**Interface Control Document**

# scope

## The purpose of this Interface Control Document (ICD) is to define the interface scope, data parameters and demarcation between the Smart Hub and Smart Systems to be ingested. It documents and tracks the necessary information required to effectively define the Smart Hub system’s interface as well as any rules for communicating with it.

## This document covers all the interface requirements between the Smart Hub and Smart Systems. This ICD helps to ensure compatibility between system segments and components by clearly communicating all possible inputs and outputs between the components.

## The Interface Control Document uses a few special terms like event and alarms. Events are operator actions, informational messages, tracking/auditing messages and statistical readings. When Smart Hub receives these events, it processes them based on the rules set and the event becomes an alarm if the event follows the rule.

# System overview

This ICD describes the relationship between the Smart Systems and Smart Hub on data ingestion aspects.

This ICD specifies the interface requirements the participating systems must meet. It describes the concept of operations for the interface, defines the message structure and protocols that govern the interchange of data, and identifies the communication paths along which the project team expects data to flow.

For each interface, the ICD provides the following information:

* A description of the data exchange format and protocol for exchange
* A general description of the interface
* Assumptions where appropriate
* Estimated size and frequency of data exchange
* Mandatory Security Standard

## Classification of Smart Hub Interface

|  |  |
| --- | --- |
| Type | Data Ingestion |
| MQTT (Message Queuing Telemetry Transport) | Yes |

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## Smart Hub Architecture on Sensor Integration

The Smart Hub platform gathers and analyses data for the various sectors and industry players critical to the realization of a Smart Nation, to achieve the following benefits:

* Timely collection of data from various incumbent and new systems to enable automated analytics and early detection of events of interest
* Situational awareness enabling quick responses to current operational processes, threatening events, emergencies, equipment/sensors alerts and other situations of interest
* Distribution of alerts and notifications through email and SMS.
* Intelligent, insightful information & prediction through data & predictive analytics for proactive day-to-day city operations as well as supporting long term planning

2.3 Modes of Data Transmission

Systems would transmit data through three modes:

| **Mode** | **Description** |
| --- | --- |
| 1 | Sensors are first connected to a vendor system/server, which would then send data to Smart Hub. |
| 2 | Sensors send data to vendor system/servers and Smart Hub simultaneously through two separate data links. |
| 3 | Sensors only send data only to Smart Hub. |

The Contractor and the respective Specialist of the Smart System(s) shall adopt the following connectivity modes for the Systems:

|  |  |
| --- | --- |
| **Smart System** | **Mode** |
| Smart Water Pump | 2 |
| Smart Private Water Meter | 3 |
| Urbanwater Harvesting System | 3 |
| Smart Irrigation | 3 |
| Smart Lighting | 1 Comply |

# Interface Requirements

## Interface Overview

Smart Hub provides MQTT as the interface method for data ingestion.

* Smart Hub sensor integration using MQTT protocol are divided into few steps:

1. Framework design (Data Dictionary, Event & Alarm Design)
2. Asset loading (Masterdata)
3. System configurations for alarms (Smart Hub admin task)
4. Client cert generation
5. Sending live sensor data over MQTT protocol

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## Protocol Allocation based on the sensor type

All Smart Systems shall use MQTT interface to transmit data to Smart Hub. Comply

## 3.3 Sensor Integration using MQTT protocol in detail

MQTT protocol specification details are available in

<http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html>

Payload format is in JavaScript Object Notation (JSON) with some mandatory key value pairs.

Sample payload:

{

**"SenderId": "Waterpump-600209-TransferPump",**

**"SensorId": "PUMP-ADEMCO-600209-TransferPumpRm-Pump-1",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-WP-20160822104950234",**

**"EventType": "Waterpump/system#reading",**

**"Parameters": {**

**"sensorstatus": "online",**

**"Time": "2018-01-30 14:49:50.276",**

**"Severity": 6,**

"PumpTripstatus": "On",

"LowlevelTankstate": "Low"

}

}

Highlighted in bold are mandatory fields/keys for successful communication with Smart Hub. The values for the mandatory fields/keys are explained below in detail. The non-mandatory fields/keys are designed based on the sensor type and based on how the user wants to see the information from the sensors.

Aztech>>S/W modification, no resource path at present

3.3.1 Mandatory Field Definition for Events

| **Field Name** | **Description** | **Sample Value** | **Length in Byte** |
| --- | --- | --- | --- |
| SenderId | SenderID refers to the sender of the data. Depending on the design of the Smart System, this could be the aggregation point of the data, location of the System, or the sensor itself.  <SensorType>-<PostalCode>-<AggregatorIdentifier>  Sensor Type must be alphabets without special characters;  Instead of Postal code, location code can be used if there is no postal code available for the location. Eg. JE-OUTDOOR | Refer to table in Appendix III | 255 |
| SensorId | <SensorType>-<Vendor>-<PostalCode>-<GenericIdentifier>  Vendor name must be alphanumeric without special characters;  Instead of Postal code, location code can be used if there is no postal code available for the location. E.g. JE-OUTDOOR  A generic Identifier is used so that even when the specific sensor is replaced by new hardware, Smart Hub recognises it as the same sensor point. | Refer to table in Appendix III | 255 |
| Resourcepath | Resource path is the postal code of the block or the location code. This values should be same as the postal code used in the master data while loading sensor details. If postal code is not available for some sensors, then location code can be used. E.g. JE-OUTDOOR | 600226 | 255 |
| EventId | Reference/transaction Id. Used to group few events together.  EV-<PostalCode>-<GenericIdentifier>-<Timestamp> | EV-600216-7E1054EA-CD-20160712104950272 | 255 |
| EventType | Format is  <SensorType>/<sub-component>  #<Type of event>  This is further defined below. | E.g.Waterpump/pump#reading | 32 |
| sensorstatus | To indicate sensor status  List of status are  online,  offline,  error,  warning | online | 10 |
| Time | yyyy-MM-dd HH:mm:ss.SSS  yyyy – Year  MM – Month  dd – Day  HH – Hour 24hr format  mm – Minute  ss – Second  SSS – Millisecond | 2016-07-12 10:49:50.272 | 25 |
| Severity | |  |  |  | | --- | --- | --- | | 1 | Critical | A situation where the System is unable to operate (e.g. SmartIrrigation/moisturesensor#equipmentfault) | | 2 | Major | Where there is a fault in some of the important equipment but it does not affect the entire operation of the System. | | 3 | Minor | Minor equipment fault. | | 4 | Info | It may not be an alarm but the user may be interested to know. | | 5 | Clear | When fault is cleared. | | 6 | Reading | While updating the system status. |   Events such as Waterpump/system#reading, WaterSM/meter#Reading, etc are for the updating of System status and hence the severity for such cases is ‘Reading’. For the faults, severity depends on the type of the fault. | e.g. 3 | 255 |
| Parameters | All the sensor related fields are to be enclosed in the parameters. It supports only two data types -- String and Number. String values are enclosed in double quotation marks, whereas numbers are not enclosed in quotation marks. | {"PumpRunStatus":"Stopped"} | Key:255  Value:255 |

Aztech>> minor S/W modification

3.3.1 Mandatory Field Definition for Events (CONT’D)

Parameters

Parameters are the property used to indicate the dynamic values of the sensors. Since each of the sensors has a different set of functionalities, which are dynamic in nature, the current design will allow many different types of combinations of parameters to be sent to Smart Hub. Unit of measurement can also be used along with parameter names for e.g.

AC\_voltage (V) or

{“AC\_current (A)”:3.0}

Event Type

Event type is used to describe what type of event it belongs to. It is used to visualize event on the operator’s console.

The strategy for creating the event types are:

Event Type = <Type of Sensor> / <sub-type> #<event type>

E.g.: Water/sub-meter#reading

Where #reading are status updates or heart beat events.

The frequency of the heart beat / status update is defined according to the sensor type.

### 3.3.2 Mandatory field definition for alarms on top of events fields

|  |  |  |
| --- | --- | --- |
| **Field Name** | **Description** | **Data Type** |
| Faultcode | Specifies type of fault as defined in the System specific dictionary | String |
| Description | Description or note of the fault/incident | String |

Faults in the Smart Systems shall be identified and assigned severity values based on the priority of the fault. For example, if a certain event type is identified as an alarm, the alarm can be configured in the Smart Hub system configuration page (hdb->cep\_config->severity.events) to get this event to appear as an alarm. Thereafter, the Smart Hub system will detect the alarms based on the severity and alarm types configured. These additional fields help to visualize the details of the alarm.

In order to clear a fault, the sensor system has to send another event to clear the previous fault generated in the same system.

|  |  |  |
| --- | --- | --- |
| **Field** | **Description** | **Data Type** |
| RefEventId | Specifies the previous fault event id | String |
| RefEventType | Specifies the previous fault event type | String |

Aztech >> Comply

### Security Requirements

MQTT Broker supports only TLS 1.2 protocol.

Supported cipher suits are:

* TLS\_ECDHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384,
* TLS\_DHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384,
* TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_GCM\_SHA384,
* TLS\_DHE\_RSA\_WITH\_AES\_256\_CBC\_SHA256,
* TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA384,
* TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_CBC\_SHA384

The SSL client certificates will be issued to each of the vendor, and the sensor has to use this certificate to authenticate itself to the broker.

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### MQTT Structure and Protocol settings

Broker URL is:

Production: ssl://192.168.8.35:9884

UAT: ssl://192.168.8.38:9884

Topic name will be based on the sensor type.

Format for topic is VirtualTopic/mqtt/<sensor type>/incoming

Proposed Quality of Services setting,

Qos 2: Exactly once delivery

This is the highest quality of service, for use when neither loss nor duplication of messages are acceptable. There is an increased overhead associated with this quality of service.

A QoS 2 message has a Packet Identifier in its variable header. The receiver of a QoS 2 PUBLISH Packet acknowledges receipt with a two-step acknowledgement process.

Keep live timeout for message is 60 seconds for MQTT broker to retain the established session. Heartbeat rate frequency for every sensor is 15 minutes, i.e. In order for the sensor to appear as online in Smart Hub, they sensor must send an event message every 15 minutes.

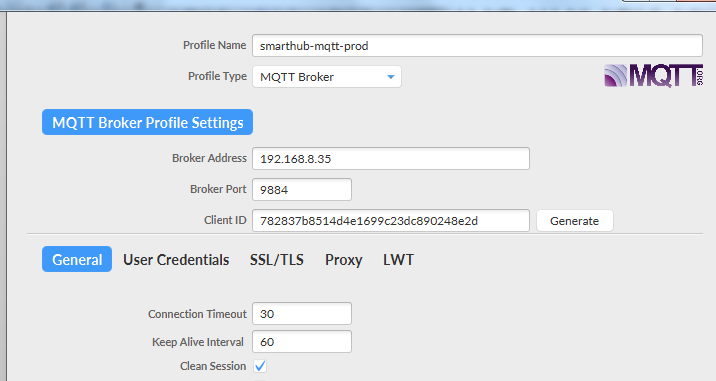
Aztech >> At present it’s 30 minutes, need f/w change

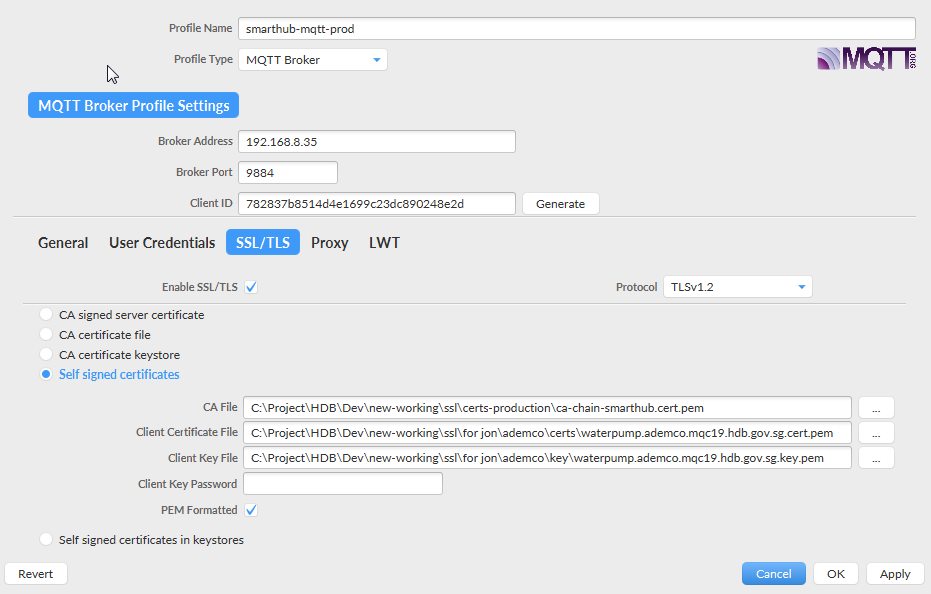
### Testing using MQTTfx (or equivalent)

MQTTfx is an example of a free Graphical User Interface (GUI) testing tool, which helps to generate MQTT messages and send to the Smart Hub for testing.

Download MQTTfx from <http://www.jensd.de/apps/mqttfx/1.7.0>

Settings needed:

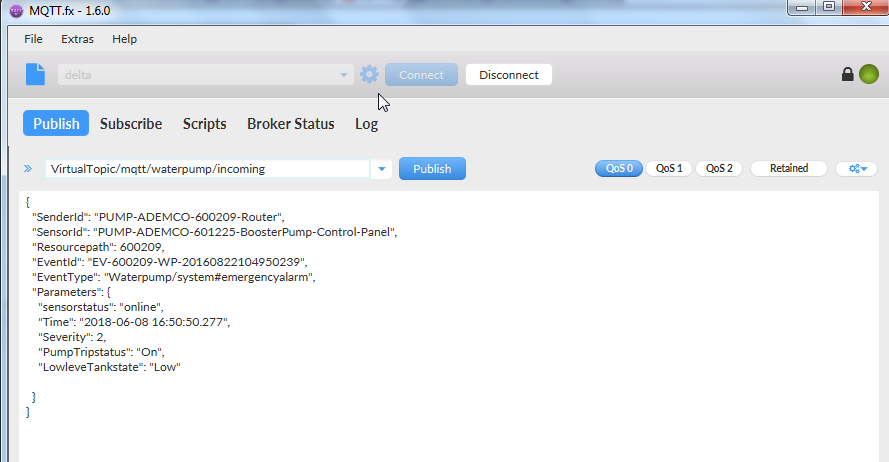




Notes:

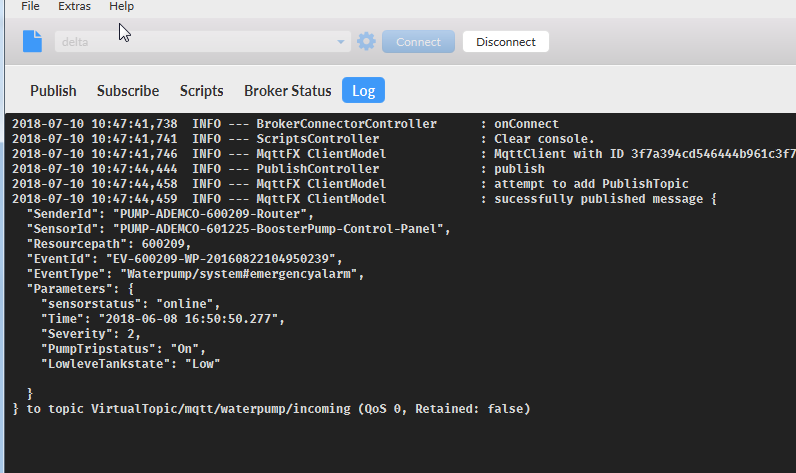
Client Id has to be regenerated by MQTTfx;

Certificate Authority (CA) file, client certificate, client key shall be provided by HDB.



Steps for publishing message to MQTT broker:

* + - 1. Select the server you want to connect.
      2. Connect and wait for green icon to appear on the right most corner
      3. Create sample payload and choose topic
      4. Publish the message
      5. Browse logs tab for logs



# Interface Definitions in Detail

The following section describes the interface definition for each sensor type in detail. In general:

The measurements readings and status changes are Events.

Faults and abnormal conditions are Alarms. The alarm is triggered based on the rules set in Smart Hub. One of the rules set is that the Smart Hub will trigger an alarm based on the severity of an event.

e.g. If severity < 4, an event turns to alarm.

* 1. Water Pump
     1. Data Dictionary

| Field Name | Description | Data Type | Max Length | Possible Values | Sample Value | Remarks |
| --- | --- | --- | --- | --- | --- | --- |
| Time | Time | String | 23 | - | 2016-11-24 14:52:50.276 |  |
| Severity | severity | Number | 8 | 1-6 | 6 |  |
| sensorstatus | sensor status | String | 10 | error/ warning/ online/ offline | online |  |
| PumpTripstatus | trip status | String | 255 | Normal/ TripON | Stopped |  |
| PumpRunStatus | Current Mode | String | 255 | Stopped/ Running |  |  |
| SuctionTankLevel | state of low level tank | String | 255 | LLow/ Low/ High/ HHigh |  |  |
| RoofTopTankLevel | state of High level tank | String | 255 | LLow/ Low/ High/ HHigh |  |  |
| EmergencyStatus | Emergency Alarm Status | String | 255 | On/ Off |  |  |
| CPSupplyPowerStatus | Control Panel Power Status | String | 255 | On/ Off |  |  |
| PumpSupplyStatus | Pump Supply status | String | 255 | On/ Off |  |  |
| Description | Description about the fault | String | 512 | Overflow/ Fault/ Power Failure/ Trip Failure/ Occurred |  |  |
| Faultcode | Fault code | String | 32 | SH-WP-OE-[101001 - 101100] | SH-WP-OE-101001 |  |
| PumpSelectorMode | Pump operation status | String | 255 | Pump1/ Pump2/ Auto |  |  |
| SystemPumpMode | Pump running mode | String | 255 | Auto/ Manual |  |  |
| CPSwitchStatus | Control Panel Switch Status | String | 255 | On/ Off |  |  |
| CumulativePumpRuntime | Cumulative hour of pump run time | Number | 15 | On/ Off |  |  |
| RTOverflowStatus | Roof Top Tank overflow status | String | 255 | On/ Off |  |  |
| STOverflowStatus | Suction Top Tank overflow status | String | 255 | On/ Off |  |  |
| InhibitStatus | Inhibit Status | String | 255 | On/ Off |  |  |
| BCPSupplyPowerStatus | Booster Control Panel Power Status | String | 255 | On/ Off |  |  |
| DutyPump | On-Duty or Off-standby | String | 255 | On/ Off |  |  |
| BoosterPumpSupplyStatus | Booster Pump Supply status | String | 255 | On/ Off |  |  |
| StatusChangedList | To list out changed parameters as compared to last event | String | 255 | SuctionTankLevel, RoofTopTankLevel,...etc |  |  |

* + 1. Event Design

| Event Type | Fields | Severity | Frequency (mins) | Remarks |
| --- | --- | --- | --- | --- |
| Waterpump/system#reading | sensorstatus, Time, Severity, SuctionTankLevel, RoofTopTankLevel, EmergencyStatus CPSupplyPowerStatus, PumpSupplyStatus, PumpSelectorMode, SystemPumpMode, CPSwitchStatus, RTOverflowStatus, STOverflowStatus, InhibitStatus, BCPSupplyPowerStatus, BoosterPumpSupplyStatus | 6 | 15 | One Per Block |
| Waterpump/pump#reading | sensorstatus, Time, Severity, PumpTripstatus, PumpRunStatus, CumilativePumpRuntime, DutyPump | 6 | 15 | Required for individual pump |
| Waterpump/pump#started | sensorstatus, Time, Severity, PumpRunStatus | 6 |  |  |
| Waterpump/pump#stopped | sensorstatus, Time, Severity, PumpRunStatus | 6 |  |  |
| Waterpump/system#resetfault | sensorstatus, Time, Severity, SuctionTankLevel, RoofTopTankLevel, EmergencyStaus CPSupplyPowerStatus, PumpSupplyStatus, PumpSelectorMode, SystemPumpMode, CPSwitchStatus, RTOverflowStatus, STOverflowStatus, InhibitStatus, BCPSupplyPowerStatus, BoosterPumpSupplyStatus | 6 |  |  |
| Waterpump/system#statuschanged | sensorstatus, Time, Severity, SuctionTankLevel, RoofTopTankLevel, EmergencyStatus CPSupplyPowerStatus, PumpSupplyStatus, PumpSelectorMode, SystemPumpMode, CPSwitchStatus, RTOverflowStatus, STOverflowStatus, InhibitStatus, BCPSupplyPowerStatus, BoosterPumpSupplyStatus, CPSwitchStatus, StatusChangedList | 6 |  |  |

* + 1. Alarm Design

| Alarm Type | Fields | Severity | Fault Code | Remarks |
| --- | --- | --- | --- | --- |
| Waterpump/system#inhibitactivated | sensorstatus, Time, Severity,  InhibitStatus, Description, Faultcode | 4 | SH-WP-OE-101001 |  |
| Waterpump/pump#tripfailure | sensorstatus, Time, Severity, PumpTripstatus, Description, Faultcode | 2 | SH-WP-OE-101002 |  |
| Waterpump/system#powerfailure | sensorstatus, Time, Severity, CPSupplyPowerStatus, PumpSupplyStatus, BCPSupplyPowerStatus, BoosterPumpSupplyStatus, Description, Faultcode | 2 | SH-WP-OE-101003 |  |
| Waterpump/system#emergencyalarm | sensorstatus, Time, Severity, EmergencyStatus, Description, Faultcode | 2 | SH-WP-OE-101004 |  |
| Waterpump/system#overflow | sensorstatus, Time, Severity, SuctionTankLevel, RoofTopTankLevel, SystemPumpMode, Description, Faultcode | 3 | SH-WP-OE-101005 |  |
| Waterpump/system#criticallylow | sensorstatus, Time, Severity, SuctionTankLevel, RoofTopTankLevel, SystemPumpMode, Description, Faultcode | 3 | SH-WP-OE-101006 |  |
| Waterpump/system#clear | sensorstatus, Time, Severity, SensorId, RefEventId, RefEventType | 5 |  |  |

* 1. Smart Private Water Meter
     1. Data Dictionary

| Field Name | Description | Data Type | Max Length | Possible Values | Sample Value | Remarks |
| --- | --- | --- | --- | --- | --- | --- |
| Time | Time | String | 23 |  | 2016-11-24 14:52:50.276 |  |
| Severity |  | Number | 8 | 1-6 | 6 |  |
| sensorstatus |  | String | 10 | error/ warning/ online/ offline | online |  |
| WaterUsage |  | Number | 512 |  |  | Note: this number may increase till infinity |
| RefEventType | Only for clearing early alarm | String | 32 |  |  |  |
| RefEventId | Only for clearing early alarm | String | 32 |  |  |  |
| Description | Description about fault | String | 512 |  |  |  |
| Faultcode | Fault Code | String | 32 | SH-WS-OE-[103201-103400] |  |  |

* + 1. Event Design

| Event Type | Fields | Severity | Frequency (mins) |
| --- | --- | --- | --- |
| Water/sub-meter#reading | sensorstatus, Time, Severity, WaterUsage | 6 | 15 |

* 1. Urbanwater Harvesting System
     1. Data Dictionary

| Field Name | Description | Data Type | Max Length | Possible Values | Sample Value | Remarks |
| --- | --- | --- | --- | --- | --- | --- |
| Time | Time | String | 23 |  | 2016-11-24 14:52:50.276 |  |
| Severity |  | Number | 8 | 1-6 | 6 |  |
| sensorstatus |  | String | 10 | online, offline, error, warning | online |  |
| WaterUsage |  | Number | 512 |  |  | Note: this number may increase till infinity |
| RefEventType | Only for clearing early alarm | String | 32 |  |  |  |
| RefEventId | Only for clearing early alarm | String | 32 |  |  |  |
| Description | Description about fault | String | 512 |  |  |  |
| Faultcode | Fault Code | String | 32 | SH-SI-OE-[103201-103400] |  |  |

* + 1. Event Design

| Event Type | Fields | Severity | Frequency (mins) |
| --- | --- | --- | --- |
| Urbanwater/sub-meter#reading | sensorstatus, Time, Severity, WaterUsage | 6 | 15 |

* 1. Smart Irrigation
     1. Data Dictionary

| Field Name | Description | Data Type | Max Length | Possible Values | Sample Value | Remarks |
| --- | --- | --- | --- | --- | --- | --- |
| Time | Time | String | 23 |  | 2016-11-24 14:52:50.276 |  |
| Severity |  | Number | 8 | 1-6 | 6 |  |
| sensorstatus |  | String | 10 | online, offline, error, warning | online |  |
| MoistureLevel |  | Number | 512 | 1-100 |  |  |
| RefEventType | Only for clearing early alarm | String | 32 |  |  |  |
| RefEventId | Only for clearing early alarm | String | 32 |  |  |  |
| Description | Description about fault | String | 512 |  |  |  |
| Faultcode | Fault Code | String | 32 | SH-SI-OE-[103201-103400] |  |  |

* + 1. Event Design

| Event Type | Fields | Severity | Frequency (mins) |
| --- | --- | --- | --- |
|  |  |  |  |
| SmartIrrigation/moisture#reading | Sensorstatus, Time, Severity, MoistureLevel | 6 | 15 |

* + 1. Alarm Design

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alarm Type | Fields | Severity | Fault Code | Remarks |
|  |  |  |  |  |
|  |  |  |  |  |
| SmartIrrigation/ moisturesensor #equipmentfault | sensorstatus, Time, Severity, Description, Faultcode | 1 | SH-SI-OE-103303 |  |
| SmartIrrigation/moisturesensor #clear | sensorstatus, Time, Severity, Description, RefEventId, RefEventType | 5 |  |  |

* 1. Smart Lighting
     1. Smart Lighting Events and Alarms
        1. Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| Time | Time | String | 25 |  | 2016-11-24 14:52:50.276 | SGT |
| Severity | Severity | Number | 8 | 1-6 | 6 | Comply |
| sensorstatus | Sensor status | String | 20 | online, offline, error | online | Need s/w change |
| GatewayStatus | Health status of gateway | String | 20 | Online / Offline | Online | Need s/w change |
| LightStatus | Health status of light | String | 20 | Normal /  Dim /  Flicker /  Dim\_Flicker /  Off | Normal | Flicker not available, need f/w, s/w change |
| SensorHealthStatus | Health status of sensor | String | 20 | Normal / Not\_Working | Normal | Comply |
| NetworkStatus | Network status of sensor | String | 20 | Online / Offline | Online | Comply |
| ELightStatus | Health status of emergency light | String | 25 | Normal /  Not\_Responding /  Emergency\_Mode /  Battery\_Out /  Battery\_Low | Normal | not available, need f/w, s/w change |
| MotionCount | Motion detection count | Number | 10 |  | 10 | Number of motion detections per update interval  Total count available |
| DaylightValue | Photo sensor value | Number | 10 |  | 2000 | Online | Comply |
| TemperatureValue | Temperature sensor value | Number | 10 |  | 28 | Value is in Celsius  not available, need h/w, f/w, s/w change |
| HumidityValue | Humidity sensor value | Number | 10 |  | 60 | Value is in relative humidity % RH  not available, need h/w, f/w, s/w change |
| RainValue | Rain sensor value | Number | 10 |  | 50 | Value is in mm/Hour  not available, need h/w, f/w, s/w change |
| EnergyUsage | Cumulative power consumption per luminaire | Number | 10 |  | 1000 | Value is in kWh  Available based on calculation |
| LightUsage | Cumulative burn time per luminaire | Number | 10 |  | 100 | Value is in hours  not available, need s/w change |
| PowerValue | Power consumption under light full on condition | Number | 10 |  | 300 | Wh or any other value that is related to light power consumption  not available, need s/w change |
| BlinkValue | Blink intensity under light full on condition | Number | 10 |  | 100 | Percent flicker, flicker index or any other value that is related to light blinking  not available, need more input on definition |
| TestType | Test type for emergency light | String | 25 | Functional /  Duration /  Commissioning | Functional | not available, need more input on definition |
| TestResult | Test result for emergency light | String | 25 | Passed /  Failed /  Not\_Tested /  Test\_In\_Progress /  Result\_Not\_Available | Passed | not available, need more input on definition |
| FailureType | Type of failure for emergency light | String | 25 | Light\_Fail /  Battery\_Fail /  Charger\_Fail | Battery\_Fail | For test failed case  not available, need h/w, f/w, s/w change |
| NotTested | Reason for not tested for emergency light | String | 50 | Emergency\_Mode /  Test\_Button\_Pressed /  Light\_Power\_Not\_Calibrated /  Battery\_Below\_Nominal\_Voltage /  Battery\_Not\_Fully\_Charged /  Battery\_Removed /  Switch\_Over\_Fail /  Incorrect\_Nominal\_Battery\_Voltage | Battery\_Removed | For not tested case  not available, need h/w, f/w, s/w change |
| BatteryVoltage | Battery voltage after lighting test for emergency light | Number | 10 | 3.6 to 12 | 3.5 | Value is in voltage  not available, need h/w, f/w, s/w change |
| RefEventType | Only for clearing early alarm | String | 32 |  |  | Comply |
| RefEventId | Only for clearing early alarm | String | 255 |  |  | Comply |
| Description | Description about the fault | String | 512 |  |  | Comply |
| Faultcode | Fault code | String | 32 | SH-LS-OE-[106301-106400] | SH-LS-OE-106001 | Comply |

* + - 1. Event Design

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Fields | Severity | Frequency(mins) |
| SmartLighting/motion#reading | sensorstatus, Time, Severity, MotionCount | 6 | 15 not available, need s/w change |
| SmartLighting/daylight#reading | sensorstatus, Time, Severity, DaylightValue | 6 | 15 at present 30 min, need s/w change |
| SmartLighting/temperature#reading | sensorstatus, Time, Severity, TemperatureValue | 6 | 15 not available, need h/w, f/w, s/w change |
| SmartLighting/humidity#reading | sensorstatus, Time, Severity, HumidityValue | 6 | 15 not available, need h/w, f/w, s/w change |
| SmartLighting/rain#reading | sensorstatus, Time, Severity, RainfallValue | 6 | 15 not available, need h/w, f/w, s/w change |
| SmartLighting/energyusage#reading | sensorstatus, Time, Severity, EnergyUsage | 6 | Once a day Available based on calculation need s/w change |
| SmartLighting/lightusage#reading | sensorstatus, Time, Severity, LightUsage | 6 | Once a day  Available based on calculation, need s/w change |
| SmartLighting/powervalue#reading | sensorstatus, Time, Severity, PowerValue | 6 | Once a day  not available, need h/w, f/w, s/w change |
| SmartLighting/blinkvalue#reading | sensorstatus, Time, Severity, BlinkValue | 6 | Once a day  not available, need h/w, f/w, s/w change |
| SmartLighting/elightresult#reading | sensorstatus, Time, Severity, TestType,  TestResult,  FailureType,  NotTested,  BatteryVoltage | 6 | Ad hoc basis  not available, need h/w, f/w, s/w change |

* + - 1. Alarm Design

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alarm Type | Fields | Severity | FaultCode | Remarks |
| SmartLighting/gateway#fault | sensorstatus, Time, Severity, Description, Faultcode, GatewayStatus | 1 | SH-LS-OE-106301 | not available, need s/w change |
| SmartLighting/light#fault | sensorstatus, Time, Severity, Description, Faultcode, LightStatus | 3 | SH-LS-OE-106302 | Comply |
| SmartLighting/sensor#fault | sensorstatus, Time, Severity, Description, Faultcode, SensorHealthStatus | 3 | SH-LS-OE-106303 | Comply |
| SmartLighting/network#fault | sensorstatus, Time, Severity, Description, Faultcode, NetworkStatus | 3 | SH-LS-OE-106304 | not available, need s/w change |
| SmartLighting/elight#fault | sensorstatus, Time, Severity, Description, Faultcode, ELightStatus | 3 | SH-LS-OE-106305 | Comply |
| SmartLighting/system#clear | sensorstatus, Time, Severity, Description, SensorId, RefEventId, RefEventType | 5 |  | Eventid and eventype should be same as fault for clearing Comply |

* + 1. Smart Lighting Configuration and Control
       1. Interface Overview

Smart Lighting System provides MQTT as the interface method for configuration and control. Integration between Smart Lighting System and Backend System using MQTT protocol are divided into few steps:

1. Framework design (Data Dictionary, Configuration Design)
2. Client cert generation
3. Sending set and get command over MQTT protocol

Aztech>>Get not available, need f/w and s/w change

* + - 1. System Integration using MQTT Protocol

MQTT protocol specification details are available in

<http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html>

Payload format is json with some mandatory key value pairs.

Set Command

Set command is used by Backend System to control or apply settings to a sensor or a group of sensors.

MQTT Broker

Backend System

Smart Lighting System

Send Set Command

(Publish)

Receive Set Command

(Subscribe)

Send Set Response

(Publish)

Receive Set Response

(Subscribe)

Get Command

Get command is used by Backend System to get settings from a sensor.

MQTT Broker

Backend System

Smart Lighting System

Send Get Command

(Publish)

Receive Get Command

(Subscribe)

Send Get Response

(Publish)

Receive Get Response

(Subscribe)

**Get Command (Unicast)**

Get command is used to retrieve the settings of a sensor based on sensor ID. It is a unicast command.

Sample payload for GET command:

{

**"SenderId": "Backend-600123-00",**

**"SensorId": "SmartLighting-ST-600209-01010215",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01010215-20160822104950234",**

**"EventType": "SmartLighting/getLightingOverride",**

**"Parameters": {**

**“CommandType”:”Get”**

}

}

Sample payload for GET command response:

{

**"SenderId": "SmartLighting-600209-01",**

**"SensorId": "SmartLighting-ST-600209-01010215",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01010215-20160822104950234",**

**"EventType": "SmartLighting/getLightingOverride",**

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“LightingControl”:”Auto”

}

}

Aztech>>Get not available, need f/w and s/w change

**Set Command (Unicast)**

Set command with unicast transmission is used to configure a single sensor based on sensor ID. In this case, configuration zone is not used and shall be set to 0.

Sample payload for unicast SET command:

{

**"SenderId": "Backend-600123-00",**

**"SensorId": "SmartLighting-ST-600209-01010215",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01010215-20160822104950234",**

**"EventType": "SmartLighting/setLightingOverride",**

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“LightingControl”:”Auto”

}

}

Sample payload for unicast SET command response:

{

**"SenderId": "SmartLighting-600209-01",**

**"SensorId": "SmartLighting-ST-600209-01010215",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01010215-20160822104950234",**

**"EventType": "SmartLighting/setLightingOverride",**

**"Parameters": {**

**“CommandType”:”Set\_Ack”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“LightingControl”:”Auto”

}

}

**Set Command (Multicast)**

Set command with multicast transmission is used to configure a group of sensors under a gateway based on gateway id (sensor id field) and zone id.

Sample payload for multicast SET command:

{

**"SenderId": "Backend-600123-00",**

**"SensorId": "SmartLighting-ST-600209-01000000",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01000000-20160822104950234",**

**"EventType": "SmartLighting/setLightingOverride",**

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Multicast”,**

**“ConfigurationZone”:1,**

“LightingControl”:”Auto”

}

}

Sample payload for multicast SET command response:

{

**"SenderId": "SmartLighting-600209-01",**

**"SensorId": "SmartLighting-ST-600209-01000000",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01000000-20160822104950234",**

**"EventType": "SmartLighting/setLightingOverride",**

**"Parameters": {**

**“CommandType”:”Set\_Ack”,**

**“Transmission”:”Multicast”,**

**“ConfigurationZone”:1,**

“LightingControl”:”Auto”

}

}

**Set Command (Broadcast)**

Set command with broadcast transmission is used to configure all sensors under a gateway based on gateway id (sensor id field). In this case, configuration zone is not used and shall be set to 0.

Sample payload for broadcast SET command:

{

**"SenderId": "Backend-600123-00",**

**"SensorId": "SmartLighting-ST-600209-01000000",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01000000-20160822104950234",**

**"EventType": "SmartLighting/setLightingOverride",**

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Broadcast”,**

**“ConfigurationZone”:0,**

“LightingControl”:”Auto”

}

}

Sample payload for broadcast SET command response:

{

**"SenderId": "SmartLighting-600209-01",**

**"SensorId": "SmartLighting-ST-600209-01000000",**

**"Resourcepath": 600209,**

**"EventId": "EV-600209-01000000-20160822104950234",**

**"EventType": "SmartLighting/setLightingOverride",**

**"Parameters": {**

**“CommandType”:”Set\_Ack”,**

**“Transmission”:”Broadcast”,**

**“ConfigurationZone”:0,**

“LightingControl”:”Auto”

}

}

Highlighted in bold are mandatory fields/keys for successful communication with Backend System. The values for the mandatory fields/keys are explained below in detail. The non-mandatory fields/keys are designed based on the parameter type.

Aztech>>Configuration Zone, Transmission type not available, need f/w and s/w change

* + - * 1. Mandatory Field Definition for Events(Smart Lighting)

| **Field Name** | **Description** | **Sample Value** | **Length in Byte** |
| --- | --- | --- | --- |
| SenderId | SenderID refers to the sender of the data. Depending on the design of the Smart System, this could be the aggregation point of the data, location of the System, or the sensor itself.  <SensorType>-<PostalCode>-<AggregatorIdentifier>  Sensor Type must be alphabets without special characters;  Instead of Postal code, location code can be used if there is no postal code available for the location. Eg. JE-OUTDOOR  Note:  Set <SystemType> to “Backend” for command initiated by backend system. | Refer to table in Appendix III | 255  Comply |
| SensorId | <SensorType>-<Vendor>-<PostalCode>-<GenericIdentifier>  Vendor name must be alphanumeric without special characters;  Instead of Postal code, location code can be used if there is no postal code available for the location. E.g. JE-OUTDOOR  A generic Identifier is used so that even when the specific sensor is replaced by new hardware, Smart Hub recognises it as the same sensor point. | Refer to table in Appendix III | 255  Comply |
| Resourcepath | Resource path is the postal code of the block or the location code. This values should be same as the postal code used in the master data while loading sensor details. If postal code is not available for some sensors, then location code can be used. E.g. JE-OUTDOOR | 600226 | 255  Need s/w change |
| EventId | Reference/transaction Id. Used to group few events together.  EV-<PostalCode>-<GenericIdentifier>-<Timestamp> | EV-600216-01010215-20160712104950272 | 255  Comply |
| EventType | Format is  <SystemType>/<parameter type> | E.g.SmartLighting/setLightingOverride | 32  Comply |
| CommandType | Indicating set / get request and response:   * Set * Set\_Ack * Set\_Error * Get * Get\_Ack * Get\_Error   Note:  Error of set / get command can be due to sensor offline or incorrect parameters. | Set | 20  Set available, for Get, need f/w, s/w chages |
| Transmission | Indicating transmission type for set command:   * Unicast * Multicast * Broadcast   Note:   * Unicast is for single sensor (select by sensor id). * Multicast is for a group of sensors under a gateway (select by gateway id and configuration zone).   Broadcast is for all sensors under a gateway (select by gateway id). | Unicast | 20  Not available, need f/w, s/w change |
| ConfigurationZone | Indicating lighting zone (1 to 63) to be configured and is meant for multicast command only. For unicast and broadcast command, configuration zone is set to 0. | 1 | 10  Not available, need f/w, s/w change |
| Parameters | All the sensor related fields are to be enclosed in the parameters. It supports only two data types -- String and Number. String values are enclosed in double quotation marks, whereas numbers are not enclosed in quotation marks. | {"LightingControl":"Auto"} | Key:255  Value:255  Comply |

Parameters

Parameters are the property used to indicate the dynamic values of the sensors. Since each of the sensors has a different set of functionalities, which are dynamic in nature, the current design will allow many different types of combinations of parameters.

Event Type

Event type is used to describe what type of event it belongs to. It is used to visualize event on the operator’s console.

The strategy for creating the event types are:

Event Type = <Type of System>/<parameter type>

Example:

SmartLighting/setLightingOverride

### Aztech>>Comply

* + - * 1. MQTT Structure and Protocol settings

Topic to Publish and Subscribe

**Backend System Command:**

Backend System publishes to the following topic to send command to a specific smart lighting system based on postal code. The command is defined in the event type.

VirtualTopic/mqtt/SmartLighting/<postal code>

Backend System subscribes to the following topic to receive command response from smart lighting system. The command response is defined in the event type.

VirtualTopic/mqtt/SmartLighting/response

**Smart Lighting System Response:**

Smart Lighting System subscribes to the following topic to receive command from Backend System. The command is defined in the event type.

VirtualTopic/mqtt/SmartLighting/<postal code>

Smart Lighting System publishes to the following topic to send command response to Backend System. The command response is defined in the event type.

VirtualTopic/mqtt/SmartLighting/response

Proposed Quality of Services setting,

Qos 2: Exactly once delivery

This is the highest quality of service, for use when neither loss nor duplication of messages are acceptable. There is an increased overhead associated with this quality of service.

A QoS 2 message has a Packet Identifier in its variable header. The receiver of a QoS 2 PUBLISH Packet acknowledges receipt with a two-step acknowledgement process.

Aztech>> Similar but need s/w change to comply

### Security Requirements

MQTT Broker supports only TLS 1.2 protocol.

* + - 1. Interface Definitions in Detail
         1. Lighting Zones

This command is used to assign up to 8 lighting zones to a sensor. Lighting zone consists of a group of sensors and is typically used for device configuration and lighting control (e.g. predictive lighting, dimming profile, etc). Total 63 lighting zones are supported per gateway.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setLightingZone | Set | Transmission,  ConfigurationZone,  NumberOfZone,  ZoneId#1  …  ZoneId#n | Assign lighting zones to a sensor  (unicast command)  Not available, need f/w, s/w change |
| Set\_Ack | Transmission,  ZoneId,  NumberOfZone,  ZoneId#1  …  ZoneId#n | Not available, need f/w, s/w change |
| SmartLighting/getLightingZone | Get |  | Get settings of lighting zones from a sensor  Not available, need f/w, s/w change |
| Get\_Ack | NumberOfZone,  ZoneId#1  …  ZoneId#n | Not available, need f/w, s/w change |

Sample parameters for SET command (SmartLighting/setLightingZone)

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“NumberOfZone”:2,

“LightingZones”:[

{

“ZoneId”:10,

},

{

“ZoneId”:15,

},

]

}

Sample parameters for GET command response (SmartLighting/getLightingZone)

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“NumberOfZone”:2,

“LightingZones”:[

{

“ZoneId”:10,

},

{

“ZoneId”:15,

},

]

}

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| NumberOfZone | Number of lighting zones assigned to a sensor | Number | 10 | 1 to 8 | 5 | Not available, need f/w, s/w change |
| ZoneId | Lighting zone id | Number | 10 | 1 to 63 | 1 | Not available, need f/w, s/w change |

* + - * 1. Trigger Zones

This command is used to assign up to 8 trigger zones to a sensor. In this case, the sensor is considered as a trigger node and the trigger zones are actually lighting zones being activated by the trigger node. When the sensor detects movement, the lights in the corresponding trigger zones (or lighting zones) will be turned on. Trigger zones are typically used by predictive lighting to turn on lights in multiple paths.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setTriggerZone | Set | Transmission,  ConfigurationZone,  NumberOfZone,  ZoneId#1  …  ZoneId#n | Assign trigger zones to a sensor  (unicast command)  Not available, need f/w, s/w change |
| Set\_Ack | Transmission,  ZoneId,  NumberOfZone,  ZoneId#1  …  ZoneId#n | Not available, need f/w, s/w change |
| SmartLighting/getTriggerZone | Get |  | Get settings of trigger zones from a sensor  Not available, need f/w, s/w change |
| Get\_Ack | NumberOfZone,  ZoneId#1  …  ZoneId#n | Not available, need f/w, s/w change |

Sample parameters for SET command (SmartLighting/setTriggerZone)

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“NumberOfZone”:2,

“TriggerZones”:[

{

“ZoneId”:10,

},

{

“ZoneId”:15,

},

]

}

Sample parameters for GET command response (SmartLighting/getTriggerZone)

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“NumberOfZone”:2,

“TriggerZones”:[

{

“ZoneId”:10,

},

{

“ZoneId”:15,

},

]

}

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| NumberOfZone | Number of trigger zones assigned to a sensor | Number | 10 | 1 to 8 | 5 | Not available, need f/w, s/w change |
| ZoneId | Trigger zone id | Number | 10 | 1 to 63 | 1 | Not available, need f/w, s/w change |

* + - * 1. Lighting Configuration

The following commands are used to configure lighting parameters.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setLightingOverride | Set | Transmission,  ConfigurationZone, LightingControl | Override lighting to auto, force on or force off mode  Not available, need f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone, LightingControl | Not available, need f/w, s/w change |
| SmartLighting/getLightingOverride | Get |  | Get lighting override mode  Not available, need f/w, s/w change |
| Get\_Ack | LightingControl | Not available, need f/w, s/w change |
| SmartLighting/setLightIntensity | Set | Transmission,  ConfigurationZone, DimIntensity, BrightIntensity | Set dim and bright intensity  Not available, need f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone, DimIntensity, BrightIntensity | Not available, need f/w, s/w change |
| SmartLighting/getLightIntensity | Get |  | Get dim and bright intensity  Not available, need f/w, s/w change |
| Get\_Ack | DimIntensity, BrightIntensity | Not available, need f/w, s/w change |
| SmartLighting/setSoftDimming | Set | Transmission,  ConfigurationZone, RampUpTime, RampDownTime | Set ramp up and ramp down time  Not available, need f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone, RampUpTime, RampDownTime | Not available, need f/w, s/w change |
| SmartLighting/getSoftDimming | Get |  | Get ramp up and ramp down time  Not available, need f/w, s/w change |
| Get\_Ack | RampUpTime, RampDownTime | Not available, need f/w, s/w change |
| SmartLighting/setTimeDelay | Set | Transmission,  ConfigurationZone,  HoldTime | Set light hold time  Comply |
| Set\_Ack | Transmission,  ConfigurationZone,  HoldTime | Comply |
| SmartLighting/getTimeDelay | Get |  | Get light hold time  Not available, need f/w, s/w change |
| Get\_Ack | HoldTime | Not available, need f/w, s/w change |
| SmartLighting/setLightInstallDate | Set | Transmission,  ConfigurationZone,  InstallDate | Set light installed date  Not available, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  InstallDate | Not available, s/w change |
| SmartLighting/getLightInstallDate | Get |  | Get light installed date  Not available, s/w change |
| Get\_Ack | InstallDate | Not available, s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| LightingControl | Set lighting operation mode | String | 20 | Auto /  Force\_On / Force\_Off | Auto | Auto: On-demand lighting based on motion detection.  Force\_On: Light full on.  Force\_Off: Light full off. |
| DimIntensity | Dim intensity of light | Number | 10 | 0 to 50 | 20 | Value is in percentage |
| BrightIntensity | Bright intensity of light | Number | 10 | 50 to 100 | 80 | Value is in percentage |
| RampUpTime | Ramp up time from dim to bright | Number | 10 | 1 to 3 | 1 | Value is in second |
| RampDownTime | Ramp down time from bright to dim | Number | 10 | 1 to 3 | 2 | Value is in second |
| HoldTime | Time interval to keep light on upon motion detection | Number | 10 | 10 to 3600 | 30 | Value is in second |
| InstallDate | Light installed date | String | 20 | dd-MM-yyyy  dd – Day  MM – Month  yyyy – Year | 01/10/2020 |  |

* + - * 1. Sensor Configuration

The following commands are used to configure sensor parameters.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setMotionSensitivity | Set | Transmission,  ConfigurationZone,  MotionSensitivity | Set motion detection range  Comply |
| Set\_Ack | Transmission,  ConfigurationZone,  MotionSensitivity |  |
| SmartLighting/getMotionSensitivity | Get |  | Get motion detection range  Not available, s/w change |
| Get\_Ack | MotionSensitivity | Not available, s/w change |
| SmartLighting/setPhotoSensing | Set | Transmission,  ConfigurationZone,  PhotoSensing,  PhotoUpperThreshold,  PhotoLowerThreshold | Set threshold values of photo sensor  Comply |
| Set\_Ack | Transmission,  ConfigurationZone,  PhotoSensing,  PhotoUpperThreshold,  PhotoLowerThreshold | Comply |
| SmartLighting/getPhotoSensing | Get |  | Get threshold values of photo sensor |
| Get\_Ack | PhotoSensing,  PhotoUpperThreshold,  PhotoLowerThreshold | Not available, s/w change |
| SmartLighting/setRainSensing | Set | Transmission,  ConfigurationZone,  RainSensing,  RainUpperThreshold,  RainLowerThreshold | Set threshold values of rain sensor  Not available, h/w, f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  RainSensing,  RainUpperThreshold,  RainLowerThreshold | Not available, h/w, f/w, s/w change |
| SmartLighting/getRainSensing | Get |  | Get threshold values of rain sensor  Not available, h/w, f/w, s/w change |
| Get\_Ack | RainSensing,  RainUpperThreshold,  RainLowerThreshold | Not available, h/w, f/w, s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| MotionSensitivity | 3 levels of motion detection range | Number | 10 | 1 to 3 | 2 | Level 1 to 3 is corresponding to low, mid and high detection range which may vary according to different sensor types (e.g. indoor / outdoor sensor). |
| PhotoSensing | Photo sensing control | String | 20 | Enable / Disable | Enable |  |
| PhotoUpperThreshold | Upper threshold of photo sensor to detect bright daylight | Number | 10 | 10 to 60,000 | 400 | Value is in lux |
| PhotoLowerThreshold | Lower threshold of photo sensor to detect dim daylight | Number | 10 | 10 to 60,000 | 200 | Value is in lux |
| RainSensing | Rain sensing control | String | 20 | Enable / Disable | Enable |  |
| RainUpperThreshold | Upper threshold of rain sensor to detect heavy rain | Number | 10 | 5 to 255 | 30 | Value is in terms of number of pulses per minute (each pulse is 0.01mm of rainfall) |
| RainLowerThreshold | Lower threshold of rain sensor to detect light rain | Number | 10 | 5 to 255 | 5 | Value is in terms of number of pulses per minute (each pulse is 0.01mm of rainfall) |

* + - * 1. Proximity Lighting

Proximity lighting is used to turn on lights in advance in a straight path where the pedestrian is heading. This is achieved by listening to the neighbour nodes and turning on light whenever neighbour nodes detect motion.

For example, assuming there are 7 sensors in a row which are configured to listen to 2 immediate neighbours. If motion is detected by say sensor 4, which will turn on its own light and lights in sensor 2, 3, 5, and 6 will be tuned on as well by the respective sensors.



1

2

3

4

5

6

7

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setProximityLighting | Set | Transmission,  ConfigurationZone,  LightingControl,  SaveNodeSetting,  NumberOfNeighbourNode | Configure proximity lighting  Through KNX only, f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  LightingControl,  SaveNodeSetting,  NumberOfNeighbourNode | Through KNX only, f/w, s/w change |
| SmartLighting/getProximityLighting | Get |  | Get settings of proximity lighting  Through KNX only, f/w, s/w change |
| Get\_Ack | LightingControl,  NumberOfNeighbourNode | Through KNX only, f/w, s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| LightingControl | Proximity lighting control | String | 20 | Enable / Disable | Enable |  |
| SaveNodeSetting | Indicating whether to save the setting of number of neighbour nodes | String | 20 | Yes / No | Yes |  |
| NumberOfNeighbourNode | Listen to number of immediate neighbour nodes for motion status | Number | 10 | 1 to 3 | 3 |  |

* + - * 1. Predictive Lighting

Predictive lighting is used to turn on lights in open areas and multiple paths such that when motion is detected by a sensor (trigger node), the lights in the corresponding trigger zones will be turned on.

For example, assuming there are 9 sensors deployed at the T-junction. Sensor 2, 3, 5, 6, 7 and 8 are configured as lighting zone 1 and these sensors are also configured as the trigger nodes that have zone 1 as the trigger zone. In this case, any motion detected by these sensors will turn on the lights in zone 1.



Zone 1

2

1

3

4

5

6

7

8

9

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setPredictiveLighting | Set | Transmission,  ConfigurationZone,  LightingControl | Configure predictive lighting (unicast command to gateway)  Through KNX only, f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  LightingControl | Through KNX only, f/w, s/w change |
| SmartLighting/getPredictiveLighting | Get |  | Get settings of predictive lighting  (unicast command to gateway)  Through KNX only, f/w, s/w change |
| Get\_Ack | LightingControl | Through KNX only, f/w, s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| LightingControl | Predictive lighting control | String | 20 | Enable / Disable | Enable |  |

* + - * 1. Timer Profiles

Timer profiles are used to control lighting operation mode based on time of day, total 10 profiles are supported. For example, it can be used to turn off lights from 7am to 7pm.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setTimerProfile | Set | Transmission,  ConfigurationZone,  ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartTime, EndTime, DayOfWeek, Action  [Profile 2]  ZoneId, StartTime, EndTime, DayOfWeek, Action  …  [Profile n]  ZoneId, StartTime, EndTime, DayOfWeek, Action | Configure up to 10 timer profiles  (unicast command to gateway)  Only 3 profiles on daily basis, f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartTime, EndTime, DayOfWeek, Action  [Profile 2]  ZoneId, StartTime, EndTime, DayOfWeek, Action  …  [Profile n]  ZoneId, StartTime, EndTime, DayOfWeek, Action | Only 3 profiles on daily basis, f/w, s/w change |
| SmartLighting/getTimerProfile | Get |  | Get settings of timer profiles  (unicast command to gateway)  Not Available, f/w, s/w change |
| Get\_Ack | ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartTime, EndTime, DayOfWeek, Action  [Profile 2]  ZoneId, StartTime, EndTime, DayOfWeek, Action  …  [Profile n]  ZoneId, StartTime, EndTime, DayOfWeek, Action | Not Available, f/w, s/w change |

Note: [Profile #] in the above table is not the actual field, it is only meant for illustration purpose.

Sample parameters for SET command (SmartLighting/setTimerProfile)

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“ProfileControl”:”Enable”,

“NumberOfProfile”:2,

“TimerProfiles”: [

{

“ZoneId”:1,

“StartTime”:”07:00”,

“EndTime”:”19:00”,

“DayOfWeek”:”Everyday”,

“Action”:”Force\_Off”

},

{

“ZoneId”:1,

“StartTime”:”19:00”,

“EndTime”:”07:00”,

“DayOfWeek”:”Everyday”,

“Action”:”Auto”

}

]

}

Sample parameters for GET command response (SmartLighting/getTimerProfile)

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“ProfileControl”:”Enable”,

“NumberOfProfile”:2,

“TimerProfiles”: [

{

“ZoneId”:1,

“StartTime”:”07:00”,

“EndTime”:”19:00”,

“DayOfWeek”:”Everyday”,

“Action”:”Force\_Off”

},

{

“ZoneId”:1,

“StartTime”:”19:00”,

“EndTime”:”07:00”,

“DayOfWeek”:”Everyday”,

“Action”:”Auto”

}

]

}

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| ProfileControl | Profile control | String | 20 | Enable / Disable | Enable |  |
| NumberOfProfile | Number of profiles to be set | Number | 10 | 1 to 10 | 5 |  |
| ZoneId | Lighting zone to apply setting when event is occurred | Number | 10 | 1 to 63 / 255 | 255 | Set to 255 to select all lights under a gateway |
| StartTime | Start time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 07:00 |  |
| EndTime | End time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 19:00 |  |
| DayOfWeek | Select day of week to monitor event | String | 20 | Weekday / Weekend / Everyday / Holiday | Everyday |  |
| Action | Perform lighting control when event is occurred | String | 20 | Auto /  Force\_On / Force\_Off | Auto |  |

* + - * 1. Dimming Profiles

Dimming profiles are used to control dim intensity based on time of day, total 10 profiles are supported. For example, it can be used to set the dim intensity of lights to a lower level after midnight to further save energy.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setDimmingProfile | Set | Transmission,  ConfigurationZone,  ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel  [Profile 2]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel  …  [Profile n]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel | Configure up to 10 dimming profiles  (unicast command to gateway)  Only 1profile on daily basis, need f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel  [Profile 2]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel  …  [Profile n]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel | Only 1profile on daily basis, need f/w, s/w change |
| SmartLighting/getDimmingProfile | Get |  | Get settings of dimming profiles  (unicast command to gateway)  Not available, need f/w, s/w change |
| Get\_Ack | ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel  [Profile 2]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel  …  [Profile n]  ZoneId, StartTime, EndTime, DayOfWeek, DimLevel | Not available, need f/w, s/w change |

Note: [Profile #] in the above table is not the actual field, it is only meant for illustration purpose.

Sample parameters for SET command (SmartLighting/setDimmingProfile)

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“ProfileControl”:”Enable”,

“NumberOfProfile”:2,

“DimmingProfiles”: [

{

“ZoneId”:1,

“StartTime”:”07:00”,

“EndTime”:”23:59”,

“DayOfWeek”:”Everyday”,

“DimLevel”:20

},

{

“ZoneId”:1,

“StartTime”:”00:00”,

“EndTime”:”07:00”,

“DayOfWeek”:”Everyday”,

“DimLevel”:10

}

]

}

Sample parameters for GET command response (SmartLighting/getDimmingProfile)

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“ProfileControl”:”Enable”,

“NumberOfProfile”:2,

“DimmingProfiles”: [

{

“ZoneId”:1,

“StartTime”:”07:00”,

“EndTime”:”23:59”,

“DayOfWeek”:”Everyday”,

“DimLevel”:20

},

{

“ZoneId”:1,

“StartTime”:”00:00”,

“EndTime”:”07:00”,

“DayOfWeek”:”Everyday”,

“DimLevel”:10

}

]

}

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| ProfileControl | Profile control | String | 20 | Enable / Disable | Enable |  |
| NumberOfProfile | Number of profiles to be set | Number | 10 | 1 to 10 | 5 |  |
| ZoneId | Lighting zone to apply setting when event is occurred | Number | 10 | 1 to 63 / 255 | 255 | Set to 255 to select all lights under a gateway |
| StartTime | Start time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 07:00 |  |
| EndTime | End time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 19:00 |  |
| DayOfWeek | Select day of week to monitor event | String | 20 | Weekday / Weekend / Everyday / Holiday | Everyday |  |
| DimLevel | Set dim intensity when event is occurred | String | 10 | 0 to 50 | 20 | Value is in percentage |

* + - * 1. Luminance Profiles

Luminance profiles are used to set the luminance level of lights based on predefined schedule, total 10 profiles are supported. For example, it can be used to set the luminance level of new lights to a lower level initially and subsequently increase the luminance level over the years to compensate LED decay.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setLuminanceProfile | Set | Transmission,  ConfigurationZone,  ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartDate, EndDate, LuminanceLevel  [Profile 2]  ZoneId, StartDate, EndDate, LuminanceLevel  …  [Profile n]  ZoneId, StartDate, EndDate, LuminanceLevel | Configure up to 10 luminance profiles  (unicast command to gateway)  Only 1profile on daily basis, need f/w, s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartDate, EndDate, LuminanceLevel  [Profile 2]  ZoneId, StartDate, EndDate, LuminanceLevel  …  [Profile n]  ZoneId, StartDate, EndDate, LuminanceLevel | Only 1profile on daily basis, need f/w, s/w change |
| SmartLighting/getLuminanceProfile | Get |  | Get settings of luminance profiles  (unicast command to gateway)  Not available, need f/w, s/w change |
| Get\_Ack | ProfileControl, NumberOfProfile,  [Profile 1]  ZoneId, StartDate, EndDate, LuminanceLevel  [Profile 2]  ZoneId, StartDate, EndDate, LuminanceLevel  …  [Profile n]  ZoneId, StartDate, EndDate, LuminanceLevel | Not available, need f/w, s/w change |

Note: [Profile #] in the above table is not the actual field, it is only meant for illustration purpose.

Sample parameters for SET command (SmartLighting/setLuminanceProfile)

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“ProfileControl”:”Enable”,

“NumberOfProfile”:2,

“LuminanceProfiles”: [

{

“ZoneId”:1,

“StartDate”:”01-01-2020”,

“EndDate”:”31-12-2020”,

“LuminanceLevel”:80

},

{

“ZoneId”:1,

“StartDate”:”01-01-2021”,

“EndDate”:”31-12-2021”,

“LuminanceLevel”:85

}

]

}

Sample parameters for GET command response (SmartLighting/getLuminanceProfile)

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“ProfileControl”:”Enable”,

“NumberOfProfile”:2,

“LuminanceProfiles”: [

{

“ZoneId”:1,

“StartDate”:”01-01-2020”,

“EndDate”:”31-12-2020”,

“LuminanceLevel”:80

},

{

“ZoneId”:1,

“StartDate”:”01-01-2021”,

“EndDate”:”31-12-2021”,

“LuminanceLevel”:85

}

]

}

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| ProfileControl | Profile control | String | 20 | Enable / Disable | Enable |  |
| NumberOfProfile | Number of profiles to be set | Number | 10 | 1 to 10 | 5 |  |
| ZoneId | Lighting zone to apply setting when event is occurred | Number | 10 | 1 to 63 / 255 | 255 | Set to 255 to select all lights under a gateway |
| StartDate | Start date of event | String | 20 | dd-MM-yyyy  dd – Day  MM – Month  yyyy – Year | 01-01-2020 |  |
| EndDate | End date of event | String | 20 | dd-MM-yyyy  dd – Day  MM – Month  yyyy – Year | 31-12-2020 |  |
| LuminanceLevel | Set luminance level when event is occurred | String | 10 | 50 to 100 | 80 | Value is in percentage |

* + - * 1. Daylight Profile

Daylight profile is used to control lighting operation mode based on ambient daylight, only one profile is supported to control lights under a gateway. For example, it can be used to activate sensor-based lighting control during overcast day as long as any of the designated photocell sensors indicate dim daylight.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks | |
| SmartLighting/setDaylightProfile | Set | Transmission,  ProfileControl,  ZoneId,  StartTime,  EndTime,  PhotoSensor1,  PhotoSensor2,  PhotoSensor3,  DimThreshold, BrightThreshold, DimAction,  BrightAction | | Configure daylight profile  (unicast command to gateway)  Partial comply, no zoneId, profile control | |
| Set\_Ack | Transmission,  ProfileControl,  ZoneId,  StartTime,  EndTime,  PhotoSensor1,  PhotoSensor2,  PhotoSensor3,  DimThreshold, BrightThreshold, DimAction,  BrightAction | Partial comply, no zoneId, profile control | |
| SmartLighting/getDaylightProfile | Get |  | Get daylight profile settings  (unicast command to gateway)  Not available, need f/w , s/w change | |
| Get\_Ack | ProfileControl,  ZoneId,  StartTime,  EndTime,  PhotoSensor1,  PhotoSensor2,  PhotoSensor3,  DimThreshold, BrightThreshold, DimAction,  BrightAction | Not available, need f/w , s/w change | |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| ProfileControl | Profile control | String | 20 | Enable / Disable | Enable |  |
| ZoneId | Lighting zone to apply setting when event is occurred | Number | 10 | 1 to 60 / 255 | 255 | Set to 255 to select all lights under a gateway |
| StartTime | Start time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 07:00 |  |
| EndTime | End time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 19:00 |  |
| PhotoSensor | Photo sensor id | String | 255 |  | SmartLighting-ST-600230-01010215 | PhotoSensor2 and PhotoSensor3 are optional, set to “Nil” if not required |
| DimThreshold | Threshold to detect dim daylight | Number | 10 | 10 to 60000 | 200 | Value is in lux |
| BrightThreshold | Threshold to detect bright daylight | Number | 10 | 10 to 60000 | 400 | Value is in lux |
| DimAction | Perform lighting control under dim daylight | String | 20 | Auto /  Force\_On / Force\_Off | Auto |  |
| BrightAction | Perform lighting control under bright daylight | String | 20 | Auto /  Force\_On / Force\_Off | Force\_Off |  |

* + - * 1. Rain Profile

Rain profile is used to control lighting operation mode based on rainfall, only one profile is supported to control lights under a gateway. For example, it can be used to keep lights fully on in surface car park as long as any of the designated rain sensors indicate heavy downpour.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setRainProfile | Set | Transmission,  ProfileControl,  ZoneId,  StartTime,  EndTime,  RainSensor1,  RainSensor2,  RainSensor3,  LightRainThreshold, HeavyRainThreshold, LightRainAction,  HeavyRainAction | Configure rain profile  (unicast command to gateway)  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ProfileControl,  ZoneId,  StartTime,  EndTime,  RainSensor1,  RainSensor2,  RainSensor3,  LightRainThreshold, HeavyRainThreshold, LightRainAction,  HeavyRainAction | Not available, need h/w, f/w , s/w change |
| SmartLighting/getRainProfile | Get |  | Get rain profile settings  (unicast command to gateway)  Not available, need h/w, f/w , s/w change |
| Get\_Ack | ProfileControl,  ZoneId,  StartTime,  EndTime,  RainSensor1,  RainSensor2,  RainSensor3,  LightRainThreshold, HeavyRainThreshold, LightRainAction,  HeavyRainAction | Not available, need h/w, f/w , s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| ProfileControl | Profile control | String | 20 | Enable / Disable | Enable |  |
| ZoneId | Lighting zone to apply setting when event is occurred | Number | 10 | 1 to 60 / 255 | 255 | Set to 255 to select all lights under a gateway |
| StartTime | Start time of event | String | 10 | HH:mm  HH – Hour  mm – Minute | 19:00 |  |
| EndTime | End time of event | String | 10 | HH:mm  HH – Hour  mm – Minute | 23:59 |  |
| RainSensor | Rain sensor id | String | 255 |  | SmartLighting-ST-600230-01010215 | RainSensor2 and RainSensor3 are optional, set to “Nil” if not required |
| LightRainThreshold | Threshold to detect light rain | Number | 10 | 5 to 255 | 5 | Value is in terms of number of pulses per minute (each pulse is corresponding to 0.01mm of rainfall) |
| HeavyRainThreshold | Threshold to detect heavy rain | Number | 10 | 5 to 255 | 30 | Value is in terms of number of pulses per minute (each pulse is corresponding to 0.01mm of rainfall) |
| LightRainAction | Perform lighting control under light rain | String | 20 | Auto /  Force\_On / Force\_Off | Auto |  |
| HeavyRainAction | Perform lighting control under heavy rain | String | 20 | Auto /  Force\_On / Force\_Off | Force\_On |  |

* + - * 1. Daylight Harvesting Profile

Daylight harvesting profile is used to adjust luminance level of each group of lights according to the ambient daylight measured using photocell sensor(s), only one profile is supported to control multiple daylight harvesting zones under a gateway. For example, it can be used to adjust luminance level of the lights near the entrance / exit of a basement car park.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/setDaylightHarvestingProfile | Set | Transmission,  ProfileControl,  OverallZone,  StartTime,  EndTime,  DayOfWeek,  DaylightThreshold,  MinLuminanceLevel, MaxLuminanceLevel | Configure daylight harvesting profile  (unicast command to gateway)  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ProfileControl,  OverallZone,  StartTime,  EndTime,  DayOfWeek,  DaylightThreshold,  MinLuminanceLevel, MaxLuminanceLevel | Not available, need h/w, f/w , s/w change |
| SmartLighting/getDaylightHarvestingProfile | Get |  | Get daylight harvesting profile settings  (unicast command to gateway)  Not available, need h/w, f/w , s/w change |
| Get\_Ack | ProfileControl,  OverallZone,  StartTime,  EndTime,  DayOfWeek,  DaylightThreshold,  MinLuminanceLevel, MaxLuminanceLevel | Not available, need h/w, f/w , s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| ProfileControl | Profile control | String | 20 | Enable / Disable | Enable |  |
| OverallZone | Overall daylight harvesting zone which consists of the sensor nodes in all the daylight harvesting zones | Number | 10 | 1 to 63 | 60 |  |
| StartTime | Start time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 07:00 |  |
| EndTime | End time of event | String | 20 | HH:mm  HH – Hour  mm – Minute | 19:00 |  |
| DayOfWeek | Select day of week for event to take effect | String | 20 | Weekday / Weekend / Everyday / Holiday | Everyday |  |
| DaylightThreshold | Daylight threshold which is used to generate multiple daylight levels | Number | 10 | 10 to 60000 | 1000 | Value is in lux |
| MaxLuminanceLevel | Maximum luminance level corresponds to dim daylight | Number | 10 | 50 to 100 | 90 | Value is in percentage |
| MinLuminanceLevel | Minimum luminance level corresponds to bright daylight | Number | 10 | 0 to 50 | 10 | Value is in percentage |

Note: The daylight threshold and min/max luminance level are used to generate 5 light bands for luminance adjustment based on measured ambient daylight. The daylight threshold is divided by 4 to generate 4 daylight levels whereas the difference of minimum and maximum luminance is divided by 4 to generate 4 luminance levels. For example:

Band 1

(10% light level)

Band 2

(30% light level)

Band 3

(50% light level)

Band 4

(70% light level)

Band 5

(90% light level)

1000 lux

750 lux

500 lux

250 lux

Min: 10%, Max: 90%

Band 1

(0% light level)

Band 2

(25% light level)

Band 3

(50% light level)

Band 4

(75% light level)

Band 5

(100% light level)

1000 lux

750 lux

500 lux

250 lux

Min: 0%, Max: 100%

* + - * 1. Normal Light Automatics Test

The following commands are used to test normal light to detect light dim and flicker.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/activateLightTest | Set | Transmission,  ConfigurationZone | Activate lighting test. Alarm message will send out if light test failed.  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ConfigurationZone | Not available, need h/w, f/w , s/w change |
| SmartLighting/setLightTestSchedule | Set | Transmission,  ConfigurationZone,  StartTime | Setup a test schedule to test all lights under a gateway. Alarm message will send out if light test failed.  (unicast command to gateway)  Not available, need h/w, f/w , s/w change |
|  | Set\_Ack | Transmission,  ConfigurationZone,  StartTime | Not available, need h/w, f/w , s/w change |
| SmartLighting/getLightTestSchedule | Get |  | Get schedule of lighting test.  (unicast command to gateway)  Not available, need h/w, f/w , s/w change |
|  | Get\_Ack | StartTime | Not available, need h/w, f/w , s/w change |
| SmartLighting/getLightStatus | Get |  | Get light health status  Not available, need h/w, f/w , s/w change |
|  | Get\_Ack | LightStatus | Not available, need h/w, f/w , s/w change |

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| StartTime | Start time to perform lighting test | String | 20 | HH:mm  HH – Hour  Mm – Minute | 03:00 |  |
| LightStatus | Health status of light | String | 20 | Normal /  Dim /  Flicker /  Off | Normal |  |

* + - * 1. Emergency Light Automatics Test

The following commands are used to perform manual and auto test for emergency lights.

|  |  |  |  |
| --- | --- | --- | --- |
| Event Type | Command Type | Fields | Remarks |
| SmartLighting/startELightTest | Set | Transmission,  ConfigurationZone,  TestType | Start emergency lighting test  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  TestType | Not available, need h/w, f/w , s/w change |
| SmartLighting/stopELightTest | Set | Transmission,  ConfigurationZone | Stop emergency lighting test  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ConfigurationZone | Not available, need h/w, f/w , s/w change |
| SmartLighting/setELightAutoTest | Set | Transmission,  ConfigurationZone,  TestControl | Control auto test  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  TestControl | Not available, need h/w, f/w , s/w change |
| SmartLighting/getELightAutoTest | Get |  | Get auto test control status  Not available, need h/w, f/w , s/w change |
| Get\_Ack | TestControl | Not available, need h/w, f/w , s/w change |
| SmartLighting/setELightTestSchedule | Set | Transmission,  ConfigurationZone,  NumberOfProfile,  [Profile 1]  ProfileIndex,  ProfileControl,  ZoneId,  FunctionalTestDate,  FunctionalTestTime,  DurationTestDate,  DurationTestTime  …  [Profile n]  ProfileIndex,  ProfileControl,  ZoneId,  FunctionalTestDate,  FunctionalTestTime,  DurationTestDate,  DurationTestTime | Setup test schedules for auto test  Not available, need h/w, f/w , s/w change |
| Set\_Ack | Transmission,  ConfigurationZone,  NumberOfProfile,  [Profile 1]  ProfileIndex,  ProfileControl,  ZoneId,  FunctionalTestDate,  FunctionalTestTime,  DurationTestDate,  DurationTestTime  …  [Profile n]  ProfileIndex,  ProfileControl,  ZoneId,  FunctionalTestDate,  FunctionalTestTime,  DurationTestDate,  DurationTestTime | Not available, need h/w, f/w , s/w change |
| SmartLighting/getELightTestSchedule | Get |  | Get test schedules for auto test  Not available, need h/w, f/w , s/w change |
| Get\_Ack | NumberOfProfile,  [Profile 1]  ProfileIndex,  ProfileControl,  ZoneId,  FunctionalTestDate,  FunctionalTestTime,  DurationTestDate,  DurationTestTime  …  [Profile n]  ProfileIndex,  ProfileControl,  ZoneId,  FunctionalTestDate,  FunctionalTestTime,  DurationTestDate,  DurationTestTime | Not available, need h/w, f/w , s/w change |
| SmartLighting/getELightTestResult | Get |  | Get result of emergency lighting test  Not available, need h/w, f/w , s/w change |
|  | Get\_Ack | Time,  TestType,  TestResult,  FailureType,  NotTested,  BatteryVoltage | Not available, need h/w, f/w , s/w change |

Note: [Profile #] in the above table is not the actual field, it is only meant for illustration purpose.

Sample parameters for SET command (SmartLighting/setELightTestSchedule)

**"Parameters": {**

**“CommandType”:”Set”,**

**“Transmission”:”Unicast”,**

**“ConfigurationZone”:0,**

“NumberOfProfile”:2,

“AutoTestProfiles”: [

{

“ProfileIndex”:1,

“ProfileControl”:”Enable”,

“ZoneId”:1,

“FunctionalTestDate”:”01-01-2020”,

“FunctionalTestTime”:”01:00”,

“DurationTestDate”:”01-15-2020”,

“DurationTestTime”:”03:00”

},

{

“ProfileIndex”:2,

“ProfileControl”:”Enable”,

“ZoneId”:2,

“FunctionalTestDate”:”02-01-2020”,

“FunctionalTestTime”:”01:00”,

“DurationTestDate”:”02-15-2020”,

“DurationTestTime”:”03:00”

}

]

}

Sample parameters for GET command response (SmartLighting/getELightTestSchedule)

**"Parameters": {**

**“CommandType”:”Get\_Ack”,**

“NumberOfProfile”:2,

“AutoTestProfiles”: [

{

“ProfileIndex”:1,

“ProfileControl”:”Enable”,

“ZoneId”:1,

“FunctionalTestDate”:”01-01-2020”,

“FunctionalTestTime”:”01:00”,

“DurationTestDate”:”01-15-2020”,

“DurationTestTime”:”03:00”

},

{

“ProfileIndex”:2,

“ProfileControl”:”Enable”,

“ZoneId”:2,

“FunctionalTestDate”:”02-01-2020”,

“FunctionalTestTime”:”01:00”,

“DurationTestDate”:”02-15-2020”,

“DurationTestTime”:”03:00”

}

]

}

### Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field Name | Description | Data Type | Max Length | Possible Values | Sample Values | Remarks |
| NumberOfProfile | Number of profiles to be set | Number | 10 | 1 to 20 | 5 |  |
| ProfileIndex | Profile index to setup test schedule | Number | 10 | 1 to 20 | 1 |  |
| ProfileControl | Test schedule control | String | 20 | Enable / Disable | Enable |  |
| ZoneId | Lighting zone for auto test | Number | 10 | 1 to 63 | 1 |  |
| FunctionalTestDate | Date of functional test | String | 20 | dd-MM-yyyy  dd – Day  MM – Month  yyyy – Year | 01/10/2020 |  |
| FunctionalTestTime | Time of functional test | String | 20 | HH:mm  HH – Hour  Mm – Minute | 01:00 |  |
| DurationTestDate | Date of duration test | String | 20 | dd-MM-yyyy  dd – Day  MM – Month  yyyy – Year | 15/10/2020 |  |
| DurationTestTime | Time of duration test | String | 20 | HH:mm  HH – Hour  Mm – Minute | 03:00 |  |
| Time | Date and time of lighting test | String | 25 | yyyy-MM-dd HH:mm:ss.SSS  yyyy – Year  MM – Month  dd – Day  HH – Hour 24hr format  mm – Minute  ss – Second  SSS – Millisecond | 2020-01-12 10:49:50.272 |  |
| TestType | Test type | String | 25 | Functional /  Duration /  Commissioning | Functional |  |
| TestControl | Auto test control | String | 20 | Enable / Disable | Enable |  |
| TestResult | Test result | String | 25 | Passed /  Failed /  Not\_Tested /  Test\_In\_Progress /  Result\_Not\_Available | Passed |  |
| FailureType | Type of failure | String | 25 | Light\_Fail /  Battery\_Fail /  Charger\_Fail | Battery\_Fail | For test failed case |
| NotTested | Reason for not tested | String | 50 | Emergency\_Mode /  Test\_Button\_Pressed /  Light\_Power\_Not\_Calibrated /  Battery\_Below\_Nominal\_Voltage /  Battery\_Not\_Fully\_Charged /  Battery\_Removed /  Switch\_Over\_Fail /  Incorrect\_Nominal\_Battery\_Voltage | Battery\_Removed | For not tested case |
| BatteryVoltage | Battery voltage after lighting test | Number | 10 | 3.6 to 12 | 3.5 | Value is in voltage |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| RefEventId | Only for clearing early alarm | String | 32 |  |  |  |
| Description | Description about fault | String | 512 |  |  |  |
| Faultcode | Fault Code | String | 32 | SH-SI-OE-[103201-103400] |  |  |

# Points to be noted

* SensorId should be unique, as elaborated in Appendix III.
* If the sensor does not follow the ICD specifications, the Smart Hub will not show sensor readings or alarms.
* Prior to send sensor data, sensorIds must be added into master data and loaded in the Smart Hub system.
* Sensors must filter out the duplicate records in the flat files and empty readings.
* Records in a file must be sequential with respect to the time.

# Master Data Configuration

6.1 The Smart Hub system requires the master device list and basic properties of the each of the devices to be configured and linked to each device object. This is a one-off action. The data is populated in accordance to the physical device hierarchical relation.

The system is designed to take in large numbers of sensors properties without the upfront definition of individual sensor. As per the design, the properties of specific sensor can be represented as key value pair in static and dynamic parameters column of the master data. Hence any properties can be added to static properties.

The inputs in this excel will fall under:

1) Smart Hub specific – mandatory attributes required for Smart Hub integration

2) Sensor specific – attributes specific to the sensor

The Master Data establishes an identity for sensor/device and tracks metadata such as device's attributes, capabilities, geo info, resource path, and so on. This consistently formatted unique id would be a primary key which can be used as reference in event data or any data set.

## 6.2 Sensor Details for Smart Hub

The format below is an example. A detailed spreadsheet will be provided to the sensor vendor to populate.

Table 6‑1: Master Data File definition

Smart Hub specific:

|  |  |  |
| --- | --- | --- |
| **Property** | **Description** | **Sample Value** |
| SensorId | <SensorType>-<Vendor>-<PostalCode>-<GenericIdentifier>  Vendor name must be alphanumeric without special characters;  Instead of Postal code, location code can be used if there is no postal code available for the location. E.g. JE-OUTDOOR  A generic Identifier is used so that even when the specific sensor is replaced by new hardware, Smart Hub recognises it as the same sensor point. | See Appendix III |
| Sensor Type | Sensor type | Smart Pump |
| Sensor Display Name | Name to be displayed in Smart Hub’s real time monitoring software GUI | Appendix III |
| Postal Code | Postal code, if the postcode is not available just add some unique code eg: 99990001 | 600321 |
| X | x/Easting | 34.345234 |
| Y | y/Northing | 64.345454 |
| Z | z/height | 22.22 |
| Location Descriptor | To display the location name in the smart hub system. | See Appendix III |
| Sensor Manufacturing Company | Brand/Vendor | Ademco |
| Sensor Model | Model | MHW33 |

**Sensor specific:**

Additional attributes will be required according to the sensor type. They are required for Smart Hub as well as for compliance with WOG sensor attribute conventions.

The sample values in the parameters/static properties column are for illustration purpose and they may not be real values of the sensors. The purpose of the static properties list to add static properties like Software Version, and compass bearing, etc.

In the master data, the attribute names (headers) should include the units.

For e.g. grid\_frequency (Hz).

## 6.3 Master Data Considerations

1. X, Y and Z coordinates shall be provided in svy21 reference system.
2. Any specific parameter with respect to sensor type can be added as key value pair, if you don’t have any value at the moment just put it as N.A (Not applicable)

Appendix I – Glossary of Terms

|  |  |
| --- | --- |
| GUI | Graphical User Interface |
| HDB | Housing & Development Board |
| ICD | Interface Control Document |
| JSON | JavaScript Object Notation |
| MQTT | Message Queue Telemetry Transport |
| Qos | Quality of Service |
| SMS | Short Messaging Service |
| SSL | Secure Sockets Layer |
| TLS | Transport Layer Security |
| URL | Uniform Resource Locator |
| WOG | Whole of Government |

Appendix II– Masterdata



This is an example of the masterdata. The Contractor shall obtain the latest masterdata document from HDB and adhere to the latest format.

Appendix III – Nomenclature for Sensor Naming and Masterdata

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Smart System** | **SenderId**  (use hyphens) | **SensorId**  (use hyphens) | **Sensor Display Name**  (no space, use hyphen only if there is hierarchy) | **Location Descriptor**  (no space, use underscore between postal code and location name) |
| **Smart Water Pump** | **SensorType-Postalcode-AggregatorIdentifier**  e.g.  Pump-700123-BoosterPumpRoom | **SensorType-Vendor-Postalcode-GenericIdentifier**  e.g.  Pump-Ademco-700123-BoosterPumpRoom-ControlPanel  Pump-Ademco-700123-BoosterPumpRoom-Pump1 | **DisplayName**  e.g.  ControlPanel  Pump1 | **Postalcode\_LocationName**  e.g.  700123\_BoosterPumpRoom |
| **Urbanwater Harvesting System** | **SensorType-Postalcode-AggregatorIdentifier**  e.g  UWHS-700123-RainwaterTreatmentRoom | **SensorType-Vendor-Postalcode-GenericIdentifier**  e.g.  UWHS-ACE-700123-PUBTopup  UWHS-ACE-700123-Washing  UWHS-ACE-700123-Irrigation | **DisplayName**  e.g.  WaterMeter-PUBTopup  WaterMeter-Washing  WaterMeter-Irrigation | **Postalcode\_LocationName**  e.g.  700123-RainwaterTreatmentRoom |
| **Smart Irrigation** | **SensorType-Postalcode-AggregatorIdentifier**  e.g.  SmartIrrigation-700123-B1 | **SensorType-Vendor-Postalcode-GenericIdentifier**  e.g.  SmartIrrigation-ATS-700123-B1-1  SmartIrrigation-ATS-700123-B1-2  SmartIrrigation-ATS-700123-L2-1 | **DisplayName**  e.g.  Moisturesensor-1  Moisturesensor-2 | **Postalcode\_LocationName**  e.g.  700123-B1  700123-L2 |
| **Smart Lighting** | **SensorType-Postalcode-AggregatorIdentifier**  e.g.  SmartLighting-700123-01 | **SensorType-Vendor-Postalcode-GenericIdentifier**  e.g.  SmartLighting-ST-700123-01010201  SmartLighting-ST-700123-01010202  SmartLighting-ST-700123-01010203 | **DisplayName**  e.g.  MotionSensor-1  MotionSensor-2 | **Postalcode\_LocationName**  e.g.  700123-LiftLobby  700123-Level1 |