



AEMP TELEMATICS DATA STANDARD V1.0

Prepared February 5, 2010

1. INTRODUCTION

The AEMP Telematics Data Standard is an XML web service that provides information about fleets of equipment. The information about a fleet is provided as a resource, typically on the Internet, at a known Uniform Resource Location (URL). Any number of fleets can be represented, each with its own URL.

Clients can access a fleet resource by sending an HTTPS GET request to the server at the given location. The server responds with an XML equipment information (EI) document whose vocabulary is defined in this specification.

2. SECURITY AND ACCESS CONTROL

Implementers will control access via Basic Access Authentication using HTTPS, as defined by the Internet Engineering Task Force (IETF). Please refer to <http://www.ietf.org> for additional information.

The telematics provider will assign security credential and access information when the end user registers the fleet. Each telematics provider will have its own registration procedure. Please contact your telematics provider for information on how to register for access to data via the AEMP Telematics Data Standard.

The response is a full snapshot of the fleet. If the fleet contains no equipment at the time of the snapshot, an empty document is returned.

To prevent excessively frequent access, the provider may return 503 Service Unavailable for requests that are more frequent than one time per hour.

3. XML FILE FORMAT

XML version 1.0 is used. The recommended encoding is UTF-8. EI files are expected to be stand-alone documents. The following XML namespace is used:

`http://schemas.aemp.org/fleet`

The file or stream that contains one EI document consists of zero or more records. Each record consists of several fields, which are detailed below.

An EI document is sent without a wrapper (such as SOAP). Its MIME type is text/xml.

4. ROOT ATTRIBUTES

The document element is named `Fleet`, and it carries two attributes:

- Version
- SnapshotTime

The version is an integer that is used to distinguish different versions of the XML schema. Whenever a breaking change in the schema is made, this number is incremented.

The snapshot time is the date and time at which the snapshot of the fleet was created. Its format is described in §38, Date and Time Formats, below.

Each field is described in detail in the following sections.

5. DATA FIELDS

Each record comprises the following fields in the following format: Descriptive / (Matching Element Names)

- Header information (EquipmentHeader)
 - Telematics Unit Installation Date (UnitInstallDateTime)
 - Equipment Make (Make)
 - Equipment Model (Model)
 - Equipment ID (EquipmentID)
 - Serial number (SerialNumber)
- Last known location (Location)
 - Date and time (datetime)
 - Latitude of location (Latitude)
 - Longitude of location (Longitude)
 - Altitude of location (Altitude)
 - Unit of measure of altitude
 - Feet and inches or
 - Meters
- Cumulative operating hours (CumulativeOperatingHours)
 - Date and time (datetime)
 - Life to date in operating hours (Hour)
 - Data reset date and time (ResetDateTime)
- Amount of fuel used (FuelUsed)
 - Date and time (datetime)
 - Unit of measure of fuel (FuelUnits)
 - Cumulative fuel used to date (FuelConsumed)
 - Data reset date and time (ResetDateTime)
- Amount of fuel used in the last 24 hours (FuelUsedLast24)
 - Date and time (datetime)
 - Unit of measure of fuel (FuelUnits)
 - Fuel used past 24 hrs (FuelConsumed)
- Distance traveled (Distance)
 - Date and time (datetime)
 - Unit of measure of distance (OdometerUnits)
 - Current odometer reading (Odometer)
 - Data reset date and time (ResetDateTime)

6. TELEMATICS UNIT INSTALLATION DATE

This date and time describes when the telematics unit was installed on the machine. Its format is described in §38, Date and Time Formats, below. This field is optional, and if blank, it is assumed that the telematics unit was installed when the machine was built.

7. EQUIPMENT MAKE

Equipment Make is the name of the manufacturer of the vehicle or equipment. It is important to note that the Manufacturer's Name may be different from that of the telematics unit provider. The data type of the Equipment Make is string. Its length is unbounded.

8. EQUIPMENT MODEL

Equipment Model is the model or series of the vehicle or equipment. The data type of the Equipment Model is string. Its length is unbounded.

9. EQUIPMENT ID

The Equipment ID identifies the end user's name for an individual vehicle or piece of equipment. The end user will provide this information to the telematics provider during fleet registration. As this field is defined by the end-user, it is not a unique identifier. Its data type is string, and its length is unbounded.

10. SERIAL NUMBER

The serial number identifies the specific instance of the vehicle or equipment. It is the VIN or Serial Number assigned by the manufacturer at the time that the machine was assembled. Its data type is string, and its length is from 1 to 17 characters.

11. LAST KNOWN LOCATION

The last known equipment location is expressed by these separate fields: date-time, latitude, longitude, and altitude. The last known equipment location field is optional.

12. DATE AND TIME OF LOCATION

The date and time indicates when the vehicle was at the described location. Its format is described in §38, Date and Time Formats, below.

13. LATITUDE OF LOCATION

The latitude is expressed as a signed decimal number with four digits of precision in the range from -90.0000 to +90.0000 degrees. The latitude at the equator is represented by 0 degrees. Latitudes north of the equator are represented as positive numbers; those south, by negative numbers.

14. LONGITUDE OF LOCATION

The longitude is expressed as a signed decimal number with four digits of precision in the range from -180.0000 to +180.0000 degrees. The prime meridian at Greenwich England is represented by 0 degrees. Longitudes to the west of the prime meridian are represented as negative numbers; those to the east, by positive numbers.

15. ALTITUDE OF LOCATION

The altitude is expressed as a distance above mean sea level of the vehicle or equipment. It can be represented either as feet and inches or as meters, depending on the value of the Unit of Measure of Altitude. This field is optional.

16. UNIT OF MEASURE OF ALTITUDE

The altitude of the location can be expressed in either feet and inches or meters. The unit of measure of altitude indicates which unit is being used. If the altitude is included in the response, this field is mandatory. It must have the value “feet-inches” or “meters”.

17. FEET OF ALTITUDE

If the altitude of location is included, and the unit of measure of altitude is “feet-inches,” then this field is required and indicates the portion of the altitude that is represented by feet. It is an unsigned integer. If the unit of measure of altitude is not “feet-inches,” this field must be omitted.

18. INCHES OF ALTITUDE

If the altitude of location is included, and the unit of measure of altitude is “feet-inches,” then this field is required and indicates the portion of the altitude that is represented by inches. It is an unsigned integer in the range from 0 to 11. If the unit of measure of altitude is not “feet-inches,” this field must be omitted.

19. METERS OF ALTITUDE

If the altitude of location is included, and the unit of measure of altitude is “meters,” then this field is required and indicates the altitude in meters. It is a decimal number. If the unit of measure of altitude is not “meters,” this field must be omitted.

20. TOTAL OPERATING HOURS

The current lifetime total operating hours of the vehicle or equipment is expressed by three separate fields: date-time, cumulative operating hours, and date-time of data reset. Generally coincides with service meter hours. This field is optional.

21. DATE AND TIME OF CUMULATIVE OPERATING HOURS

The date and time indicates when the vehicle was the described age (i.e. when the value for cumulative operating hours was valid). Its format is described in §38, Date and Time Formats, below.

22. CUMULATIVE OPERATING HOURS

The current total lifetime operating hours of the vehicle or equipment is expressed as a duration. Its format is specified by ISO Standard 8601.

23. DATE AND TIME OF DATA RESET, OPERATING HOURS

The date and time that the operating hours were reset to some value other than the next increment, such as may occur with an ECM replacement. If no value is returned, it is assumed that the data has not been reset. Its format is described in §38, Date and Time Formats, below.

24. FUEL USED TO DATE (PREFERRED)

The amount of fuel the vehicle has used is expressed by four fields: date-time, unit of measure of fuel, amount of fuel, and date-time of data reset. This field is optional. This is the cumulative amount of fuel used by the unit since inception. This is the preferred fuel measure, and should always be included when the telematics provider is able to support cumulative fuel.

25. DATE AND TIME OF FUEL USED TO DATE

The date and time indicates when the vehicle had used the specified amount of fuel. Its format is described in §38, Date and Time Formats, below.

26. UNIT OF MEASURE OF FUEL USED TO DATE

Quantity of fuel can be expressed in either liters or gallons. The unit of measure of fuel field indicates which unit is being used. It must have the value “liter” or “gallon”. It may not be omitted.

27. AMOUNT OF FUEL USED TO DATE

This field indicates the quantity of fuel that has been used cumulatively by the vehicle or equipment as of the specified date and time. Its data type is unsigned integer, which includes all

integral values from 0 to 4,294,967,295, inclusive. Note that commas are not included in the XML file. This field is optional.

28. DATE AND TIME OF DATA RESET, FUEL

The date and time that the value for fuel used to date was reset to some value other than the next increment, such as may occur with an ECM replacement. If no value is returned, it is assumed that the data has not been reset. Its format is described in §38, Date and Time Formats, below.

29. FUEL USED IN THE LAST 24 HOURS (ALTERNATIVE, NOT PREFERRED)

The amount of fuel the vehicle used during the last 24 hours is expressed by three fields: date-time, unit of measure of fuel, and amount of fuel. This field is optional. This is not the preferred measure of fuel, but may be used as an alternative to “FUEL USED TO DATE” in the event that a telematics provider is unable to support that preferred measure.

30. DATE AND TIME OF FUEL USED IN THE LAST 24 HOURS

The date and time indicates when the 24-hour period ended during which the vehicle used the specified amount of fuel. Its format is described in §38, Date and Time Formats, below.

31. UNIT OF MEASURE OF FUEL USED IN THE LAST 24 HOURS

Quantity of fuel can be expressed in either liters or gallons. The unit of measure of fuel field indicates which unit is being used. It must have the value “liter” or “gallon”. It may not be omitted.

32. AMOUNT OF FUEL USED IN THE LAST 24 HOURS

This field indicates the quantity of fuel that was used by the vehicle or equipment during the 24-hour period that ended at the specified date and

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time. Its data type is unsigned integer, which includes all integral values from 0 to 4,294,967,295, inclusive. Note that commas are not included in the XML file. This field is optional.

33. DISTANCE TRAVELED

The distance the vehicle has traveled is expressed by four fields: date-time, unit of measure of distance, odometer reading, and date-time of data reset. This field is optional.

34. DATE AND TIME OF DISTANCE

The date and time indicates when the vehicle had traveled the specified distance. Its format is described in §38, Date and Time Formats, below.

35. UNIT OF MEASURE OF DISTANCE

When available on a vehicle or piece of equipment, the distance traveled by the vehicle can be expressed in either kilometers or miles. The unit of measure of distance field indicates which unit is being used. It must have the value “kilometer” or “mile”. It may not be omitted.

36. CURRENT ODOMETER READING

When available on a vehicle or piece of equipment, this field indicates the cumulative

ISO-8601 Date & Time are expressed as:

YYYY-MM-DDThh:mm:ss

For further information on the ISO-8601 Date & Time format, see

http://www.iso.org/iso/date_and_time_format

Note that minutes and seconds are optional as per ISO-8601.

distance the vehicle has traveled as of the specified date and time. Its data type is unsigned integer, which includes all integral values from 0 to 4,294,967,295, inclusive. Note that commas are not included in the XML file.

37. DATE AND TIME OF DATA RESET, ODOMETER

The date and time that the value for odometer reading was reset to some value other than the next increment, such as may occur with an ECM replacement. If no value is returned, it is assumed that the data has not been reset. Its format is described in §38, Date and Time Formats, below

38. DATE AND TIME FORMATS

All dates and times in an EI document are formatted as ISO-8601 “date and time” that includes the year, month, day, hour, minutes, and seconds. It does not include fractional seconds. If the information available to the server does not include seconds, the seconds are set to zero. It is expressed in Universal Coordinated Time (UTC) with the use of the UTC indicator (“Z”).



APPENDIX A. DATA SCHEMA

The following XML Schema describes the format of the XML file.

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema attributeFormDefault="unqualified" elementFormDefault="qualified"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://schemas.aemp.org/fleet"
  xmlns="http://schemas.aemp.org/fleet"
  >
  <xs:element name="Fleet">
    <xs:complexType>
      <xs:sequence>
        <xs:element maxOccurs="unbounded" name="Equipment">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="EquipmentHeader" type="EquipmentHeader"
                minOccurs="1" maxOccurs="1"/>

              <xs:element name="Location" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="Latitude" type="lat" />
                    <xs:element name="Longitude" type="long" />
                    <xs:element name="Altitude" type="altitude" minOccurs="0"
                      maxOccurs="1"/>
                  </xs:sequence>
                  <xs:attribute name="datetime" type="xs:dateTime" use="required"/>
                </xs:complexType>
              </xs:element>

              <xs:element name="CumulativeOperatingHours" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="Hour" type="xs:duration" />
                    <xs:element name="ResetDateTime" minOccurs="0" maxOccurs="1"
                      type="xs:dateTime" />
                  </xs:sequence>
                  <xs:attribute name="datetime" type="xs:dateTime" use="required"/>
                </xs:complexType>
              </xs:element>

              <xs:element name="FuelUsed" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="FuelUnits" type="fueluom" />
                    <xs:element name="FuelConsumed" type="xs:unsignedInt" />
                  </xs:sequence>
                  <xs:attribute name="datetime" type="xs:dateTime" use="required"/>
                </xs:complexType>
              </xs:element>

              <xs:element name="FuelUsedLast24" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="FuelUnits" type="fueluom" />
                    <xs:element name="FuelConsumed" type="xs:unsignedInt" />
                  </xs:sequence>
                  <xs:attribute name="datetime" type="xs:dateTime" use="required"/>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
```

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```
<xs:element name="Distance" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="OdometerUnits" type="odometeruom" />
      <xs:element name="Odometer" type="xs:unsignedInt" />
      <xs:element name="ResetDateTime" minOccurs="0" maxOccurs="1"
        type="xs:dateTime" />
    </xs:sequence>
    <xs:attribute name="datetime" type="xs:dateTime" use="required"/>
  </xs:complexType>
</xs:element>

</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
<xs:attribute name="version" type="xs:unsignedInt" use="required"/>
<xs:attribute name="snapshotTime" type="xs:dateTime" use="required"/>
</xs:complexType>
</xs:element>
<xs:simpleType name="serno">
  <xs:restriction base="xs:string">
    <xs:minLength value="1"/>
    <xs:maxLength value="17"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="lat">
  <xs:restriction base="xs:decimal">
    <xs:totalDigits value="6"/>
    <xs:fractionDigits value="4"/>
    <xs:minInclusive value="-90.0000"/>
    <xs:maxInclusive value="+90.0000"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="long">
  <xs:restriction base="xs:decimal">
    <xs:totalDigits value="7"/>
    <xs:fractionDigits value="4"/>
    <xs:minInclusive value="-180.0000"/>
    <xs:maxInclusive value="+180.0000"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="fueluom">
  <xs:restriction base="xs:string">
    <xs:enumeration value="gallon"/>
    <xs:enumeration value="liter"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="odometeruom">
  <xs:restriction base="xs:string">
    <xs:enumeration value="mile"/>
    <xs:enumeration value="kilometer"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="altitudeuom">
  <xs:restriction base="xs:string">
    <xs:enumeration value="feet-inches"/>
    <xs:enumeration value="meters"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="inch">
  <xs:restriction base="xs:unsignedInt">
```

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```
<xs:fractionDigits value="0"/>
<xs:minInclusive value="0"/>
<xs:maxInclusive value="11"/>
</xs:restriction>
</xs:simpleType>
<xs:complexType name="EquipmentHeader">
  <xs:sequence>
    <xs:element name="UnitInstallDateTime" minOccurs="0" maxOccurs="1"
      type="xs:dateTime" />
    <xs:element name="Make" minOccurs="0" maxOccurs="1"
      type="xs:string" />
    <xs:element name="Model" minOccurs="0" maxOccurs="1"
      type="xs:string" />
    <xs:element name="EquipmentID" minOccurs="0" maxOccurs="1"
      type="xs:string" />
    <xs:element name="SerialNumber" minOccurs="0" maxOccurs="1"
      type="xs:string" />
  </xs:sequence>
</xs:complexType>
<xs:complexType name="altitude">
  <xs:sequence>
    <xs:element name="AltitudeUnits" type="altitudeuom"/>
    <xs:choice>
      <xs:sequence>
        <xs:element name="Feet" type="xs:unsignedInt"/>
        <xs:element name="Inches" type="xs:string"/>
      </xs:sequence>
      <xs:element name="Meters" type="xs:decimal"/>
    </xs:choice>
  </xs:sequence>
</xs:complexType>
</xs:schema>
```

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APPENDIX B. SAMPLE FILE

The following is an example of a data file.

```
<?xml version="1.0" encoding="utf-8"?>
<Fleet version="1" snapshotTime="2010-02-09T16:48:00Z" xmlns="http://schemas.aemp.org/fleet">
  <Equipment>
    <EquipmentHeader>
      <UnitInstallDateTime>2010-01-10T07:58:00Z</UnitInstallDateTime>
      <Make>XYZOEM</Make>
      <Model>i93ED</Model>
      <EquipmentID>78907X</EquipmentID>
      <SerialNumber>123YJA7334912436</SerialNumber>
    </EquipmentHeader>
    <Location datetime="2010-02-09T06:40:00Z">
      <Latitude>39.2855</Latitude>
      <Longitude>-84.4316</Longitude>
      <Altitude>
        <AltitudeUnits>meters</AltitudeUnits>
        <Meters>28.5</Meters>
      </Altitude>
    </Location>
    <CumulativeOperatingHours datetime="2010-02-09T15:18:00Z">
      <Hour>P321DT9H43M30S</Hour>
      <ResetDateTime>2009-02-23T05:34:30Z</ResetDateTime>
    </CumulativeOperatingHours>
    <FuelUsed datetime="2010-02-09T11:51:00Z">
      <FuelUnits>gallon</FuelUnits>
      <FuelConsumed>12345</FuelConsumed>
    </FuelUsed>
    <FuelUsedLast24 datetime="2010-02-09T09:13:00Z">
      <FuelUnits>gallon</FuelUnits>
      <FuelConsumed>45</FuelConsumed>
    </FuelUsedLast24>
    <Distance datetime="2010-02-09T07:16:00Z">
      <OdometerUnits>kilometer</OdometerUnits>
      <Odometer>28</Odometer>
      <ResetDateTime>2009-12-16T07:16:00Z</ResetDateTime>
    </Distance>
  </Equipment>
  <Equipment>
    <EquipmentHeader>
      <UnitInstallDateTime>2010-01-10T14:09:00Z</UnitInstallDateTime>
      <Make>XYZOEM</Make>
      <Model>i93ED</Model>
      <EquipmentID>78908X</EquipmentID>
      <SerialNumber>123YJA5467812</SerialNumber>
    </EquipmentHeader>
    <Location datetime="2010-02-09T11:38:00Z">
      <Latitude>39.4012</Latitude>
      <Longitude>-84.2345</Longitude>
      <Altitude>
        <AltitudeUnits>feet-inches</AltitudeUnits>
        <Feet>88</Feet>
        <Inches>6</Inches>
      </Altitude>
    </Location>
    <CumulativeOperatingHours datetime="2010-02-09T09:19:00Z">
      <Hour>P3DT5H</Hour>
      <ResetDateTime>2010-01-07T04:19:00Z</ResetDateTime>
    </CumulativeOperatingHours>
    <FuelUsed datetime="2010-02-09T06:54:00Z">
```

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```
<FuelUnits>liter</FuelUnits>
<FuelConsumed>12345</FuelConsumed>
</FuelUsed>
<FuelUsedLast24 datetime="2010-02-09T15:20:00Z">
  <FuelUnits>liter</FuelUnits>
  <FuelConsumed>34</FuelConsumed>
</FuelUsedLast24>
<Distance datetime="2010-02-09T09:15:00Z">
  <OdometerUnits>mile</OdometerUnits>
  <Odometer>12</Odometer>
  <ResetDateTime>2009-12-16T09:15:00Z</ResetDateTime>
</Distance>
</Equipment>
<Equipment>
  <EquipmentHeader>
    <UnitInstallDateTime>2010-01-10T15:09:00Z</UnitInstallDateTime>
    <Make>XYZOEM</Make>
    <Model>i93ED</Model>
    <EquipmentID>78908X</EquipmentID>
    <SerialNumber>123YJA5467819</SerialNumber>
  </EquipmentHeader>
  <CumulativeOperatingHours datetime="2010-02-09T07:30:00Z">
    <Hour>P4DT3H</Hour>
    <ResetDateTime>2010-01-06T04:30:00Z</ResetDateTime>
  </CumulativeOperatingHours>
  <FuelUsed datetime="2010-02-09T13:44:00Z">
    <FuelUnits>gallon</FuelUnits>
    <FuelConsumed>86</FuelConsumed>
  </FuelUsed>
  <FuelUsedLast24 datetime="2010-02-09T10:10:00Z">
    <FuelUnits>gallon</FuelUnits>
    <FuelConsumed>6</FuelConsumed>
  </FuelUsedLast24>
</Equipment>
</Fleet>
```

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APPENDIX C. HTTP ERRORS

Providers follow the standard HTTP protocol as specified in RFC 2616, *Hypertext Transfer Protocol – HTTP/1.1*. Specifically, the following responses are used in this protocol:

1. CLIENT ERROR 4XX

- 400 Bad Request
- 401 Unauthorized
- 402 Payment Required
- 403 Forbidden
- 404 Not Found
- 405 Method Not Allowed
- 406 Not Acceptable
- 407 Proxy Authentication Required
- 408 Request Timeout
- 409 Conflict
- 410 Gone
- 411 Length Required
- 412 Precondition Failed
- 413 Request Entity Too Large
- 414 Request-URI Too Long
- 415 Unsupported Media Type
- 416 Requested Range Not Satisfiable
- 417 Expectation Failed

2. SERVER ERROR 5XX

- 500 Internal Server Error
- 501 Not Implemented
- 502 Bad Gateway
- 503 Service Unavailable
- 504 Gateway Timeout
- 505 HTTP Version Not Supported

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