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# Data Center Equipment Schema Readme

## Information for Work-in-Progress version:

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This document's normative language is English. Translation into other languages is permitted.

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# Foreword

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The following files are part of the Redfish Data Center Equipment Schema development effort:

- DataCenterEquipmentSchemaREADME.pdf - Redfish Data Center Equipment Schema Readme (Work in Progress release)

# Redfish Work in Progress Schemas

The following new schema files are released as Work In Progress documents.

Schema File	Version	Date	Description
AirHandlingUnit_v1	0.1.0a	2017-8-22	Work in Progress release.
AirHandlingUnitCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
CRAC_v1	0.1.0a	2017-8-22	Work in Progress release.
CRACCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
CRAH_v1	0.1.0a	2017-8-22	Work in Progress release.
CRAHCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
Chiller_v1	0.1.0a	2017-8-22	Work in Progress release.
ChillerCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
CoolingTower_v1	0.1.0a	2017-8-22	Work in Progress release.
CoolingTowerCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
DCIMCooling_v1	0.1.0a	2017-8-22	Work in Progress release.
DCIMCoolingCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
DCIMPower_v1	0.1.0a	2017-8-22	Work in Progress release.
DCIMPowerCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
Generator_v1	0.1.0a	2017-8-22	Work in Progress release.
GeneratorCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
PDU_v1	0.1.0a	2017-8-22	Work in Progress release.
PDUCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
RackPDU_v1	0.1.0a	2017-8-22	Work in Progress release.

Schema File	Version	Date	Description
RackPDUCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
Rectifier_v1	0.1.0a	2017-8-22	Work in Progress release.
RectifierCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
Sensor_v1	0.1.0a	2017-8-22	Work in Progress release.
SensorCollection_v1	1.0.0a	2017-86-22	Work in Progress release.
CRAC_v1	0.1.0a	2017-8-22	Work in Progress release.
CRACCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
ServiceRoot_v1	1.3.0a	2017-8-22	Work in Progress release.
SwitchGear_v1	0.1.0a	2017-8-22	Work in Progress release.
SwitchGearCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
TransferSwitch_v1	0.1.0a	2017-8-22	Work in Progress release.
TransferSwitchCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
Transformer_v1	0.1.0a	2017-8-22	Work in Progress release.
TransformerCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
UPS_v1	0.1.0a	2017-8-22	Work in Progress release.
UPSCollection_v1	1.0.0a	2017-8-22	Work in Progress release.
VFD_v1	0.1.0a	2017-8-22	Work in Progress release.
VFDCollection_v1	1.0.0a	2017-8-22	Work in Progress release.

# Equipment Modeling Methodology

The Work In Progress (WIP) data center power and cooling equipment data models are based on an initial collection of the kinds of inventory, status, metric and sensor properties each type of equipment is often instrumented with. Further refinement was started in the WIP schemas by creating a sensor abstraction with a related collection so that there could be flexibility in representing equipment with more or less sensors and still achieve a level of interoperable consistency in the API representation. Additionally, the concept of one or more power and cooling "domains" (or "zones") was introduced to reflect real world installations and organization of this kind of equipment. The following is a more detailed description of the modeling methodology used in this WIP release.

# 1. Domains

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- Domain Collections located in the API Service Root and referenced from API Service Root document.
  - Organize data center facility equipment into 2 domains represented as Domain Collections
    - Power Domain Collection – Name proposal “DCIMPower”
    - Cooling Domain Collection – Name proposal “DCIMCooling”
  - Each Domain Collection consists of 1 or more members, with a domain member representing the group of equipment in the domain being instrumented and information/metrics properties at the domain level.
  - A domain member consists of a JSON document with navigation reference properties to specific equipment type collections and top level properties representing domain information and domain level metrics.

## 2. Specific Equipment Collections

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- An equipment collection consists of 0 or more members, with an equipment collection member representing a specific piece of equipment.

## 3. Equipment Modeling Pattern

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- Equipment is represented as CSDL/JSON entity in schema.
- Equipment inventory information and metrics represented as entity top level properties.
- Sensors are represented in one or more collections referenced as top level property per collection.
- Equipment sub-components are represented as 1 or more members of top level array property.
- Each sub-component is represented as a complex property (object) with top level properties of component information and metrics and a sensors collection.

# Sensor Modeling and Types

- Sensors of various types are represented in the DCIM equipment proposed data models as individual members of Sensor Collections subordinate to each equipment model entity and as Sensor Collections subordinate to sub-component representations.
- The specific types of sensors typically available on or required by a particular DCIM equipment model are not described in the individual equipment data definition schema. Instead, the specific sensors required are defined in a planned DCIM Interop Profile that specifies the types of sensors required for a particular DCIM equipment. The following information describe the typical sensors available on the various type of Power and Cooling equipment for which there are proposed CSDL schema. Sensor collections are located either:
  - At the “Equipment” or system level or
  - At the “Component” or sub-system level

## 4. Power Equipment Sensor Types

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Sensors types for Redfish data model aligned power equipment schema.

### 4.1. Generator

- Fuel Level
- Temperature
- AC Output Sub-Component Sensors
  - Frequency
  - RMS Voltage (L-L)
  - RMS Voltage (L-G)
  - RMS Current
  - Output Ground Current
  - Battery Voltage

### 4.2. PDU (Power Distribution Unit) - RackPDU

- Temperature
- Humidity
- AC Input Sub-Component (1-n) Sensors
  - RMS Voltage

- RMS Current
- Frequency
- AC Output Sub-Component (1-n) Sensors
  - RMS Voltage
  - RMS Current
  - Frequency

### 4.3. Rectifier

- Temperature
- AC Input Sub-Component (n) Sensors
  - RMS Voltage
  - RMS Current
  - Frequency
- DC Bus (n)
  - DC Voltage
- Rectifier (n)
  - DC Current
  - Temperature

### 4.4. Transformer

- Temperature
- Ambient Temperature
- Humidity
- Pressure
- Liquid Level
- AC Input
  - RMS Voltage
  - RMS Current
  - Frequency
- AC Output
  - RMS Voltage
  - RMS Current
  - Frequency

### 4.5. UPS

- AC Utility Input
  - RMS Voltage (L-L) Phase A-B
  - RMS Voltage (L-L) Phase B-C
  - RMS Voltage (L-L) Phase C-A

- RMS Current
- Frequency
- Ambient Temperature
- Humidity
- AC Static Bypass Input
  - RMS Voltage (L-N)
  - RMS Voltage (L-L)
  - RMS Current
  - Frequency
- AC Maintenance Bypass Input
  - RMS Voltage (L-N)
  - RMS Voltage (L-L)
  - RMS Current
  - Frequency
- DC Bus
  - Voltage
  - DC Current
- Battery Sub-Component (1-n)
  - Temperature
- AC Output
  - RMS Voltage (L-N)
  - RMS Voltage (L-L)
  - RMS Current
  - Frequency

## 4.6. VFD

- Speed
- AC Input
  - RMS Current
  - RMS Voltage (L-L)
- AC Output
  - Frequency
  - RMS Voltage (L-L)
  - RMS Current
- DC Bus
  - DC Voltage

## 5. Cooling Equipment Sensor Types

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Sensors types for Redfish data model aligned cooling equipment schema.

## 5.1. Air Handling Unit

- Supply Air Temperature
- Return Air Temperature
- Relative Humidity
- RA Relative Humidity
- Supply Fan Speed
- Exhaust Fan Speed
- Supply Water Temperature
- Return Water Temperature
- Chilled Water Valve Opening
- Differential Water Pressure
- Outside Air Temperature
- Outside Air Relative Humidity
- Outside Air Damper Position
- Exhaust Air Damper Position
- Return Air Damper Position
- Mixing Air Damper
- Reheat Coil Discharge Temperature

## 5.2. Chiller

- Chilled Water Return Temperature
- Chilled Water Supply Temperature
- Cold Water Return from Chiller
- Cold Water Supply to Chiller
- Compressor Discharge Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Compressor Suction Temperature
- Evaporator Entering Water Temp
- Evaporator Leaving Water Temp
- Evaporator Saturated Refrigerant Temperature
- Evaporator Refrigerant Pressure
- Condenser Saturated Refrigerant Temperature
- Condenser Refrigerant Pressure
- Chilled Water Flow
- Cold Water Flow
- Chilled Water Valve Position
- Cold Water Valve Position
- Chilled Water Pump Speed
- Cold Water Pump Speed

- Make Up Chilled Water
- Compressor Oil Temperature
- Compressor Oil Pressure
- Compressor Phase AB Voltage
- Compressor Phase BC Voltage
- Compressor Phase CA Voltage
- Compressor Line 1 Current
- Compressor Line 2 Current
- Compressor Line 3 Current
- Compressor Line 1 Current RLA
- Compressor Line 2 Current RLA
- Compressor Line 3 Current RLA

### **5.3. CRAC (Computer Room Air Conditioner)**

- Supply Air Temperature
- Return Air Temperature
- Relative Humidity
- Unit Fan Speed
- Condensor Fan Speed
- Compressor Discharge Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Compressor Suction Temperature
- Outside Air Humidity
- Outside Air Temperature

### **5.4. CRAH (Computer Room Air Handler)**

- Supply Air Temperature
- Return Air Temperature
- Relative Humidity
- Unit Fan Speed
- Supply Water Temperature
- Return Water Temperature
- Chilled Water Valve Opening
- Cold Water Valve Opening
- Differential Water Pressure
- Outside Air Humidity
- Outside Air Temperature