Data Pump Messages Version 2

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CalAmp Telematics Cloud Data Pump Messages Version 2

Contents

1   CalAmp Telematics Cloud Data Pump API Services

CalAmp Telematics Cloud (CTC) Data Pump API Services enable the retrieval of messages which have been sent by devices and queued in the platform. Messages are removed from the Data Pump queue once they are retrieved. Messages must be retrieved within 14 days of arrival or they are purged.

Note that this document describes Version 2 of the Data Pump messaging format.

The service endpoints are:

- **Event Count API Service –** This API Service gives the count of currently queued events.
- **Events API Service –** This API Service returns the specified number of queued events. This is a FIFO queue of received messages of all types from all devices. Events are deleted from the Data Pump queue once they are retrieved. The service response contains the counts of and actual messages for each of the different message types.

2   Data Pump Message Types

The 3 main categories of message types that are retrieved from the Data Pump are described in the next sections:

- **AVL Events** – Automatic Vehicle Location events that report GPS, Accelerometer and Digital Input related information. Each message has an **eventType** and possible additional information. See **Section 3 below**.

- **Device Command Events** – Devices can be commanded to reboot, report their location or to read / write PEG parameters. The responses to those commands are described in **Section 3.1 below**.

- **Telematics Events** – For devices that are capable of reading the engine bus, daily, hourly and ad hoc messages are sent to report telematics information. See **Section 5 below**.
    - dtcEvents
    - jbusDtc1708Events
    - jbusDtc1939Events
    - jbusHourlyReportEvents
    - jbusDailyReportEvents
    - jbusEvents
    - vehicleBusCapabilitiesEvents
    - jbusConstructionDailyReportEvents
    - jbusConstructionHourlyReportEvents
    - jbusFaultReportEvents
    - jbusHydraulicReportEvents

3   AVL Events

3.1   avlEvent Message Structure

Each **avlEvent** message has the following <u>common</u> elements:

Note that the message described is from the default CalAmp script for fleet vehicles.

Message Element	Example Value	Description
address	{	Reverse geo-coded address information based on the reported lat lon.
city	"Herndon",	
country	"US",	
county	"Fairfax",	
crossStreet	"St Margaret's Road",	
addressLatitude	38.1457119,	The latitude of the street address the device's location is closest to.
addressLongitude	-77.376039,	The longitude of the street address the device's location is closest to.
postalCode	"20170",	
postedSpeedLimit	25,	
roadTypeCode	"Paved, Private",	
speedLimitUnits	"mph",	
state	"Virginia",	
stateProvinceCd	"VA",	
street	"Viking Drive",	
tollRoadFlag	"false"	
} end of address		
carrier	260,	The System Identification Code (SID) of the Carrier/Operator the wireless modem is using
fixStatus	false,	True / false indicator of whether the GPS quality is above the minimal acceptable threshold
hdop	1.3,	The GPS Horizontal Dilution of Precision - it is a unit-less value. Lower numbers indicate higher GPS quality
heading	225,	The direction of travel in degrees from true North
latitude	38.1457283,	The latitude reading of the GPS receiver, measured in degrees with a 1x10^-7 degree lsb
longitude	-77.376028,	The longitude reading of the GPS receiver, measured in degrees with a 1x10^-7 degree lsb
satellites	7,	The number of satellites used in the GPS solution, i.e. visible to the device
deviceAirId	"CZ2-LYM-51G",	Unique 9 character identifier of the instance of this device
deviceEsn	"4532251904",	The Electronic Serial Number of the device

deviceMessageSequence Number	2794,	A sequence number for the message assigned by the sending device
deviceId	29,	Identifier of the device within the Account
eventTime	"2016-09-26T18:20:20.000Z",	When the event was _recorded_ at the device
messageUuid	"863d1eb8-1d35-45d4-b557-f40f28f532f4",	a unique identifier for this message assigned by the platform
asset	{	If an Asset is associated with this device, it is identified in the following fields
href	"https: //connect.calamp.com/connect/services/assets/64"	A link to the asset entity
rel	"asset"	
title	"WAH74F37N070944"	
vin	"WAUDH74F37N070944"	
} end of asset		
rawDeviceHexMessage	"83054532251904010101020aea57e966e457e966e … ",	The complete contents of the message sent by the device in raw format
port	0,	
eventCode	2,	The numeric code of the messageType (0-255)
inputs	{	The status of the input ports on the device (if applicable)
ignition	false,	
input1	false,	
input2	false,	
input3	true,	
input4	false,	
input5	false,	
input6	false,	
input7	false,	
value	"00010000"	a bitmap indicating input status
} end of inputs		
eventType	"IGON",	
deviceDataConverted	{	
type	"avlDeviceData",	
accumulators	[	Which accumulators are used and the values in accumulators will depend on the PEG script in the device.
{		

label	"GPSOdometer",	All CalAmp default scripts contain the GPS-derived distance meter in accumulator 0. Other specific messageTypes contain other accumulators and are described below.
value	"11157565.86",	
index	"0",	
units	"m",	
type	"Distance"	
},		
] end of accumulators		
altitude	{	Altitude derived from gps
value	"12566",	
units	"cm"	
} end of altitude		
gpsSpeed	{	Speed derived from gps
value	"0.00",	
units	"km/h"	
} end of gps speed		
rssi	{	The received signal strength on the data network
value	"-99.00",	
units	"dB"	
} end of rssi		
systemOfUnits	"Metric"	The system for units of measure in effect for deviceDataConverted.
} end of deviceDataConverted		
commState	{	Flags indicating the communication state of the device.
available	true,	
connected	true,	
dataService	true,	
networkService	true,	
roaming	true,	
threeGNetwork	false,	
voiceCallActive	false	
} end of comm state		
gpsFixStatus	{	Flags indicating quality of gps signal
predicted	false,	
differentiallyCorrected	false,	
lastKnown	false,	
invalidFix	false,	
twoDFix	false,	
historic	true,	
invalidTime	false	
} end gpsFixStatus		

3.2 Default AVL Event Types:

For CalAmp default scripts, these AVL Event Types are with possible additional information as is described in the following sections:

Event Type	Event Code	Event Name – Corresponding LMU Trigger
POWUP	0	Power On – The LMU has been powered Up and is running on external power
ALIVE	1	Alive – A once per 24 hour indication that the LMU is alive.
IGON	2	Ignition On – The Ignition input has transitioned from low to high. Note that for devices capable of reading the engine bus, this indicates the Ignition input is high <u>and</u> the engine has positive RPMs.
IGOFF	3	Ignition Off – The ignition input has transitioned from high to low
START	4	Start – The LMU's speed indicates movement. Default is >= 5 mph for 10 secs.
STOP	5	Stop – The LMU's speed indicates stopping. Default is < 5 mph for 120 seconds.
PRIOD	6	Moving – One of the (Time, Distance, Heading) settings for location reporting has been reached. Default is to report every 120 seconds or with every heading change of > 45 degrees while moving.
SPEED	7	Begin Speeding – The speed is >= the Speed threshold for the configured time interval. Default = 65 mph for 30 seconds.
NOSPD	8	End Speeding – The speed is < the Speed threshold. Max speed attained and duration of speeding interval are also included. See Section 3.5 below for additional data provided with this event.
GPSY	9	GPS Acquired – The GPS receiver acquired a fix.
GPSN	10	GPS Lost – The GPS receiver has lost its fix.
CGAIN	11	Comm Up – The wireless modem connected to the data network.
CLOSS	12	Comm Down – The wireless modem lost its data connection.
INxHI, INxLO	14 - 17	Input Transition – A Digital Input (x) transitioned its state to High or Low.
ACCEL	20	Acceleration – Reported when excessive acceleration is detected. See Section 3.4 below for additional data provided with this event.
DECEL	21	Deceleration – Reported when excessive deceleration (hard braking) is detected. See Section 3.4 below for additional data provided with this event.
ZONE_ENTRY	22	Geo-Zone Exit – Reported when a Geo-Zone is exited. See Section 3.6 below for additional data provided with this event.
ZONE_EXIT	23	Geo-Zone Exit – Reported when a Geo-Zone is exited. See Section 3.6 below for additional data provided with this event.

DKFOB	24	Driver Key Fob – A operator in a unit equipped with an electronic key reader has touched his key fob to the reader and an ID has been read.
JBUS_PTO_ON	25	PTO On – The vehicle bus has reported that the PTO is in the On state. LMU-4520 or LMU-2620 with jPOD only.
JBUS_PTO_OFF	26	PTO Off – The vehicle bus has reported that the PTO is in the Off state. LMU-4520 or LMU-2620 with jPOD only.
COLLISION	27	Acceleration at or above the configured collision threshold (5g) has been detected indicating the likelihood of a collision.
TOWING_START	28	Movement has been detected in a powered device with its ignition off.
TOWING_STOP	29	Movement has stopped in a powered device with its ignition off.
HARD_CORNERING_LEFT	30	Excessive lateral acceleration
HARD_CORNERING_RIGHT	31	Excessive lateral acceleration
OBD_BOARD_DISABLE	32	The device is capable of reading the OBD-II engine bus in a light-duty vehicle, but has experienced a high number of bus errors causing it to disable its connection to the bus.
OBD_BOARD_ENABLE	33	The device is capable of reading the OBD-II engine bus in a light-duty vehicle, and has enabled its connection to the bus.
LONG_IDLE	34	Ignition On with no movement for longer than the configured threshold time period.
JBUS_DTC_THROTTLE	36	5 or more Diagnostic Codes were sent from a device with a connected jPOD accessory. Diagnostics will be throttled for 1 hour and turned back on again.
APWUP	100	Power On – Asset Tracker Message. Indicates the TTU device has had its battery connected. This is only expected the first time the device is powered.
APOSN	101	Position – Asset Tracker Message. This is the periodic location update.
AMOTN	102	Motion – Asset Tracker Message. This is the indication that the Asset is in motion; it is essentially a periodic location update indicating motion.
ABATLO	103	Battery Low – The voltage provided by the battery in an Asset Tracking device has fallen below its threshold of 5% of its original charge.
ABATOK	104	Battery OK – The voltage provided by the battery in an Asset Tracking device has been restored to at least 50% of its original charge.
BPWUP	200	Battery Power On – Indicates that a battery powered device has switched to operating on its own battery power. It has been disconnected from external power.
BPOSN	201	Position. This is the periodic location update for a device on internal battery power or an externally powered device that is moving with its ignition off (being towed).
BMOTN	202	Motion – Indicates the detection of motion in the Ignition Off state (i.e., towing).

BBATLO	203	Battery Low – The voltage provided by the internal battery in a device has fallen below its threshold of 3400 millivolts.
BBATOK	204	Battery OK – The voltage provided by the internal battery in a device has been restored to below its threshold of 3400 millivolts.

3.3 AVL Event Message additional fields for OBD-II capable devices

Some CalAmp devices are capable of reading a light-duty vehicle's OBD-II engine bus. In those vehicles, the default script can report additional information as described below. This will be in the **deviceDataConverted** element of the message as additional accumulator values for

- Vehicle Bus Speed
- Vehicle Bus Fuel Usage
- Vehicle Bus Odometer

And an additional message element for

- Vehicle Bus Indicators

Message Element	Example Value	Description
accumulators	[	OBD-II capable devices using the default CalAmp script will report additional accumulator values:
{		
label	"GPSOdometer",	All CalAmp default scripts contain the GPS-derived distance meter in accumulator 0. Other specific messageTypes contain other accumulators and are described below.
value	"11157565.86",	
index	"0",	
units	"m",	
type	"Distance"	
},		
{		
label	"VBSpeed",	Speed of the vehicle as read from the Vehicle Bus
value	"43.86",	
index	"6",	
units	"mi/h",	
type	"VBUS: Vehicle Speed"	
},		
{		
label	"VBCalcFuelUsage",	A calculated fuel consumption meter.
value	"11.86",	
index	"7",	
units	"ga",	
type	"VBUS: Calculated Fuel Usage"	
},		
{		
label	"VBOdometer",	The vehicle odometer reading as read from the Vehicle Bus

value	"57565.86",	
index	"8",	
units	"mi",	
type	"Distance"	
},		
] end of accumulators		
vbusIndicators	{	Flags indicating OBD-II Vehicle bus indicators status.
absActiveLamp	false,	
absDashIndicator	false,	
acSystemRefrigerantMonitor	false,	
airbagDashIndicator	false,	
brakePedalPressed	false,	
catalystMonitor	false,	
comprehensiveComponentMonitor	false,	
coolantHotLight	false,	
cruiseControlStatus	false,	
egrSystemMonitor	false,	
evaporativeSystemMonitor	false,	
fuelSystemMonitor	false,	
heatedCatalystMonitor	false,	
ho2SHeaterControlMalfunction	false,	
ho2SHeaterResistanceMalfunction	false,	
ignitionStatus	true,	
milStatus	false,	
misfireMonitor	false,	
o2SensorCircuitNoActivity	false,	
o2SensorHeaterCircuitMalfunction	false,	
oilPressureLamp	false,	
oxygenSensorHeatedMonitor	false,	
oxygenSensorMonitor	false,	
parkBrakeLight	true,	
ptoStatus	false,	
seatBeltFastened	true,	
secondaryAirSystemMonitor	false,	
tpmsStatus	false	
} end of vbusIndicators		

3.4 AVL Event Message additional fields for Acceleration and Deceleration Events

Rapid Acceleration and Hard Braking events report additional information in the CalAmp default scripts.

This will be in the **deviceDataConverted** element of the message as additional accumulator values for

- Acceleration Latitude
- Acceleration Longitude

And additional message elements for

- Acceleration Magnitude
- Accelerometer calibration state
- Acceleration Duration
- Acceleration Starting Speed

Message Element	Example Value	Description
eventType	"ACCEL" or "DECEL"	
deviceDataConverted	{	The deviceDataConverted element contains the data specific to this envetType in the units of measure that match the user's configuration.
type	"avlDeviceData",	
acceleration	{	
accelerationMagnitude	{	
value	"0.25",	
units	"g_force"	
} end accelerationMagnitude		
calibration	"BEST",	
duration	{	
value	"22.00",	
units	"s"	
} end duration		
label	"Acceleration",	
startingSpeed	{	The speed at the time the acceleration began
value	"2.28",	
units	"mi/h"	
} end startingSpeed		
} end acceleration		
accumulators	[	Acceleration events in the default CalAmp script will report additional accumulator values:
{		
label	"Acceleration Latitude",	The Latitude of the location where the acceleration interval began

value	"3891584725",	
index	"10",	
type	"Acceleration Latitude"	
},		
label	"Acceleration Longitude",	The Longitude of the location where the acceleration interval began
value	"3891584725",	
index	"11",	
type	"Acceleration Longitude"	
},		
] end of accumulators		
} end of deviceDataConverted		

3.5 AVL Event Message additional fields for Speeding Events

The End of Speeding Interval event reports additional information in the CalAmp default scripts.

This will be in the **deviceDataConverted** element of the message as additional accumulator values for

- Speeding Stop Time
- GPS Max Speed

Message Element	Example Value	Description
eventType	"NOSPEED"	The end of speeding interval event
accumulators	[	Acceleration events in the default CalAmp script will report additional accumulator values:
{		
label	"Speeding StopTime",	The amount of time that the speeding interval actually stopped prior to the reporting of the end of the speeding interval. This delay in reporting prevents spurious Speeding / NoSPeeding toggling.
value	"30",	
index	"4",	
units	"s",	
type	"Time"	
},		
label	"GPSMaxSpeed",	The maximum speed attained during the speeding interval.
value	"94.30",	
index	"5",	
units	"km/h",	
type	"Speed"	
},		
] end of accumulators		

3.6 AVL Event Message additional fields for Zone Entry / Exit Events

Zone Entry and Exit events report additional information in the CalAmp default scripts.

This will be in the **deviceDataConverted** element of the message as additional accumulator values for

- Current in/out state for all GeoZones
- Previous in/out state for all GeoZones

A bitwise comparison between these bitmaps will yield which zones have been entered or exited.

Message Element	Example Value	Description
eventType	"ZONE_ENTRY" or "ZONE_EXIT"	Events indicating the entry to or exit from pre-defined geographic zones.
accumulators	[	Acceleration events in the default CalAmp script will report additional accumulator values:
{		
label	"GeozoneCurrent",	A 32 bit bitmap indicating the <u>current</u> entered (1) or not entered (0) status of the device with respect to all zones
value	" 1101000111000111 0000001011110000 ",	
index	"10",	
type	"GeoZone"	
},		
label	"GeozonePrevious",	A 32 bit bitmap indicating the <u>previous</u> entered (1) or not entered (0) status of the device with respect to all zones.
value	" 1011000111000111 0000001011110000 ",	
index	"11",	
type	"GeoZone"	
},		
] end of accumulators		

4 Device Command and Response Events

The following Device Command requests can be sent to devices:

- **Reboot Device Request**
- **Location Report Request**
- **Write Parameter Request** sent with a parameter / value list
- **Read Parameter Request** sent with a parameter list

The corresponding responses to these commands arrive on the Data Pump:

Sent Device Command	Received Device Response
Reboot Device Request	**Acknowledgement** with success or failure indicated
Location Report Request	**Locate Report**, which contains the information found in an AVL Message header, above plus the time the last GPS fix was attained.
Write Parameter Request	**Acknowledgement** with success or failure indicated. If the requested parameter is a Geo-Zone definition the request contained the Geo-Zone definition information values. See below
Read Parameter Request	**Device Parameter Read Response(s)** with the parameter(s) and current value(s) included. If the requested parameter is a Geo-Zone definition the response contains the Geo-Zone definition information. See below

4.1 Geo-Zone definition Information

- **Type** = RECTANGLE or CIRCLE
- **Zone Id** = 0-31, supported LMUs can have up to 32 defined Geo-Zones
- **Latitude** of the Zone center point
- **Longitude** of the Zone center point
- **Distance North** to rectangle edge or radius if circle
- **Distance East** to rectangle edge or radius if circle
- **Hysteresis** = How far outside or inside the Zone the Device must travel in order to register the next boundary crossing.

5 Events for Vehicle Engine Monitoring (Telematics)

- Heavy duty vehicles can be equipped with jPOD devices which can report the J1708 and J1939 engine data that is provided by the vehicle's Electronic Control Units. Note that not all vehicles report all values. Data is reported at different intervals as noted below.
- Passenger cars and light duty trucks can be equipped with devices capable of reading the OBD-II engine bus which report the telematics data noted below.
- The Telematics Event Types are:
  - OBD-II DTC Events
  - OBD-II Provision Events
  - J-Bus Diagnostic 1708 Events
  - J-Bus Diagnostic 1939 Events
  - J-Bus Hourly Report Events
  - J-Bus Daily Report Events
  - J-Bus Construction Hourly Report Events
  - J-Bus Construction Daily Report Events
  - J-Bus Construction Daily Usage Report Events

5.1 Telematics Event Types Common Fields

These fields are common to all telematics events messages:

- **deviceEsn** (string, optional) – The Electronic Serial Number of the device, example "4532121405"
- **deviceAirId** (string, optional) – Unique 9 character identifier of the instance of this device, example "G6P-NHL-XCX".
- **deviceId** – Identifier of the device within the Account, example "77".
- **eventTime** (string, optional) – When the event was recorded at the device (UTC Time)
- **messageUuid** (string, optional) – a unique identifier for this message.
- **assetName** (string, optional) – the name of the Asset associated with this device (if any)
- **assetId** – the ID of the Asset associated with this device (if any)

5.2 Telematics Events Units of Measure

Note that in Version 2 messages, all parameter readings include both a value and the explicitly stated units of measure that the value represents.
Example:

```
"engineBatteryVoltage": {
        "value": "24.00",
        "units": "V"},
"engineCoolantPressure": {
        "value": "320.00",
        "units": "kPa"},
"engineCoolantTemperature": {
        "value": "248.00",
        "units": "F"}
```

The default system of units is a configurable option per Account and can be overridden per User.

The choices of System of Units are:

- **US** – Units commonly used in the United States
- **Metric** – commonly used metric units
- **SI** – International Standard Units
- **Device** – Units reported by the device and forwarded as-is with no conversion
- **Mixed** – The Messaging Version 1 utilized units

Measurement Type	US Units	Metric Units	SI Units	Device Units	Mixed Units
Acceleration	g	m/s2	cm/s2	cm/s2	g
Duration Seconds	s	s	s	s	s
Duration Days	d	d	d	d	d
Duration Hours	h	h	h	h	h
Electric Potential	V	mV	mV	mV	mV
Frequency	r/min	r/min	r/min	.1r/min	r/min
Fuel Efficiency	mi/g	kM / L	kM / L	.1 kM / L	mi/g
Length	mi	m	cm or m	cm or m	mi
Percentage	%	%	%	.01 %	%
Power (Signal Strength)	dB	dB	dB	dB	dB
Pressure	lb/in2	kPa	kPa	kPa	kPa
Temperature	F	C	C	1/16 C (signed)	F
Velocity	mi/h	cm/s	cm/s	cm/s	mi/h
Volume	ga	l	l	ml	ga
Volumetric Flow Rate	ml/h	ml/h	ml/h	ml/h	ml/h
Altitude					cm

5.3   OBD-II DTC Events Structure

From LMU-3030 devices or LMU-2620 devices equipped with vPOD. DTC codes are reported as they set / clear. These fields are specific to OBD-II DTC Events messages:

- **gps** (gps, optional) – The information derived from the GPS location determined by the device including measures of GPS quality, street address and GPS-derived Speed. See Section 3.1 above.
- **dtcCode** (string, optional) – The reported 5 character DTC Code, example "P0173"
- **description** (string, optional) – Explanatory text for standard DTC Codes, example, "Fuel Trim Malfunction (Bank 2)"
- **status** (Status, optional) = ['ON' or 'OFF'],

5.4 OBD-II Provision Event Structure

From LMU-3030 devices or LMU devices equipped with vPOD. These messages indicate the Vehicle VIN, OBD protocol and supported readings and indicators. These fields are specific to OBD-II Provision Events messages:

- **vin** (string, optional) – the 17 character Vehicle Identification ID of the vehicle the device is installed in.
- **Reportable Parameter / Indicator flags –** a set of flags that indicate whether specific Parameters and Indicators are capable of being reported by the device in the vehicle.

5.5 J-Bus Diagnostic 1708 Event Structure

From LMU devices equipped with jPOD.   J1708 Diagnostics are reported as they occur. These fields are specific to J-Bus Diagnostic 1708 Events messages:

- **sourceAddress**
- **pid** (integer) – Parameter Identifier
- **csf** (boolean) – Current Status of Fault
- **dct** (boolean) – Diagnostic Code Type
- **lci** (boolean) – Low Character Identifier,
- **oc** (integer) – Occurrence Count
- **fmi** (integer) – Failure Mode Indicator

5.6 J-Bus Diagnostic 1939 Event Structure

From LMU devices equipped with jPOD.   J1939 Diagnostics are reported as they occur.   These fields are specific to J-Bus Diagnostic 1939 Events messages:

- **sourceAddress**
- **fmi** (integer) – Failure Mode Indicator
- **oc** (integer) – Occurrence Count
- **spn** (integer) – Suspect Parameter Number

5.7   J-Bus Fleet Vehicle Reports

These are the message types sent by the standard CalAmp jPOD script indented for use in heavy duty Fleet Vehicles.

5.7.1   J-BUS HOURLY REPORT EVENT STRUCTURE

From LMU devices equipped with jPOD.   J-Bus readings that are reported hourly while the vehicle is running and at every Ignition Off. These fields are specific to J-Bus Hourly Report Events messages:

- **engineCoolantTemperature**
- **engineOilTemperature**
- **engineOilPressure**
- **engineCrankcasePressure**
- **engineCoolantPressure**
- **engineBatteryVoltage**
- **engineFuelTankLevel1**
- **engineFuelTankLevel2**
- **transmissionOilTemperature**
- **averageFuelEconomy**

5.7.2   J-BUS DAILY REPORT EVENT STRUCTURE

From LMU devices equipped with jPOD.   J-Bus readings that are reported once daily. These fields are specific to J-Bus Daily Report Events messages:

- **engineTotalHours**
- **engineIdleHours**
- **engineIdleFuel**
- **engineOilLevel**
- **engineCoolantLevel**
- **DEFTankLevel**

5.8 J-Bus Construction Equipment Reports

These are the message types sent by the standard CalAmp jPOD script indented for use in Construction Equipment.

5.8.1 J-BUS CONSTRUCTION HOURLY REPORT EVENT STRUCTURE

From LMU devices equipped with jPOD.   J-Bus readings that are reported once hourly when the machine is running and at every ignition off. These fields are specific to J-Bus Construction Hourly Report Events messages:

- **totalEngineHours**
- **DEFTankLevel**
- **fuelTankLevel1**

5.8.2 J-BUS CONSTRUCTION DAILY REPORT EVENT STRUCTURE

From LMU devices equipped with jPOD.   J-Bus readings that are reported once daily. These fields are specific to J-Bus Construction Daily Report Events messages.. It shows the Min, Max, and Average of multiple readings for the day:

- **engineTotalFuelUsed**
- **avgEngineFuelRate**
- **avgActualEngineTorque**
- **minEngineSpeed**
- **maxEngineSpeed**
- **avgEngineSpeed**
- **minDEFConcentration**
- **maxDEFConcentration**
- **avgDEFConcentration**
- **minDEFTempr**
- **maxDEFTempr**
- **avgDEFTempr**
- **minEngineOilPressure**
- **maxEngineOilPressure**
- **avgEngineOilPressure**
- **minEngineOilTempr**
- **maxEngineOilTempr**
- **avgEngineOilTempr**
- **minEngineCoolantTempr**
- **maxEngineCoolantTempr**
- **avgEngineCoolantTempr**
- **minEngineFuelTempr1**
- **maxEngineFuelTempr1**
- **avgEngineFuelTempr1**

- **minAmbientAirTempr**
- **maxAmbientAirTempr**
- **avgAmbientAirTempr**
- **minAuxiliaryTempr1**
- **maxAuxiliaryTempr1**
- **avgAuxiliaryTempr1**

5.8.3   J-BUS CONSTRUCTION DAILY USAGE REPORT EVENT STRUCTURE

From LMU devices equipped with jPOD.   J-Bus readings that are reported once daily. These fields are specific to J-Bus Construction Daily Usage Report Events messages. Each represents the amount of time uf usage in each of the categories for torque and throttle position:

- **engineTorque0To10PercentUsage**
- **engineTorque10To20PercentUsage**
- **engineTorque20To30PercentUsage**
- **engineTorque30To40PercentUsage**
- **engineTorque40To50PercentUsage**
- **engineTorque50To60PercentUsage**
- **engineTorque60To70PercentUsage**
- **engineTorque70To80PercentUsage**
- **engineTorque80To90PercentUsage**
- **engineTorqueOver90PercentUsage**
- **positionTorque0To10PercentUsage**
- **positionTorque10To20PercentUsage**
- **positionTorque20To30PercentUsage**
- **positionTorque30To40PercentUsage**
- **positionTorque40To50PercentUsage**
- **positionTorque50To60PercentUsage**
- **positionTorque60To70PercentUsage**
- **positionTorque70To80PercentUsage**
- **positionTorque80To90PercentUsage**
- **positionTorqueOver90PercentUsage**

6   Telematics Data Reference

Data	Description	Reporting Frequency
True Ignition Status	Status based on ignition switch + engine RPM	As **IGON** and **IGOFF** AVL events
Odometer	Reading reported by the ECU, not GPS derived	Included with every AVL event
Vehicle Speed	Reading reported by the ECU, not GPS derived	Included with every AVL event
Fuel Consumption	Lifetime fuel consumption meter	Included with every AVL event
Vehicle VIN	17 character Vehicle Identification Number	Reported Daily and at Device Power-Up
PTO On / Off	PTO Status if it is wired to engine bus.	Reported via **AVL event** as on / off status changes occur
J1708 Diagnostics	Widely used starting in 1994; still in use in older vehicles	Reported as **J-Bus Diagnostic 1708 Events** as they occur
J1939 Diagnostics	Widely adopted by engine manufacturers since 2005	Reported as **J-Bus Diagnostic 1939 Events** as they occur

6.1 Parameter Availability by jPOD Message Type

Parameter	Fleet Hourly	Fleet Daily	Constr. Hourly	Construction Daily	Construction Daily Usage
Engine Coolant Temperature	☑			Min/Max/Avg	
Engine Oil Temperature	☑			Min/Max/Avg	
Engine Crankcase Pressure	☑			Min/Max/Avg	
Engine Coolant Pressure	☑				
Engine Battery Voltage	☑				
Engine Oil Pressure	☑				
Engine Fuel Tank Level 1	☑		☑		
Engine Fuel Tank Level 2	☑				
Transmission Oil Temperature	☑				
Average Fuel Economy	☑				
Engine Total Hours		☑	☑		
Engine Idle Hours		☑			
Engine Idle Fuel		☑			
Engine Oil Level		☑			
Engine Coolant Level		☑			
DEF Tank Level		☑	☑		
Engine Total Fuel				☑	
Engine Fuel Rate				AVG	
Engine Speed (RPMs)				Min/Max/Avg	
DEF Concentration				Min/Max/Avg	
DEF Temperature				Min/Max/Avg	
Fuel Temperature				Min/Max/Avg	
Ambient Air Temperature				Min/Max/Avg	
Auxiliary Temperature 1				Min/Max/Avg	
Engine Torque				AVG	10% Increments
Throttle Position					10% Increments

7 Appendix A – AVL Event Example (Ignition Off Event with OBD-II Data)

"avlEvent": {

"address": {

       "city": "Ashburn",

       "country": "US",

       "county": "Loudoun",

       "crossStreet": "Duke Dr",

       "addressLatitude": 38.25846,

       "addressLongitude": -77.54412,

       "postalCode": "20105",

       "postedSpeedLimit": 40,

       "roadTypeCode": "Paved",

       "speedLimitUnits": "mph",

       "state": "Virginia",

       "stateProvinceCd": "VA",

       "street": "4270 Nogales Ct",

       "tollRoadFlag": "false"

},

"carrier": 260,

"fixStatus": true,

"hdop": 1,

"heading": 8,

"latitude": 38.2584397,

"longitude": -77.4447852,

"satellites": 8,

"deviceAirId": "E-0GYV-5J7H",

"deviceEsn": "4562053398",

"deviceMessageSequenceNumber": 56,

"deviceId": 510,

"eventTime": "2016-09-22T15:55:55.000Z",

"messageUuid": "54008ead-578e-4dc2-9e15-32fdbe7c5500",

"asset": {

       "href": "https://connect.calamp.co.uk/connect/services/assets/64",

       "rel": "asset",

       "title": "WAUDH74F37N070944",

       "vin": "WAUDH74F37N070944"

},

"assetName": "WAUDH74F37N070944",

"assetId": 64,

"rawDeviceHexMessage":

"83054562053398010101 8c05d1c736cb00001ea1000000000000808000104ffaf6f0a00009b03620000000000ffffff

ff0002c9bd0000000000000000000000000000000000000000000000000000000000000008f0b211317328a04d
1c715dd000000000000000000000000000001155200000001000000000000000000000000000000000000000000
00000000005e00000349200000000000000000000000000000640000000a000041b100000b86",

"port": 0,
"eventCode": 3,
"inputs": {
        "ignition": false,
        "input1": false,
        "input2": false,
        "input3": false,
        "input4": false,
        "input5": false,
        "input6": false,
        "input7": false,
        "value": "00000000"
},
"eventType": "IGOFF",
"deviceDataConverted": {
        "type": "avlDeviceData",
        "accumulators": [
                {
                "label": "GPSOdometer",
                "value": "182724.92",
                "index": "0",
                "units": "m",
                "type": "Distance"
                },
                {
                "label": "VBSpeed",
                "value": "0.00",
                "index": "6",
                "units": "km/h",
                "type": "VBUS: Vehicle Speed"
                },
                {
                "label": "VBCalcFuelUsage",
                "value": "0.00",
                "index": "7",
                "units": "ga",
                "type": "VBUS: Calculated Fuel Usage"
                },

```json
                    {
                    "label": "VBOdometer",
                    "value": "0.00",
                    "index": "8",
                    "units": "m",
                    "type": "Distance"
                    },
            ],
            "altitude": {
                    "value": "7841",
                    "units": "cm"
            },
            "gpsSpeed": {
                    "value": "0.00",
                    "units": "km/h"
            },
            "rssi": {
                    "value": "-81.00",
                    "units": "dB"
            },
            "systemOfUnits": "Metric"
    },
    "commState": {
            "available": true,
            "connected": true,
            "dataService": true,
            "networkService": true,
            "roaming": true,
            "threeGNetwork": true,
            "voiceCallActive": false
    },
    "vbusIndicators": {
            "absActiveLamp": false,
            "absDashIndicator": false,
            "acSystemRefrigerantMonitor": false,
            "airbagDashIndicator": false,
            "brakePedalPressed": false,
            "catalystMonitor": false,
            "comprehensiveComponentMonitor": false,
            "coolantHotLight": false,
            "cruiseControlStatus": false,
```

```json
            "egrSystemMonitor": false,
            "evaporativeSystemMonitor": false,
            "fuelSystemMonitor": false,
            "heatedCatalystMonitor": false,
            "ho2SHeaterControlMalfunction": false,
            "ho2SHeaterResistanceMalfunction": false,
            "ignitionStatus": true,
            "milStatus": false,
            "misfireMonitor": false,
            "o2SensorCircuitNoActivity": false,
            "o2SensorHeaterCircuitMalfunction": false,
            "oilPressureLamp": false,
            "oxygenSensorHeatedMonitor": false,
            "oxygenSensorMonitor": false,
            "parkBrakeLight": false,
            "ptoStatus": false,
            "seatBeltFastened": false,
            "secondaryAirSystemMonitor": false,
            "tpmsStatus": false
    },
    "gpsFixStatus": {
            "predicted": false,
            "differentiallyCorrected": false,
            "lastKnown": false,
            "invalidFix": false,
            "twoDFix": false,
            "historic": false,
            "invalidTime": false
    }
    }
    }
```

```
"avlEvent": {
"address": {
        "city": "Centreville",
        "country": "US",
        "county": "Fairfax",
        "crossStreet": "Frontier Hills Dr",
        "addressLatitude": 38.2448765,
        "addressLongitude": -77.24489987,
        "postalCode": "20151",
        "postedSpeedLimit": 45,
        "roadTypeCode": "Paved, MultiDigitized",
        "speedLimitUnits": "mph",
        "state": "Virginia",
        "stateProvinceCd": "VA",
        "street": "4505 Gunmetal Rd",
        "tollRoadFlag": "false"
},
"carrier": 260,
"fixStatus": true,
"hdop": 1,
"heading": 7,
"latitude": 38.2259874,
"longitude": -77.2598745,
"satellites": 8,
"deviceAirId": "E-0GYV-5J7H",
"deviceEsn": "4562053398",
"deviceMessageSequenceNumber": 76,
"deviceId": 510,
"eventTime": "2016-09-23T17:10:23.000Z",
"messageUuid": "6bb77eb0-a7bb-4c7d-8cba-c58f7be09e9a",
"asset": {
        "href": "https://connect.calamp.co.uk/connect/services/assets/64",
        "rel": "asset",
        "title": "WAUDH74F37N070944",
        "vin": "WAUDH74F37N070944"
},
"assetName": "WAUDH74F37N070944",
"assetId": 64,
"rawDeviceHexMessage":
"83054562053398010101e561ff173242a2d1c7791100001ee7000008d2000708000104ff9f6f0a11002714620000
```

000002ffffffff0002cbd8000000050000000000000000000000000000000000000000007600000000000000000008b0cc0fa
17321e08d1c773610000000000000000000000000000001155200000000100000760000008bc000091aa00000cde00
0000000000000000000003f00000329500000000000000000000000000000000640000000a0000007a00000b86",
"port": 0,
"eventCode": 20,
"inputs": {
       "ignition": true,
       "input1": false,
       "input2": false,
       "input3": false,
       "input4": true,
       "input5": false,
       "input6": false,
       "input7": false,
       "value": "10001000"
},
"eventType": "ACCEL",
"deviceDataConverted": {
       "type": "avlDeviceData",
       "acceleration": {
              "accelerationMagnitude": {
                     "value": "0.25",
                     "units": "g_force"
              },
              "calibration": "BEST",
              "duration": {
                     "value": "22.00",
                     "units": "s"
              },
              "label": "Acceleration",
              "startingSpeed": {
                     "value": "2.28",
                     "units": "mi/h"
              }
       },
       "accumulators": [
              {
              "label": "GPSOdometer",
              "value": "113.87",
              "index": "0",
              "units": "mi",

```json
                    "type": "Distance"
                },
                {
                "label": "AccelerationLatitude",
                "value": "382547787",
                "index": "10",
                "type": "Acceleration Latitude"
                },
                {
                "label": "AccelerationLongitude",
                "value": "3519509345",
                "index": "11",
                "type": "Acceleration Longitude"
                },
        ],
        "altitude": {
                "value": "7151",
                "units": "cm"
        },
        "gpsSpeed": {
                "value": "50.51",
                "units": "mi/h"
        },
        "rssi": {
                "value": "-97.00",
                "units": "dB"
        },
        "systemOfUnits": "US"
},
"commState": {
        "available": true,
        "connected": true,
        "dataService": true,
        "networkService": true,
        "roaming": true,
        "threeGNetwork": true,
        "voiceCallActive": false
},
"gpsFixStatus": {
        "predicted": false,
        "differentiallyCorrected": false,
```

```
        "lastKnown": false,
        "invalidFix": false,
        "twoDFix": false,
        "historic": false,
        "invalidTime": false
    }
}
```

9 Appendix C – JBus Hourly Report Event Message Example

```
"jbusHourlyReportEvent": {
"asset": {
        "href": "http://aq-cxtcoresvc-vip/connect/services/assets/4360",
        "rel": "asset",
        "title": "WVWZZZAAZED011089",
        "vin": "WVWZZZAAZED011089"
},
"deviceAirId": "BVZ-RK9-HXL",
"deviceDataConverted": {
        "type": "jbusHourlyReportData",
        "averageFuelEconomy": {
                "value": "30.61",
                "units": "km/l"
        },
        "engineBatteryVoltage": {
                "value": "24.00",
                "units": "V"
        },
        "engineCoolantPressure": {
                "value": "320.00",
                "units": "kPa"
        },
        "engineCoolantTemperature": {
                "value": "248.00",
                "units": "F"
        },
        "engineCrankcasePressure": {
                "value": "-250.00",
                "units": "kPa"
        },
        "engineFuelTankLevel1": {
                "value": "64.00",
                "units": "%"
        },
        "engineFuelTankLevel2": {
                "value": "0.00",
                "units": "%"
        },
        "engineOilPressure": {
                "value": "640.00",
                "units": "kPa"
        },
        "engineOilTemperature": {
                "value": "276.80",
                "units": "F"
        },
        "transmissionOilTemperature": {
                "value": "-459.40",
                "units": "F"
        },
```

          "systemOfUnits": "Mixed"
},
"deviceEsn": "4641223585",
"deviceId": 142,
"deviceMessageSequenceNumber": 14,
"eventTime": "2016-10-07T17:52:11.000Z",
"messageUuid": "83fcf036-00e2-4e6e-92eb-6ea87c7a0a2f",
"rawDeviceHexMessage":
"8305464122358501010105000e57f7e0cb57f7e0cc173852b3d1db64cb0000205900000000012c09000012ffab0f091400008
200149285000000a02033a00000a0e001a0000000383d"
}