



HES XML Data Push Integration Guide

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HES XML Data Push Integration Guide

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Revision History

Revision	Release Date	Change Description
A	June 23, 2014	Initial release.
B	November 13, 2014	<ul style="list-style-type: none">■ Clarified device state requirement (i.e., maintenance mode vs operational mode) so that XML data can be sent.■ Updated SDU Schemas: FCISdu, KONWPTSdu, SEL8301ASdu, TIQSdu, and ElectricAMISdu

1 Introduction

On-Ramp Total View (OTV) 1.0 and OTV 1.1 support XML data push integration via HTTP through the Head End System (HES) component. Currently, it works with FCI, FAA lighting, and TIQ applications. This data can be sent to Distribution Management Systems (DMS) and Outage Management Systems (OMS) or to systems such as OSIsoft PI System. To enable XML data integrations, the appropriate HES application adapter needs to be installed.

2 Configuration

Each application must be configured separately to use the XML data push integration. This configuration resides in the `hes_config.properties` file. After configuration, each application has the ability to populate and send data through this XML interface.

2.1 Overview

All XML data integrations are in the following format:

```
<application>.xmlintegration.<id>.<config_setting>
```

where:

- `<application>` is the application name.
- `<id>` is the name of a single integration instance. It is case-sensitive.
- `<config_setting>` is the specific configurations allowed for this integration instance which are detailed below.

Example:

```
fci.xmlintegration.Test.enabled
```

For each `<id>` (case-sensitive), received SDUs of type “`xmlintegration.<id>.sdu`” are each formatted as a simple XML document, transformed by an optional XSLT file located at path “`xmlintegration.<id>.transform.file`,” and published with an HTTP POST to “`xmlintegration.<id>.http.url`” (required).

The following application names are supported:

- FAALIGHT
- FCI
- KONWPT
- SEL8301A
- TIQ
- WiYZ

NOTE: Devices *must* be in Operational Mode in order for XML data to be sent through this interface. For documentation on Maintenance vs Operational States, refer to the *OTV Operator Guide (010-0106-00)*.

2.2 XML Integrations

2.2.1 Enabling

```
xmlintegration.<id>.enabled
```

This setting determines whether the integration is enabled. Disabling an integration is different from removing it, in that its last state is retained. After it is re-enabled, it resumes from where it left off. The default is true.

2.2.2 Description

```
xmlintegration.<id>.description
```

This is an optional setting that allows you to provide a text description of the integration.

2.2.3 SDU Filter

```
xmlintegration.<id>.sdu.filter
```

This SDU filter setting is an optional value that is passed to app type implementations supporting XML data filtering. The behavior is dependent on the `sdu.filter_class_name` implementation. If this property is absent, then it submits XMLs for all types. If this property is present but empty, then no XMLs are sent.

```
xmlintegration.<id>.sdu.filter_class_name
```

This SDU filter setting is an optional value that specifies a Java class that is executed upon each SDU class before it is serialized to XML. This provides an opportunity for injecting values into the SDU class that are needed for XML serialization but are not, by default, populated. Also, this class is passed to the `sdu.filter` property and can use it to determine whether an SDU is qualified to be sent for XML publishing or skipped.

NOTE: The SDU filter settings are currently only supported for the FCI application.

2.2.4 HTTP Settings

Setting	Description
<code>xmlintegration.<id>.http.url</code>	HTTP URL to POST the XML data to. This is required.
<code>xmlintegration.<id>.http.username</code> <code>xmlintegration.<id>.http.password</code>	HTTP basic authentication username and password.
<code>xmlintegration.<id>.http.connect_timeout_ms</code>	HTTP connection timeout. The default is 5000.
<code>xmlintegration.<id>.http.read_timeout_ms</code>	HTTP read timeout. The default is 15000.
<code>xmlintegration.<id>.http.ssl.validate</code>	Whether SSL certificates should be validated. This includes strict host name validation. The default is true.
<code>xmlintegration.<id>.http.ssl.client_cert</code>	Alias for a SSL client certificate in the configured keystore.
<code>xmlintegration.<id>.http.success_response.regex</code>	If the service URL returns HTTP 2XX's response codes and success/error codes inside the returned content. Use this regular expression to search for a success message. Empty means ignore the returned content and just look for the HTTP 2XX response code.
<code>xmlintegration.<id>.interval_ms</code>	The minimum number of milliseconds that are allowed to elapse between subsequent HTTP requests. The default is 100.

Setting	Description
<code>xmlintegration.<id>.http.headers</code>	Header key/value pairs should be separated by '< >' and key values separated by '<::>', e.g., <code>SOAPAction<::>test< >HeaderKey1<::>Sample Value1</code> will result in the headers 'SOAPAction: test' and 'HeaderKey1: SampleValue1'.

2.2.5 Retries

```
xmlintegration.<id>.retry.count
xmlintegration.<id>.retry.interval_ms
```

On any publishing failure (including XSLT processor errors and HTTP connection/read timeouts or non-2XX response codes), up to “`xmlintegration.<id>.retry.count`” (default 3) additional attempts are made every “`xmlintegration.<id>.retry.interval_ms`” (default 30000) milliseconds to publish the SDU.

2.3 Sample FCI XML Integration Configuration

```
fci.xmlintegration.Test.description=FCI
fci.xmlintegration.Test.enabled=true
fci.xmlintegration.Test.sdu.filter=comment this out to have all sdus sent on xml
fci.xmlintegration.Test.sdu.filter_class_name=orw.hes.adapter.fci.FCIHttpXmlFilter
fci.xmlintegration.Test.transform.file=/opt/onramp_apps/hes/instance_1/sample.xslt
fci.xmlintegration.Test.http.url=https://localhost/sample.cgi
fci.xmlintegration.Test.http.headers=SOAPAction<::>test
fci.xmlintegration.Test.http.username=foo
fci.xmlintegration.Test.http.password=bar
fci.xmlintegration.Test.http.connect_timeout_ms=5000
fci.xmlintegration.Test.http.read_timeout_ms=5000
fci.xmlintegration.Test.http.ssl.validate=true
fci.xmlintegration.Test.http.ssl.client_cert=localhost-cert
fci.xmlintegration.Test.http.ssl.jks_file=/opt/your/path/certs.jks
fci.xmlintegration.Test.http.ssl.jks_pwd=
fci.xmlintegration.Test.http.success_response.regex=:0k\\s*</errorString>
fci.xmlintegration.Test.retry.count=10
fci.xmlintegration.Test.retry.interval_ms=60000
fci.xmlintegration.Test.interval_ms=1000
```


3 SDU Schema Reference

The XML *payload* is the body data or contents (e.g., the “cargo”) of a data transmission as opposed to the *wrapper* which is the boilerplate XML around the content. As such, the payload is the *variable* part of the reply. This chapter provides the XML Schema Definitions (XSD) for uplink SDUs for various device types.

3.1 WiYZSdu Schema

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="WiYZProcessControlValue" type="WiYZProcessControlValue"/>

  <xs:element name="WiYZSdu" type="WiYZSdu"/>

  <xs:complexType name="WiYZSdu">
    <xs:all>
      <xs:element name="AppTypeID" type="xs:int"/>
      <xs:element name="isAlarm" type="xs:boolean"/>
      <xs:element name="alertClass" type="xs:int"/>
      <xs:element name="alertCounter" type="xs:int"/>
      <xs:element name="alertDirection" type="xs:int"/>
      <xs:element name="alertId" type="xs:int"/>
      <xs:element name="alertReserved" type="xs:int"/>
      <xs:element name="App_Device_Id" type="xs:long"/>
      <xs:element name="sensorData">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="sensor" type="WiYZProcessControlValue" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="destinationOID" type="xs:int"/>
      <xs:element name="downLinkResponse" type="xs:string"/>
      <xs:element name="Message_Id" type="xs:long"/>
      <xs:element name="Failures">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="messageType" type="xs:int"/>
      <xs:element name="Device_Id" type="xs:long"/>
      <xs:element name="Message_Received" type="xs:long"/>
      <xs:element name="sduTimestamp" type="xs:long"/>
      <xs:element name="sourceOID" type="xs:int"/>
    </xs:all>
  </xs:complexType>
</xs:schema>
```

```

    <xs:element name="ULP_Node_Id" type="xs:Long"/>
    <xs:element name="MetaAttribs">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:all>
</xs:complexType>

<xs:complexType name="wiYZProcessControlValue">
  <xs:all>
    <xs:element name="id" type="xs:Long"/>
    <xs:element name="limitstatus" type="xs:int"/>
    <xs:element name="nodeId" type="xs:Long"/>
    <xs:element name="portId" type="xs:Long"/>
    <xs:element name="quality" type="xs:int"/>
    <xs:element name="reserved" type="xs:int"/>
    <xs:element name="scaledValue" type="xs:string"/>
    <xs:element name="sduId" type="xs:Long"/>
    <xs:element name="substatus" type="xs:int"/>
    <xs:element name="rawValue" type="xs:string"/>
  </xs:all>
</xs:complexType>

<xs:complexType name="FailureType">
  <xs:sequence>
    <xs:element name="Id" type="xs:int"/>
    <xs:element name="Severity" type="xs:int" nillable="true"/>
    <xs:element name="Time" type="xs:Long" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>
</xs:complexType>
</xs:schema>

```

3.2 FAALightSdu Schema

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="FAALightSdu" type="faaLightSdu"/>

  <xs:complexType name="faaLightSdu">
    <xs:all>
      <xs:element name="AppTypeID" type="xs:int"/>

```

```

<xs:element name="App_Device_Id" type="xs:Long"/>
<xs:element name="computedLightStatus" type="xs:Long" nillable="true"/>
<xs:element name="computedTimeOfDay" type="xs:Long" nillable="true"/>
<xs:element name="dipSwitch" type="xs:int" nillable="true"/>
<xs:element name="Message_Id" type="xs:Long"/>
<xs:element name="intrusionDetection" type="xs:Long" nillable="true"/>
<xs:element name="invalidRmuConfig" type="xs:int" nillable="true"/>
<xs:element name="Failures">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="LightNotFunctional" type="xs:Long" nillable="true"/>
<xs:element name="lightsOutLatch" type="xs:int" nillable="true"/>
<xs:element name="nightTooShort" type="xs:int" nillable="true"/>
<xs:element name="Device_Id" type="xs:Long"/>
<xs:element name="opCode" type="xs:Long" nillable="true"/>
<xs:element name="rmuVersion" type="xs:Long" nillable="true"/>
<xs:element name="powerSupplyStatus" type="xs:Long" nillable="true"/>
<xs:element name="powerSupplyType" type="xs:Long" nillable="true"/>
<xs:element name="pushbuttonStatus" type="xs:Long" nillable="true"/>
<xs:element name="Message_Received" type="xs:Long"/>
<xs:element name="replaceBattery" type="xs:Long" nillable="true"/>
<xs:element name="timeOfDay" type="xs:Long" nillable="true"/>
<xs:element name="timeOfDayHoursPast" type="xs:Long" nillable="true"/>
<xs:element name="totalBulbs" type="xs:Long" nillable="true"/>
<xs:element name="ULP_Node_Id" type="xs:Long"/>
<xs:element name="MetaAttribs">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:all>
</xs:complexType>

<xs:complexType name="FailureType">
  <xs:sequence>
    <xs:element name="Id" type="xs:int"/>
    <xs:element name="Severity" type="xs:int" nillable="true"/>
    <xs:element name="Time" type="xs:Long" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>

```

```
</xs:complexType>
</xs:schema>
```

3.3 FCISdu Schema

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="FCISdu" type="fciSdu"/>

  <xs:complexType name="PastHourlyAverageCurrentAmps">
    <xs:sequence>
      <xs:element name="Value" type="xs:decimal" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="BaseTime" type="xs:long" use="required"/>
  </xs:complexType>

  <xs:complexType name="PastHourlyAverageTemperatureCelsius">
    <xs:sequence>
      <xs:element name="Value" type="xs:decimal" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="BaseTime" type="xs:long" use="required"/>
  </xs:complexType>

  <xs:complexType name="fciSdu">
    <xs:all>
      <xs:element name="AppTypeID" type="xs:int"/>
      <xs:element name="Version" type="Version"/>
      <xs:element name="ReportType" type="ReportType"/>
      <xs:element name="V2ReportType" type="V2ReportType"/>
      <xs:element name="ReportTimestamp" type="xs:dateTime"/>
      <xs:element name="millis" type="xs:int"/>
      <xs:element name="BatteryVoltage" type="xs:int"/>
      <xs:element name="MechanicalTargetFaulted" type="xs:boolean"/>
      <xs:element name="LowBattery" type="xs:boolean"/>
      <xs:element name="Armed" type="xs:boolean"/>
      <xs:element name="FlashError" type="xs:boolean"/>
      <xs:element name="RamError" type="xs:boolean"/>
      <xs:element name="FCIEventLarm" type="xs:boolean"/>
      <xs:element name="FirmwareRelease" type="xs:int"/>
      <xs:element name="FirmwareReleaseMinor" type="xs:int"/>
      <xs:element name="FaultThresholdAmps" type="xs:int"/>
      <xs:element name="FaultMagnitudeAmps" type="xs:int"/>
      <xs:element name="BatteryRemainingAmpSeconds" type="xs:int"/>
      <xs:element name="MomentaryFaultCount" type="xs:int"/>
      <xs:element name="MomentaryLoadPickupCount" type="xs:int"/>
      <xs:element name="MomentaryLossOfCurrentCount" type="xs:int"/>
      <xs:element name="MomentaryLossOfVoltageCount" type="xs:int"/>
      <xs:element name="MomentaryFaultDisturbance" type="xs:int"/>
      <xs:element name="CumulativeFaultCount" type="xs:int"/>
      <xs:element name="CumulativeLossOfCurrentCount" type="xs:int"/>
    </xs:all>
  </xs:complexType>
</xs:schema>
```

```

    <xs:element name="CumulativeLossOfVoltageCount" type="xs:int"/>
    <xs:element name="CumulativeLossOfCurrentAndVoltageCount" type="xs:int"/>
    <xs:element name="PeakLoadFlag" type="xs:boolean"/>
    <xs:element name="StatisticIntervals" type="xs:int"/>
    <xs:element name="App_Device_Id" type="xs:long"/>
    <xs:element name="Message_Id" type="xs:long"/>
    <xs:element name="Failures">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="Device_Id" type="xs:long"/>
    <xs:element name="PastHourlyAverageCurrentAmps"
type="PastHourlyAverageCurrentAmps"/>
    <xs:element name="PastHourlyAverageTemperatureCelsius"
type="PastHourlyAverageTemperatureCelsius"/>
    <xs:element name="Message_Received" type="xs:long"/>
    <xs:element name="ULP_Node_Id" type="xs:long"/>
    <xs:element name="MetaAttribs">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:all>
</xs:complexType>

<xs:complexType name="FailureType">
  <xs:sequence>
    <xs:element name="Id" type="xs:int"/>
    <xs:element name="Severity" type="xs:int" nillable="true"/>
    <xs:element name="Time" type="xs:long" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:simpleType name="Version">
  <xs:restriction base="xs:string">
    <xs:enumeration value="FCI_VERSION_ONE"/>
    <xs:enumeration value="FCI_VERSION_TWO"/>
    <xs:enumeration value="FCI_VERSION_TWO_B"/>
  </xs:restriction>
</xs:simpleType>

```

```
<xs:simpleType name="ReportType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="PERIODIC"/>
    <xs:enumeration value="FAULT"/>
    <xs:enumeration value="LOSS_OF_CURRENT_FAULT"/>
    <xs:enumeration value="LOSS_OF_VOLTAGE_FAULT"/>
    <xs:enumeration value="LOSS_OF_CURRENT_AND_VOLTAGE_FAULT"/>
    <xs:enumeration value="TIMEOUT_INTERVAL_EXCEEDED"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="V2ReportType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="NULL"/>
    <xs:enumeration value="Deployment"/>
    <xs:enumeration value="Periodic"/>
    <xs:enumeration value="Restoration"/>
    <xs:enumeration value="Fault"/>
    <xs:enumeration value="LOSS_OF_CURRENT"/>
    <xs:enumeration value="LOSS_OF_VOLTAGE"/>
    <xs:enumeration value="LOSS_OF_CURRENT_VOLTAGE"/>
    <xs:enumeration value="DOWNLINK_RESPONSE_ACK"/>
    <xs:enumeration value="DOWNLINK_RESPONSE_NEGATIVE_ACK"/>
    <xs:enumeration value="FCI_SOFTWARE_UPGRADE_ACK"/>
    <xs:enumeration value="FCI_SOFTWARE_UPGRADE_NEGATIVE_ACK"/>
    <xs:enumeration value="TIMEOUT_INTERVAL_EXCEEDED"/>
    <xs:enumeration value="Invalid"/>
    <xs:enumeration value="MOMENTARY_LOAD_PICKUP_EVENT"/>
    <xs:enumeration value="MOMENTARY_DISTURBANCE_FAULT"/>
    <xs:enumeration value="MOMENTARY_LOSS_OF_CURRENT"/>
    <xs:enumeration value="MOMENTARY_FAULT"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="v2PayloadType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="NULL"/>
    <xs:enumeration value="DEVICE_INFORMATION"/>
    <xs:enumeration value="MOMENTARY_EVENT_COUNTER"/>
    <xs:enumeration value="CUMULATIVE_EVENT_COUNTER"/>
    <xs:enumeration value="FAULT_INFORMATION"/>
    <xs:enumeration value="LOAD_INFORMATION"/>
    <xs:enumeration value="TIMESTAMP"/>
  </xs:restriction>
</xs:simpleType>
</xs:schema>
```

3.4 KONWPTSdu Schema

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="KONWPTSdu" type="konwptSdu"/>

  <xs:complexType name="konwptSdu">
    <xs:all>
      <xs:element name="AppTypeID" type="xs:int"/>
      <xs:element name="App_Device_Id" type="xs:long"/>
      <xs:element name="batteryHealth" type="xs:int"/>
      <xs:element name="deviceTimestamp" type="xs:long" minOccurs="0"/>
      <xs:element name="deviceType" type="xs:int"/>
      <xs:element name="Message_Id" type="xs:long"/>
      <xs:element name="Failures">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="LowBatteryAlarm" type="xs:boolean"/>
      <xs:element name="messageType" type="messageType"/>
      <xs:element name="Device_Id" type="xs:long"/>
      <xs:element name="overThresholdAlarm" type="xs:boolean"/>
      <xs:element name="pressure" type="xs:double"/>
      <xs:element name="rateOfChangeAlarm" type="xs:boolean"/>
      <xs:element name="Message_Received" type="xs:long"/>
      <xs:element name="sensorFaultAlarm" type="xs:boolean"/>
      <xs:element name="tempOverThresholdAlarm" type="xs:boolean"/>
      <xs:element name="timeAcquisitionError" type="xs:boolean"/>
      <xs:element name="ULP_Node_Id" type="xs:long"/>
      <xs:element name="underThresholdAlarm" type="xs:boolean"/>
      <xs:element name="voltage" type="xs:double"/>
      <xs:element name="MetaAttribs">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:all>
  </xs:complexType>

  <xs:complexType name="FailureType">
    <xs:sequence>
      <xs:element name="Id" type="xs:int"/>
      <xs:element name="Severity" type="xs:int" nillable="true"/>
      <xs:element name="Time" type="xs:long" nillable="true"/>
    </xs:sequence>
  </xs:complexType>

```



```

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:simpleType name="messageType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="Periodic"/>
    <xs:enumeration value="GetDeviceSettings"/>
    <xs:enumeration value="SetDeviceSettings"/>
    <xs:enumeration value="GetDeviceStats"/>
    <xs:enumeration value="ResetALarms"/>
  </xs:restriction>
</xs:simpleType>
</xs:schema>

```

3.5 SEL8301ASdu Schema

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="SEL8301APortSdu" type="sel8301APortSdu"/>

  <xs:element name="SEL8301ASdu" type="sel8301ASdu"/>

  <xs:complexType name="sel8301APortSdu">
    <xs:all>
      <xs:element name="armed" type="xs:boolean"/>
      <xs:element name="attachedSensorField" type="xs:int"/>
      <xs:element name="cumulativeFaults" type="xs:int"/>
      <xs:element name="cumulativeLossOfCurrent" type="xs:int"/>
      <xs:element name="cumulativeReserved0" type="xs:int"/>
      <xs:element name="cumulativeReserved1" type="xs:int"/>
      <xs:element name="eventOffset" type="xs:int"/>
      <xs:element name="fault" type="xs:boolean"/>
      <xs:element name="faultInfoCurrent" type="xs:int"/>
      <xs:element name="faultThreshold" type="xs:int"/>
      <xs:element name="id" type="xs:long"/>
      <xs:element name="loadraw" type="xs:string"/>
      <xs:element name="loc" type="xs:boolean"/>
      <xs:element name="momentaryDisturbanceFault" type="xs:int"/>
      <xs:element name="momentaryFaults" type="xs:int"/>
      <xs:element name="momentaryLoadPickUp" type="xs:int"/>
      <xs:element name="momentaryLossOfCurrent" type="xs:int"/>
      <xs:element name="offline" type="xs:boolean"/>
      <xs:element name="isPeak" type="xs:boolean"/>
      <xs:element name="portFailure" type="xs:boolean"/>
      <xs:element name="portId" type="xs:int"/>
      <xs:element name="portRestoration" type="xs:boolean"/>
      <xs:element name="powerDirection" type="xs:boolean"/>
    </xs:all>
  </xs:complexType>
</xs:schema>

```



```

    <xs:element name="reportTimestamp" type="xs:Long"/>
    <xs:element name="nodeId" type="xs:Long"/>
  </xs:all>
</xs:complexType>

<xs:complexType name="sel8301ASdu">
  <xs:all>
    <xs:element name="AppTypeID" type="xs:int"/>
    <xs:element name="App_Device_Id" type="xs:Long"/>
    <xs:element name="batteryVoltage" type="xs:int" nillable="true"/>
    <xs:element name="deviceEnvCurrent" type="xs:int"/>
    <xs:element name="deviceEnvTemperature" type="xs:int"/>
    <xs:element name="deviceExternalPower" type="xs:boolean"/>
    <xs:element name="deviceFlashError" type="xs:boolean"/>
    <xs:element name="deviceId" type="xs:Long" nillable="true"/>
    <xs:element name="deviceLowBattery" type="xs:boolean"/>
    <xs:element name="deviceOutageWarning" type="xs:boolean"/>
    <xs:element name="devicePortError" type="xs:boolean"/>
    <xs:element name="devicePortFailure" type="xs:boolean"/>
    <xs:element name="deviceRamError" type="xs:boolean"/>
    <xs:element name="deviceUnderpowered" type="xs:boolean"/>
    <xs:element name="downlinkHex" type="xs:string"/>
    <xs:element name="downlinkMessageLength" type="xs:int"/>
    <xs:element name="downlinkReserved" type="xs:int"/>
    <xs:element name="firmwareVersion" type="xs:string" nillable="true"/>
    <xs:element name="Message_Id" type="xs:Long"/>
    <xs:element name="Failures">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="Device_Id" type="xs:Long"/>
    <xs:element name="offlinePorts" type="xs:boolean" nillable="true"/>
    <xs:element name="packetLength" type="xs:int" nillable="true"/>
    <xs:element name="packetType" type="xs:int" nillable="true"/>
    <xs:element name="payloadPacketCount" type="xs:int" nillable="true"/>
    <xs:element name="portFirmwareVersion" type="xs:string" nillable="true"/>
    <xs:element name="Ports">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="port" type="sel8301APortSdu" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="Message_Received" type="xs:Long"/>
    <xs:element name="reportTimestamp" type="xs:Long" nillable="true"/>
    <xs:element name="statisticsInterval" type="xs:int"/>
    <xs:element name="ULP_Node_Id" type="xs:Long"/>
    <xs:element name="MetaAttribs">
      <xs:complexType>

```

```

        <xs:sequence>
          <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:all>
</xs:complexType>

<xs:complexType name="FailureType">
  <xs:sequence>
    <xs:element name="Id" type="xs:int"/>
    <xs:element name="Severity" type="xs:int" nillable="true"/>
    <xs:element name="Time" type="xs:long" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="position">
  <xs:sequence>
    <xs:element name="column" type="xs:int"/>
    <xs:element name="row" type="xs:int"/>
  </xs:sequence>
</xs:complexType>

<xs:simpleType name="sensorType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="NONE"/>
    <xs:enumeration value="CURRENT_SENSOR"/>
    <xs:enumeration value="DIGITAL_FCI_SENSOR"/>
    <xs:enumeration value="POWER_SENSOR"/>
  </xs:restriction>
</xs:simpleType>
</xs:schema>

```

3.6 TIQSDu Schema

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="TIQSDu" type="tiqSdu"/>

  <xs:complexType name="Alarm">
    <xs:sequence>
      <xs:element name="Failure" type="xs:string"/>
      <xs:element name="Threshold" type="xs:int"/>
      <xs:element name="Winding" type="xs:int"/>
    </xs:sequence>
  </xs:complexType>

```

```

    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="tiqSdu">
    <xs:all>
      <xs:element name="AppTypeID" type="xs:int"/>
      <xs:element name="AccumulatedPowerKVARWinding1" type="xs:double"
nillable="true"/>
      <xs:element name="AccumulatedPowerKVARWinding2" type="xs:double"
nillable="true"/>
      <xs:element name="AccumulatedPowerKVARWinding3" type="xs:double"
nillable="true"/>
      <xs:element name="AccumulatedPowerKWHRWinding1" type="xs:double"
nillable="true"/>
      <xs:element name="AccumulatedPowerKWHRWinding2" type="xs:double"
nillable="true"/>
      <xs:element name="AccumulatedPowerKWHRWinding3" type="xs:double"
nillable="true"/>
      <xs:element name="Alarms" type="Alarm" maxOccurs="unbounded"/>
      <xs:element name="AmbientTemperature" type="xs:int" nillable="true"/>
      <xs:element name="AmpsWindings1" type="xs:int" nillable="true"/>
      <xs:element name="AmpsWindings2" type="xs:int" nillable="true"/>
      <xs:element name="AmpsWindings3" type="xs:int" nillable="true"/>
      <xs:element name="App_Device_Id" type="xs:long"/>
      <xs:element name="Conductor1Temperature" type="xs:int" nillable="true"/>
      <xs:element name="Conductor2Temperature" type="xs:int" nillable="true"/>
      <xs:element name="Conductor3Temperature" type="xs:int" nillable="true"/>
      <xs:element name="FaultDurationCyclesWinding1" type="xs:int" nillable="true"/>
      <xs:element name="FaultDurationCyclesWinding2" type="xs:int" nillable="true"/>
      <xs:element name="FaultDurationCyclesWinding3" type="xs:int" nillable="true"/>
      <xs:element name="Message_Id" type="xs:long"/>
      <xs:element name="Failures">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="MaxLoadPercentageWindings1" type="xs:double"
nillable="true"/>
      <xs:element name="MaxLoadPercentageWindings2" type="xs:double"
nillable="true"/>
      <xs:element name="MaxLoadPercentageWindings3" type="xs:double"
nillable="true"/>
      <xs:element name="MaxVoltageSwellWinding1" type="xs:int" nillable="true"/>
      <xs:element name="MaxVoltageSwellWinding2" type="xs:int" nillable="true"/>
      <xs:element name="MaxVoltageSwellWinding3" type="xs:int" nillable="true"/>
      <xs:element name="MinVoltageSagWinding1" type="xs:int" nillable="true"/>
      <xs:element name="MinVoltageSagWinding2" type="xs:int" nillable="true"/>
      <xs:element name="MinVoltageSagWinding3" type="xs:int" nillable="true"/>
      <xs:element name="NeutralAmps" type="xs:int" nillable="true"/>
      <xs:element name="Device_Id" type="xs:long"/>
      <xs:element name="PhaseAngleWindings1" type="xs:int" nillable="true"/>

```

```

<xs:element name="PhaseAngleWindings2" type="xs:int" nillable="true"/>
<xs:element name="PhaseAngleWindings3" type="xs:int" nillable="true"/>
<xs:element name="PowerFactorWindings1" type="xs:double" nillable="true"/>
<xs:element name="PowerFactorWindings2" type="xs:double" nillable="true"/>
<xs:element name="PowerFactorWindings3" type="xs:double" nillable="true"/>
<xs:element name="Message_Received" type="xs:long"/>
<xs:element name="TopOil1Temperature" type="xs:int" nillable="true"/>
<xs:element name="TopOil2Temperature" type="xs:int" nillable="true"/>
<xs:element name="TopOil3Temperature" type="xs:int" nillable="true"/>
<xs:element name="Transformer_Id" type="xs:int"/>
<xs:element name="ULP_Node_Id" type="xs:long"/>
<xs:element name="Winding1FaultMagnitude" type="xs:int" nillable="true"/>
<xs:element name="Winding1HotSpot" type="xs:int" nillable="true"/>
<xs:element name="Winding2FaultMagnitude" type="xs:int" nillable="true"/>
<xs:element name="Winding2HotSpot" type="xs:int" nillable="true"/>
<xs:element name="Winding3FaultMagnitude" type="xs:int" nillable="true"/>
<xs:element name="Winding3HotSpot" type="xs:int" nillable="true"/>
<xs:element name="Windings1FltMagExceed" type="xs:boolean" nillable="true"/>
<xs:element name="Windings1Voltage" type="xs:int" nillable="true"/>
<xs:element name="Windings2FltMagExceed" type="xs:boolean" nillable="true"/>
<xs:element name="Windings2Voltage" type="xs:int" nillable="true"/>
<xs:element name="Windings3FltMagExceed" type="xs:boolean" nillable="true"/>
<xs:element name="Windings3Voltage" type="xs:int" nillable="true"/>
<xs:element name="MetaAttribs">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:all>
</xs:complexType>

<xs:complexType name="FailureType">
  <xs:sequence>
    <xs:element name="Id" type="xs:int"/>
    <xs:element name="Severity" type="xs:int" nillable="true"/>
    <xs:element name="Time" type="xs:long" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>
</xs:complexType>
</xs:schema>

```

3.7 ElectricAMISdu Schema

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="ElectricAMIEventsSdu" type="electricAMIEventsSdu"/>

  <xs:element name="ElectricAMIReadingsSdu" type="electricAMIReadingsSdu"/>

  <xs:element name="ElectricAMISdu" type="electricAMISdu"/>

  <xs:complexType name="electricAMIReadingsSdu">
    <xs:all>
      <xs:element name="amiSduId" type="xs:long"/>
      <xs:element name="appDeviceId" type="xs:long"/>
      <xs:element name="delta" type="xs:double" minOccurs="0"/>
      <xs:element name="qualityCode" type="xs:string" minOccurs="0"/>
      <xs:element name="qualityCodeDescription" type="xs:string" minOccurs="0"/>
      <xs:element name="readingDate" type="xs:dateTime" minOccurs="0"/>
      <xs:element name="readingTypeId" type="xs:string" minOccurs="0"/>
      <xs:element name="readingTypeDescription" type="xs:string" minOccurs="0"/>
      <xs:element name="Received" type="xs:dateTime" minOccurs="0"/>
      <xs:element name="uLpNodeId" type="xs:long"/>
      <xs:element name="value" type="xs:double"/>
    </xs:all>
  </xs:complexType>

  <xs:complexType name="parseMessageSummary" abstract="true">
    <xs:sequence/>
  </xs:complexType>

  <xs:complexType name="electricAMISdu">
    <xs:all>
      <xs:element name="AppTypeID" type="xs:int"/>
      <xs:element name="App_Device_Id" type="xs:long"/>
      <xs:element name="eventData">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="event" type="electricAMIEventsSdu" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="Failures">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="item" type="FailureType" nillable="true" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="messageSummary" type="xs:string" minOccurs="0"/>
      <xs:element name="Device_Id" type="xs:long"/>
      <xs:element name="readingData">

```

```

    <xs:complexType>
      <xs:sequence>
        <xs:element name="reading" type="electricAMIReadingsSdu" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <xs:element name="Message_Received" type="xs:Long"/>
  <xs:element name="ULP_Node_Id" type="xs:Long"/>
  <xs:element name="UplinkType" type="UplinkType" minOccurs="0"/>
  <xs:element name="MetaAttribs">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Attrib" type="XMLMetaAttrib" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:all>
</xs:complexType>

<xs:complexType name="FailureType">
  <xs:sequence>
    <xs:element name="Id" type="xs:int"/>
    <xs:element name="Severity" type="xs:int" nillable="true"/>
    <xs:element name="Time" type="xs:Long" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="XMLMetaAttrib">
  <xs:sequence>
    <xs:element name="Name" type="xs:string" nillable="true"/>
    <xs:element name="Value" type="xs:string" nillable="true"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="electricAMIEventsSdu">
  <xs:all>
    <xs:element name="amiSduId" type="xs:Long"/>
    <xs:element name="appDeviceId" type="xs:Long"/>
    <xs:element name="categoryCodeId" type="xs:string" minOccurs="0"/>
    <xs:element name="eventDescription" type="xs:string" minOccurs="0"/>
    <xs:element name="failureTypeId" type="xs:int" minOccurs="0"/>
    <xs:element name="occurenceDate" type="xs:dateTime" minOccurs="0"/>
    <xs:element name="Received" type="xs:dateTime" minOccurs="0"/>
    <xs:element name="ulpNodeId" type="xs:Long"/>
  </xs:all>
</xs:complexType>

<xs:simpleType name="RequestType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="MDMS_READ"/>
    <xs:enumeration value="MDMS_CONNECT"/>
    <xs:enumeration value="MDMS_DISCONNECT"/>
  </xs:restriction>
</xs:simpleType>

```

```
<xs:enumeration value="MDMS_CONNECT_STATE"/>
<xs:enumeration value="MDMS_LOAD_PROFILE"/>
<xs:enumeration value="MDMS_DEMAND_RESET"/>
<xs:enumeration value="EMCM_GET_POWER_QUALITY_REPORT"/>
<xs:enumeration value="EMCM_GET_POWER_QUALITY_REPORT_LINE_DIAG"/>
<xs:enumeration value="EMCM_GET_POWER_QUALITY_REPORT_INST_DEMAND"/>
<xs:enumeration value="EMCM_GET_POWER_QUALITY_REPORT_INST_DISTORTION"/>
<xs:enumeration value="MDMS_ARM_TO_CONNECT "/>

<xs:enumeration value="EMCM_GET_LOGS"/>
<xs:enumeration value="EMCM_GET_METER_INFO"/>
<xs:enumeration value="EMCM_RESET_NODE"/>
<xs:enumeration value="EMCM_RESET_EMCM_E"/>
<xs:enumeration value="EMCM_RESET_METER"/>
<xs:enumeration value="EMCM_CLEAR_METER_FLAG"/>
<xs:enumeration value="EMCM_UPLOAD_MARRIAGE_FILE"/>
<xs:enumeration value="EMCM_SET_CONFIG_VALUE"/>
<xs:enumeration value="EMCM_UPLOAD_MARRIAGE_FILE_CSV"/>
<xs:enumeration value="EMCM_SET_MDMS_SERVICE_STATE"/>
<xs:enumeration value="EMCM_GET_REST_SERVICE_URL"/>
<xs:enumeration value="EMCM_HARD_RESET_EMCM"/>
<xs:enumeration value="EMCM_CLEAR_ALL_METER_FLAGS"/>
</xs:restriction>
</xs:simpleType>

<xs:simpleType name="UplinkType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="NONE"/>
    <xs:enumeration value="EVENT"/>
    <xs:enumeration value="BULK_READINGS"/>
    <xs:enumeration value="INTERVAL_READINGS"/>
    <xs:enumeration value="METER_INFO"/>
    <xs:enumeration value="RELAY_STATE"/>
  </xs:restriction>
</xs:simpleType>
</xs:schema>
```