 3201 | Yes |
| **IPSO Analogue Input** | 3202 | Yes |
| **IPSO Analogue Output** | 3203 | Yes |
| **IPSO Generic Sensor** | 3300 | Yes |
| **IPSO Illuminance Sensor** | 3301 | Yes |
| **IPSO Presence Sensor** | 3302 | Yes |
| **IPSO Temperature Sensor** | 3303 | Yes |
| **IPSO Humidity Sensor** | 3304 | Yes |
| **IPSO Power Measurement** | 3305 | Yes |
| **IPSO Actuation** | 3306 | Yes |
| **IPSO Set Point** | 3308 | Yes |
| **IPSO Load Control** | 3310 | Yes |
| **IPSO Light Control** | 3311 | Yes |
| **IPSO Power Control** | 3312 | Yes |
| **IPSO Accelerometer** | 3313 | Yes |
| **IPSO Magnetometer** | 3314 | Yes |
| **IPSO Barometer** | 3315 | Yes |

# IPSO Object: Digital Input

Description: This IPSO object is a generic object that can be used with any kind of digital input interface.

Specific objects for a few particular types of sensors are described later in the document, enabling identification of the type of sensor directly from its Object ID. This object may be used as a generic object if a dedicated one does not exist.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Digital Input** | 3200 | urn:oma:lwm2m:ext:3200 | Yes | Generic digital input for non-specific sensors |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Digital**  **Input**  **State** | 5500 | R | No | Mandatory | Boolean |  |  | The current state of a digital input. |
| **Digital Input**  **Counter** | 5501 | R | No | Optional | Integer |  |  | The cumulative value of active state detected. |
| **Digital**  **Input**  **Polarity** | 5502 | R,W | No | Optional | Boolean |  |  | The polarity of the digital input as a Boolean (0 = Normal, 1= Reversed) |
| **Digital Input**  **Debounce Period** | 5503 | R,W | No | Optional | Integer |  | ms | The debounce period in ms. |
| **Digital**  **Input**  **Edge Selection** | 5504 | R,W | No | Optional | Integer | 1-3 |  | The edge selection as an integer (1 = Falling edge, 2 = Rising edge, 3 = Both Rising and Falling edge) |
| **Digital**  **Input**  **Counter**  **Reset** | 5505 | E | No | Optional | Opaque |  |  | Reset the Counter value |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |
| **Sensor Type** | 5751 | R | No | Optional | String |  |  | The type of the sensor, for instance PIR type |

# IPSO Object: Digital Output

Description: This IPSO object is a generic object that can be used with any kind of digital output interface.

Specific objects for a few particular types of sensors are described later in the document, enabling identification of the type of sensor directly from its Object ID. This object may be used as a generic object if a dedicated one does not exist.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Digital Output** | 3201 | urn:oma:lwm2m:ext:3201 | Yes | Generic digital output for non-specific actuators |

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **Digital Output State** | 5550 | R,W | No | Mandatory | Boolean |  |  | The current state of a digital output. |
| **Digital Output Polarity** | 5551 | R,W | No | Optional | Boolean |  |  | The polarity of a digital ouput as a Boolean (0 = Normal, 1= Reversed) |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |

# IPSO Object: Analog Input

Description: This IPSO object is a generic object that can be used with any kind of analog input interface.

Specific objects for a few particular types of sensors are described later in the document, enabling identification of the type of sensor directly from its Object ID. This object may be used as a generic object if a dedicated one does not exist.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Analog Input** | 3202 | urn:oma:lwm2m:ext:3202 | Yes | Generic analog input for non-specific sensors |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Analog Input**  **Current Value** | 5600 | R | No | Mandatory | Float | 0-1 |  | The current value of the analog input. |
| **Min Measured**  **Value** | 5601 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |
| **Sensor Type** | 5751 | R | No | Optional | String |  |  | The type of the sensor, for instance PIR type |

# IPSO Object: Analog Output

Description: This IPSO object is a generic object that can be used with any kind of analog output interface.

Specific objects for a few particular types of sensors are described later in the document, enabling identification of the type of sensor directly from its Object ID. This object may be used as a generic object if a dedicated one does not exist.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Analog Output** | 3203 | urn:oma:lwm2m:ext:3203 | Yes | Generic analog output for non-specific actuators |

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **Analog Output**  **Current Value** | 5650 | R,W | No | Mandatory | Float | 0-1 |  | The current value of the analog output. |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |

# IPSO Object: Generic Sensor

Description: This IPSO object allows the description of a generic sensor. It is based on the description of a value and measurement units according to the UCUM specification. Thus, any type of value defined within the UCUM specification can be reported using this object.

Specific objects for a few particular types of sensors are described later in the document, enabling identification of the type of sensor directly from its Object ID. This object may be used as a generic object if a dedicated one does not exist.

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Generic Sensor** | 3300 | urn:oma:lwm2m:ext:3300 | Yes | Generic sensor for applications not covered by a specific object type |

**Object Info:**

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sensor Value** | 5700 | R | No | Mandatory | Float |  | Defined by “Units” resource. | Last or Current Measured Value from the Sensor |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Min Measured**  **Value** | 5601 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |
| **Sensor Type** | 5751 | R | No | Optional | String |  |  | The type of the sensor, for instance PIR type |

# IPSO Object: Illuminance

Description: This IPSO object should be used with an illuminance (light intensity) sensor to report an illuminance measurement. It also provides resources for minimum/maximum measured values and the minimum/maximum range that can be measured by the sensor. An example measurement unit is Lux (ucum:lx).

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Illuminance** | 3301 | urn:oma:lwm2m:ext:3301 | Yes | Illuminance sensor, example units = lx |

**Object Info:**

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sensor Value** | 5700 | R | No | Mandatory | Float |  |  | Last or Current Measured Value from the Sensor |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Min Measured**  **Value** | 5601 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |

# IPSO Object: Presence

Description: This IPSO object should be used with a presence sensor to report presence detection. It also provides resources to manage a counter, the type of sensor used (e.g the technology of the probe), and configuration for the delay between busy and clear detection state.

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Presence** | 3302 | urn:oma:lwm2m:ext:3302 | Yes | Presence sensor with digital sensing, optional delay parameters |

**Object Info:**

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **Digital Input State** | 5500 | R | No | Mandatory | Boolean |  |  | The current state of the presence sensor |
| **Digital Input**  **Counter** | 5501 | R | No | Optional | Integer |  |  | The cumulative value of active state detected. |
| **Digital**  **Input**  **Counter Reset** | 5505 | E | No | Optional | Opaque |  |  | Reset the Counter value |
| **Sensor Type** | 5751 | R | No | Optional | String |  |  | The type of the sensor, for instance PIR type |
| **Busy to Clear delay** | 5903 | R,W | No | Optional | Integer |  | ms | Delay from the detection state to the clear state in ms |
| **Clear to Busy delay** | 5904 | R,W | No | Optional | Integer |  | ms | Delay from the clear state to the busy state in ms |

# IPSO Object: Temperature

Description: This IPSO object should be used with a temperature sensor to report a temperature measurement. It also provides resources for minimum/maximum measured values and the minimum/maximum range that can be measured by the temperature sensor. An example measurement unit is degrees Celsius (ucum:Cel).

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Temperature** | 3303 | urn:oma:lwm2m:ext:3303 | Yes | Temperature sensor, example units = Cel |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sensor Value** | 5700 | R | No | Mandatory | Float |  |  | Last or Current Measured Value from the Sensor |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Min Measured**  **Value** | 5601 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |

# IPSO Object: Humidity

Description: This IPSO object should be used with a humidity sensor to report a humidity measurement. It also provides resources for minimum/maximum measured values and the minimum/maximum range that can be measured by the humidity sensor. An example measurement unit is relative humidity as a percentage (ucum:%).

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Humidity** | 3304 | urn:oma:lwm2m:ext:3304 | Yes | Relative humidity sensor, example units = % |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sensor Value** | 5700 | R | No | Mandatory | Float |  |  | Last or Current Measured Value from the Sensor |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Min Measured**  **Value** | 5601 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |

# IPSO Object: Power Measurement

Description: This IPSO object should be used with a power measurement sensor to report a power measurement. It also provides resources for minimum/maximum measured values and the minimum/maximum range for both active and reactive power. Il also provides resources for cumulative energy, calibration, and the power factor.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Descriptiomn** |
| --- | --- | --- | --- | --- |
| **IPSO Power Measurement** | 3305 | urn:oma:lwm2m:ext:3305 | Yes | Power measurement object with reactive power and min/max tracking |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Instantaneous active power** | 5800 | R | No | Mandatory | Float |  | W | The current active power |
| **Min Measured**  **active power** | 5801 | R | No | Optional | Float |  | W | The minimum active power measured by the sensor since power ON or reset |
| **Max Measured**  **active power** | 5802 | R | No | Optional | Float |  | W | The maximum active power measured by the sensor since power ON or reset |
| **Min**  **Range**  **active power** | 5803 | R | No | Optional | Float |  | W | The minimum active power that can be measured by the sensor |
| **Max Range**  **active power** | 5804 | R | No | Optional | Float |  | W | The maximum active power that can be measured by the sensor |
| **Cumulative active power** | 5805 | R | No | Optional | Float |  | Wh | The cumulative active power since the last cumulative energy reset or device start |
| **Active Power Calibration** | 5806 | W | No | Optional | Float |  | W | Request an active power calibration by writing the value of a calibrated load. |
| **Instantaneous reactive power** | 5810 | R | No | Optional | Float |  | var | The current reactive power |
| **Min Measured**  **reactive power** | 5811 | R | No | Optional | Float |  | var | The minimum reactivepower measured by the sensor since power ON or reset |
| **Max Measured**  **reactive power** | 5812 | R | No | Optional | Float |  | var | The maximum reactivepower measured by the sensor since power ON or reset |
| **Min**  **Range**  **reactive power** | 5813 | R | No | Optional | Float |  | var | The minimum active power that can be measured by the sensor |
| **Max Range**  **reactive power** | 5814 | R | No | Optional | Float |  | var | The maximum reactivepower that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |
| **Cumulative reactive power** | 5815 | R | No | Optional | Float |  | varh | The cumulative reactive power since the last cumulative energy reset or device start |
| **Reactive Power Calibration** | 5816 | W | No | Optional | Float |  | var | Request a reactive power calibration by writing the value of a calibrated load. |
| **Power factor** | 5820 | R | No | Optional | Float |  |  | The power factor of the load. |
| **Current Calibration** | 5821 | R,W | No | Optional | Float |  |  | Read or Write the current calibration coefficient |
| **Reset Cumulative energy** | 5822 | E | No | Optional | Opaque |  |  | Reset both cumulative active/reactive power |

# IPSO Object: Actuation

Description: This IPSO object is dedicated to remote actuation such as ON/OFF action or dimming. A multi-state output can also be described as a string. This is useful to send pilot wire orders for instance. It also provides a resource to reflect the time that the device has been switched on.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Actuation** | 3306 | urn:oma:lwm2m:ext:3306 | Yes | Actuator object with on/off control and proportional control |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **On/Off** | 5850 | R, W | No | Mandatory | Boolean |  |  | On/off control, 0=OFF, 1=ON |
| **Dimmer** | 5851 | R, W | No | Optional | Integer | 0-100 | % | Proportional control, integer value between 0 and 100 as a percentage. |
| **On Time** | 5852 | R, W | No | Optional | Integer |  | s | The time in seconds that the device has been on. Writing a value of 0 resets the counter. |
| **Muti-state Output** | 5853 | R,W | No | Optional | String |  |  | A string describing a state for multiple level output such as Pilot Wire |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |

# IPSO Object: Set Point

Description: This IPSO object should be used to set a desired value to a controller, such as a thermostat. This object enables a setpoint to be expressed units defined in the UCUM specification, to match an associated sensor or measurement value. A special resource is added to set the colour of an object.

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Setpoint** | 3308 | urn:oma:lwm2m:ext:3308 | Yes | Setpoint object with configurable units float and optional color setting resource |

**Object Info:**

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **Set Point Value** | 5900 | R,W | No | Mandatory | Float |  | Defined by “Units” resource. | The setpoint value. |
| **Colour** | 5706 | R,W | No | Optional | String |  | Defined by “Units” resource. | A string representing a value in some color space |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Application Type** | 5750 | R,W | No | Optional | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |

# IPSO Object: Load Control

Description: This Object is used for demand-response load control and other load control in automation applications (not limited to power).

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Load Control** | 3310 | urn:oma:lwm2m:ext:3310 | Yes | Load control object with critical event parameters |

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **Event Identifier** | 5823 | R, W | No | Mandatory | String |  |  | The event identifier as a string. |
| **Start Time** | 5824 | R, W | No | Mandatory | Time |  |  | Time when the load control event will start started. |
| **Duration In Min** | 5825 | R, W | No | Mandatory | Integer |  | min | The duration of the load control event. |
| **Criticality Level** | 5826 | R, W | No | Optional | Integer | 0-3 |  | The criticality of the event. The device receiving the event will react in an appropriate fashion for the device. |
| **Avg Load Adj Pct** | 5827 | R, W | No | Optional | Integer | 0-100 | % | Defines the maximum energy usage of the receiving device, as a percentage of the device's normal maximum energy usage. |
| **Duty Cycle** | 5828 | R, W | No | Optional | Integer | 0-100 | % | Defines the duty cycle for the load control event, i.e, what percentage of time the receiving device is allowed to be on. |

# IPSO Object: Light Control

Description: This Object is used to control a light source, such as a LED or other light. It allows a light to be turned on or off and its dimmer setting to be control as a % between 0 and 100. An optional colour setting enables a string to be used to indicate the desired colour.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Light Control** | 3311 | urn:oma:lwm2m:ext:3311 | Yes | Light control object with on/off and optional dimming and energy monitor |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **On/Off** | 5850 | R, W | No | Mandatory | Boolean |  |  | On/off control, 0=OFF, 1=ON |
| **Dimmer** | 5851 | R, W | No | Optional | Integer | 0-100 | % | Proportional control, integer value between 0 and 100 as a percentage. |
| **Colour** | 5706 | R,W | String | Optional | String |  | Defined by “Units” resource. | A string representing a value in some color space |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **On Time** | 5852 | R, W | No | Optional | Integer |  | s | The time in seconds that the light has been on. Writing a value of 0 resets the counter. |
| **Cumulative active power** | 5805 | R | No | Optional | Float |  | Wh | The cumulative active power since the last cumulative energy reset or device start |
| **Power factor** | 5820 | R | No | Optional | Float |  |  | The power factor of the load. |

# IPSO Object: Power Control

Description: This Object is used to control a power source, such as a Smart Plug. It allows a power relay to be turned on or off and its dimmer setting to be control as a % between 0 and 100.

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Power Control** | 3312 | urn:oma:lwm2m:ext:3312 | Yes | Power control object with on/off and optional dimming and energy monitor |

**Object Info:**

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **On/Off** | 5850 | R, W | No | Mandatory | Boolean |  |  | On/off control, 0=OFF, 1=ON |
| **Dimmer** | 5851 | R, W | No | Optional | Integer | 0-100 | % | Proportional control, integer value between 0 and 100 as a percentage. |
| **On Time** | 5852 | R, W | No | Optional | Integer |  | s | The time in seconds that the power relay has been on. Writing a value of 0 resets the counter. |
| **Cumulative active power** | 5805 | R | No | Optional | Float |  | Wh | The cumulative active power since the last cumulative energy reset or device start |
| **Power factor** | 5820 | R | No | Optional | Float |  |  | The power factor of the load. |

# IPSO Object: Accelerometer

Description: This IPSO object can be used to represent a 1-3 axis accelerometer.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Accelerometer** | 3313 | urn:oma:lwm2m:ext:3313 | Yes | Accelerometer sensor for 1 to 3 axis, example units = g |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X Value** | 5702 | R | No | Mandatory | Float |  | Defined by “Units” resource. | The measured value along the X axis. |
| **Y Value** | 5703 | R | No | Optional | Float |  | Defined by “Units” resource. | The measured value along the Y axis. |
| **Z Value** | 5704 | R | No | Optional | Float |  | Defined by “Units” resource. | The measured value along the Z axis. |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |

# IPSO Object: Magnetometer

Description: This IPSO object can be used to represent a 1-3 axis magnetometer with optional compass direction.

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Magnetometer** | 3314 | urn:oma:lwm2m:ext:3314 | Yes | Magnetometer object with 3 axis, example units = G, optional compass |

**Resources:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| **X Value** | 5702 | R | No | Mandatory | Float |  | Defined by “Units” resource. | The measured value along the X axis. |
| **Y Value** | 5703 | R | No | Optional | Float |  | Defined by “Units” resource. | The measured value along the Y axis. |
| **Z Value** | 5704 | R | No | Optional | Float |  | Defined by “Units” resource. | The measured value along the Z axis. |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Compass Direction** | 5705 | R | No | Optional | Float | 0-360 | deg | The compass direction |

# IPSO Object: Barometer

Description: This IPSO object should be used with an air pressure sensor to report a barometer measurement. It also provides resources for minimum/maximum measured values and the minimum/maximum range that can be measured by the barometer sensor. An example measurement unit is kPa (ucum:kPa).

**Object Info:**

| **Object** | **Object ID** | **Object URN** | **Multiple Instances?** | **Description** |
| --- | --- | --- | --- | --- |
| **IPSO Barometer** | 3315 | urn:oma:lwm2m:ext:3315 | Yes | Barometer object, example units = kPa |

**Resources:**

| **Resource Name** | **Resource ID** | **Access Type** | **Multiple**  **Instances?** | **Mandatory** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sensor Value** | 5700 | R | No | Mandatory | Float |  |  | Last or Current Measured Value from the Sensor |
| **Units** | 5701 | R | No | Optional | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **Min Measured**  **Value** | 5601 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | No | Optional | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | No | Optional | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |

# Reusable Resource ID Definitions

This section defines new resources defined for the Reusable Resource Registry maintained by OMNA. These resources are used to compose the objects.

Table 2 Reusable Resource definitions

| **Resource Name** | **Resource ID** | **Access Type** | **Type** | **Range or Enumeration** | **Units** | **Descriptions** |
| --- | --- | --- | --- | --- | --- | --- |
| **Digital Input State** | 5500 | R | Boolean |  |  | The current state of a digital input. |
| **Digital Input**  **Counter** | 5501 | R | Integer |  |  | The cumulative value of active state detected. |
| **Digital Input Polarity** | 5502 | R,W | Boolean |  |  | The polarity of a digital input as a Boolean (0 = Normal, 1= Reversed) |
| **Digital Input Debounce Period** | 5503 | R,W | Integer |  | ms | The debounce period in ms. |
| **Digital Input**  **Edge Selection** | 5504 | R,W | Integer |  |  | The edge selection as an integer (1 = Falling edge, 2 = Rising edge, 3 = Both Rising and Falling edge) |
| **Digital**  **Input**  **Counter Reset** | 5505 | E | Opaque |  |  | Reset the Counter value |
| **Digital Output State** | 5550 | R,W | Boolean |  |  | The current state of a digital output. |
| **Digital Output Polarity** | 5551 | R,W | Boolean |  |  | The polarity of a digital input as a Boolean (0 = Normal, 1= Reversed) |
| **Analog**  **Input**  **Current Value** | 5600 | R | Float | 0-100 | % | The current value of the analog input. |
| **Min Measured**  **Value** | 5601 | R | Float | Same as Measured Value | Same as Measured Value | The minimum value measured by the sensor since power ON or reset |
| **Max Measured**  **Value** | 5602 | R | Float | Same as Measured Value | Same as Measured Value | The maximum value measured by the sensor since power ON or reset |
| **Min**  **Range**  **Value** | 5603 | R | Float | Same as Measured Value | Same as Measured Value | The minimum value that can be measured by the sensor |
| **Max Range**  **Value** | 5604 | R | Float | Same as Measured Value | Same as Measured Value | The maximum value that can be measured by the sensor |
| **Reset Min and Max Measured Values** | 5605 | E | Opaque |  |  | Reset the Min and Max Measured Values to Current Value |
| **Analog Output**  **Current Value** | 5650 | R,W | Float | 0-100 | % | The current value of the analog output. |
| **Sensor Value** | 5700 | R | Float |  | Defined by “Units” resource. | Last or Current Measured Value from the Sensor |
| **Sensor Units** | 5701 | R | String |  |  | Measurement Units Definition e.g. “Cel” for Temperature in Celsius. |
| **X Value** | 5702 | R | Float |  | Defined by “Units” resource. | The measured value along the X axis. |
| **Y Value** | 5703 | R | Float |  | Defined by “Units” resource. | The measured value along the Y axis. |
| **Z Value** | 5704 | R | Float |  | Defined by “Units” resource. | The measured value along the Z axis. |
| **Compass Direction** | 5705 | R | Float | 0-360 | deg | The compass direction indicated by the calibrated magnetic field |
| **Colour** | 5706 | R,W | String |  | Defined by “Units” resource. | A string representing a value in some color space |
| **Application Type** | 5750 | R,W | String |  |  | The application type of the sensor or actuator as a string, for instance, “Air Pressure” |
| **Sensor Type** | 5751 | R | String |  |  | The type of the sensor, for instance PIR type |
| **Instantaneous active power** | 5800 | R | Float |  | W | The current active power |
| **Min Measured**  **active power** | 5801 | R | Float |  | W | The minimum active power measured by the sensor since it is ON |
| **Max Measured**  **active power** | 5802 | R | Float |  | W | The maximum active power measured by the sensor since it is ON |
| **Min Range**  **active power** | 5803 | R | Float |  | W | The minimum active power that can be measured by the sensor |
| **Max Range**  **active power** | 5804 | R | Float |  | W | The maximum active power that can be measured by the sensor |
| **Cumulative active power** | 5805 | R | Float |  | Wh | The cumulative active power since the last cumulative energy reset or device start |
| **Active Power Calibration** | 5806 | W | Float |  | W | Request an active power calibration by writing the value of a calibrated load. |
| **Instantaneous reactive power** | 5810 | R | Float |  | var | The current reactive power |
| **Min Measured**  **reactive power** | 5811 | R | Float |  | var | The minimum reactivepower measured by the sensor since it is ON |
| **Max Measured**  **reactive power** | 5812 | R | Float |  | var | The maximum reactivepower measured by the sensor since it is ON |
| **Min Range**  **reactive power** | 5813 | R | Float |  | var | The minimum active power that can be measured by the sensor |
| **Max Range**  **reactive power** | 5814 | R | Float |  | var | The maximum reactivepower that can be measured by the sensor |
| **Cumulative reactive power** | 5815 | R | Float |  | varh | The cumulative reactive power since the last cumulative energy reset or device start |
| **Reactive Power Calibration** | 5816 | W | Float |  | var | Request a reactive power calibration by writing the value of a calibrated load. |
| **Power factor** | 5820 | R | Float |  |  | If applicable, the power factor of the current consumption. |
| **Current Calibration** | 5821 | R,W | Float |  |  | Read or Write the current calibration coefficient |
| **Reset Cumulative energy** | 5822 | E | Opaque |  |  | Reset both cumulative active/reactive power |
| **Event Identifier** | 5823 | R, W | String |  |  | The event identifier as a string. |
| **Start Time** | 5824 | R, W | Time |  |  | Time when the load control event will start started. |
| **Duration In Min** | 5825 | R, W | Integer |  | min | The duration of the load control event. |
| **Criticality Level** | 5826 | R, W | Integer | 0-3 |  | The criticality of the event. The device receiving the event will react in an appropriate fashion for the device. |
| **Avg Load Adj Pct** | 5827 | R, W | Integer | 0-100 | % | Defines the maximum energy usage of the receiving device, as a percentage of the device's normal maximum energy usage. |
| **Duty Cycle** | 5828 | R, W | Integer | 0-100 | % | Defines the duty cycle for the load control event, i.e, what percentage of time the receiving device is allowed to be on. |
| **On/Off** | 5850 | R, W | Boolean |  |  | This resource represents an on/off actuator, which can be controlled, the setting of which is a Boolean value (1,0) where 1 is on and 0 is off. |
| **Dimmer** | 5851 | R, W | Integer | 0-100 | % | This resource represents a dimmer setting, which has an Integer value between 0 and 100 as a percentage. |
| **On time** | 5852 | R, W | Integer |  | s | The time in seconds that the device has been turned on. Writing a value of 0 resets the counter. |
| **Muti-state Output** | 5853 | R,W | String |  |  | A string describing a state for multiple level output such as Pilot Wire |
| **Set Point Value** | 5900 | R,W | Float |  | Defined by “Units” resource. | The setpoint value. |
| **Busy to Clear delay** | 5903 | R,W | Integer |  | ms | Delay from the detection state to the clear state in ms |
| **Clear to Busy delay** | 5904 | R,W | Integer |  | ms | Delay from the clear state to the busy state in ms |

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