



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

1. 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.

2. 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

3. 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 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

4. 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 output 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"

5. 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

6. 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"

7. 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 per the UCUM specification [5]. Thus, any type of value defined within the UCUM specification can be reported using this object.

Specific objects for a few 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 Generic Sensor	3300	urn:oma:lwm2m:ext:3300	Yes	Generic sensor for applications not covered by a specific object type

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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

8. 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 Info:

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

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. An example measurement unit is Lux (ucum:lx).
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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

9. 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 Info:

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

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

10. 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

11. 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

12. 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. It also provides resources for cumulative energy, calibration, and the power factor.

Object Info:

Object	Object ID	Object URN	Multiple Instances?	Description
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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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 reactive power measured by the sensor since power ON or reset
Max Measured reactive power	5812	R	No	Optional	Float		var	The maximum reactive power 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 reactive power 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

13. 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
Application Type	5750	R,W	No	Optional	String			The application type of the sensor or actuator as a string, for instance, “Air Pressure”

14. 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 Info:

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

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”

15. 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.

16. 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	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.
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.

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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.

17. 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 Info:

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

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.

18. 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

19. 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

20. 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

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Range or Enumeration	Units	Descriptions
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

21. 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.

Resource Name	Resource ID	Access Type	Type	Range or Enumeration	Units	Descriptions
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 reactive power measured by the sensor since it is ON

Resource Name	Resource ID	Access Type	Type	Range or Enumeration	Units	Descriptions
Max Measured reactive power	5812	R	Float		var	The maximum reactive power 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 reactive power 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.

Resource Name	Resource ID	Access Type	Type	Range or Enumeration	Units	Descriptions
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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