

## ORION Binary Data Format V7

Note: When \$SetDataMode.[Data Mode]=1 (Use Binary data format via GPRS), refer to this document for decoding.

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; The Byte Order of the data is Little-endian  
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; GPRS Packet Syntax  
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GPRS-PACKET:= PKT-HEADER PKT-BODY PKT-NO PKT-CRC  
PKT-HEADER:= HDR1 HDR2 BODY-TYPE  
HDR1:= 'P'  
; 1 byte  
HDR2:= 'W'  
; 1 byte  
; HDR1 and HDR2 are fixed value  
BODY-TYPE:= BODY-TYPE-RESERVED (T-USERLOG | T-SYSLOG)  
; 1 byte  
BODY-TYPE-RESERVED:= {0..15}  
; bit4~bit7  
; reserved for future  
T-USERLOG:= 0  
; bit0~bit3  
; Payload is USERLOG-DATA  
T-SYSLOG:= 3  
; bit0~bit3  
; Payload is SYSLOG  
PKT-BODY:= USERLOG-DATA | SYSLOG-DATA  
PKT-NO:= {0..255}  
; Serial number increased by 1  
PKT-CRC:= {0x0000..0xFFFF}  
; 2 bytes, CRC-16 calculations of PKT-HEADER ,PKT-BODY and PKT-NO

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## ; User Log Event-ID Syntax

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USER-LOG-EVENT-ID:= {0..63}

; 1 byte

- ; 0 (0x00) : LGTK (GPRS Time based tracking event)
- ; 1 (0x01) : LMTK (SMS Time based tracking event)
- ; 2 (0x02) : LACN (ACC ON event)
- ; 3 (0x03) : LACF (ACC OFF event)
- ; 4 (0x04) : LD2N (DI2 ON event)
- ; 5 (0x05) : LD2F (DI2 OFF event)
- ; 6 (0x06) : LD3N (DI3 ON event)
- ; 7 (0x07) : LD3F (DI3 OFF event)
- ; 8 (0x08) : LD4N (DI4 ON event)
- ; 9 (0x09) : LD4F (DI4 OFF event)
- ; 10 (0x0A) : LD5N (DI5 ON event)
- ; 11 (0x0B) : LD5F (DI5 OFF event)
- ; 12 (0x0C) : LD6N (DI6 ON event)
- ; 13 (0x0D) : LD6F (DI6 OFF event)
- ; 14 (0x0E) : LDIS (Distance based tracking event)
- ; 15 (0x0F) : LVML (Over mile event)
- ; 16 (0x10) : LANG (Deviation angle event)
- ; 17 (0x11) : LIDL (Idle event)
- ; 18 (0x12) : LMOV (Move event)
- ; 19 (0x13) : LSIN (Speeding start event)
- ; 20 (0x14) : LSUT (Speeding End event)
- ; 21 (0x15) : LGPS (Get position event)
- ; 22 (0x16) : LMPN (Main power ON event)
- ; 23 (0x17) : LMPF (Main power OFF event)
- ; 24 (0x18) : LBAT (Time based tracking event during ACC OFF)
- ; 25 (0x19) : LGIN (Geofence in event)
- ; 26 (0x1A) : LGUT (Geofence out event)
- ; 27 (0x1B) : LUIN (RFID login event)
- ; 28 (0x1C) : LKIN (Keyin event)
- ; 29 (0x1D) : LGRK (Timer tracking event, GPRS)
- ; 30 (0x1E) : LGSK (VACC ON event, GPRS)
- ; 31 (0x1F) : LMSK (VACC ON event, SMS)
- ; 32 (0x20) : LIBT (iButton event)

- ; 33 (0x21) : LMPL (Main power low event)
- ; 34 (0x22) : LMRK (Timer tracking event, SMS)
- ; 35 (0x23) : LGEK (VACC OFF event, GPRS)
- ; 36 (0x24) : LMEK (VACC OFF event, SMS)
- ; 37 (0x25) : LGSR (G sensor event)
- ; 38 (0x26) : LRPN (RPM over limit event)
- ; 39 (0x27) : LDTC (OBD DTC code event)
- ; 40 (0x28) : LRPF (RPM under limit event)
- ; 41 (0x29) : LCTN (Coolant temperature over limit event)
- ; 42 (0x2A) : LCTF (Coolant temperature under limit event)
- ; 43 (0x2B) : LHSA (Harsh acceleration event)
- ; 44 (0x2C) : LHSB (Harsh brake event)
- ; 45 (0x2D) : LHSC (Harsh cornering event)
- ; 46 (0x2E) : LTLN (Temperature sensor over limit event)
- ; 47 (0x2F) : LTLF (Temperature sensor under limit event)
- ; 48 (0x30) : Reserved
- ; 49 (0x31) : LCRH (Crash event)
- ; 50 (0x32) : LTSK (ActTracking command Start tracking event)
- ; 51 (0x33) : LTTK (ActTracking command Time based tracking event)
- ; 52 (0x34) : LTEK (ActTracking command Stop tracking event)
- ; 53 (0x35) : LBTL (Backup battery low voltage event)
- ; 54 (0x36) : LCAL (Auto Calibration Dynamic done event)
- ; 55 (0x37) : Reserved
- ; 56 (0x38) : Reserved
- ; 57 (0x39) : Reserved
- ; 59: LOBD (OBD2 learning result event)

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; Essential GPS Data Syntax

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GPS-DATA1:= LAT LON ALTITUDE ANGLE SPEED GPS-UTC GPS-QUALITY

LON:= SIGNED INTEGER

; 4 bytes

; GPS longitude

; Original value=LON/10000

; East if value>0, West if value <0

LAT:= SIGNED INTEGER

; 4 bytes

; GPS latitude  
; Original value=LAT/10000  
; North if value>0, South if value <0  
ALTITUDE:= SIGNED INTEGER  
; 2 bytes  
; GPS altitude  
; Original value=ALTITUDE/10 m  
ANGLE:=  
; 2 bytes  
; GPS heading  
SPEED:= UNSIGNED INTEGER  
; 2 bytes  
; Original value=SPEED/10 km/h  
GPS-UTC:= YY MM DD hh mm ss  
; GPS timestamp  
YY:= {00..99}  
; 1 byte, year  
MM:= {1..12}  
; 1 byte, month  
DD:= {1..31}  
; 1 byte, year  
hh:= {0..23}  
; 1 byte, hour  
mm:= {0..59}  
; 1 byte, minute  
ss:= {0..59}  
; 1 byte, second  
GPS-QUALITY:= UNSIGNED INTEGER  
; 1 byte  
; Number of satellites

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; [Optional Data Syntax](#)

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OPTION-DATA-GROUP = 1\*N(OPTION-DATA)

; Optional data set

; N= {1..255}

OPTION-DATA:= (OPT-GSM-INFO | OPT-RPM-TEMP | OPT-VOLTAGE

| OPT-DI | ~~OPT-DO~~ OPT-FUELLEVEL | OPT-SPEED-THRESH | OPT-GEO-ID  
| OPT-MAX-ACCE | OPT-GPS-STATE| OPT-CALI-DATA  
| OPT-ENGINE-LOAD  
| OPT-OTHERS)  
OPT-LEN:= {1..255}  
; Total length of the OPTION-DATA, in byte  
OPT-TYPE:= OPT-INVALID(bit7) OPT-DATA-TYPE(bit0~bit6)  
; 1 byte  
OPT- INVALID:= {0 | 1}  
; indicates this option data whether is valid or not  
; 0: valid data, 1: invalid data  
OPT-DATA-TYPE:= {1..127}  
; Option data type:  
; 1: payload is GSM info (PLMN LAC CI),  
; 2: payload is RPM and coolant temperature (OPT-RPM-TEMP)  
; 3: payload is main power voltage and battery voltage (OPT-VOLTAGE)  
; 4: payload is digital input (OPT-DI),  
; 5: payload is ~~digital output (OPT-DO)~~ fuel level(OPT-FUELLEVEL)  
; 6: payload is the setting of the Speed threshold (OPT-SPEED-THRESH)  
; 7: payload is the geofencing reference ID (OPT-GEO-ID)  
; 8: reserved  
; 9: payload is the setting of the acceleration max. value (OPT-MAX-ACCE)  
; 10: payload is the GPS-DATA1 and relative status (OPT-GPS-STATE)  
; 11: payload is the calibration data (OPT-CALI-DATA)  
; 12: payload is engine load  
; 13: reserved  
; 14: payload includes OBD2 speed and trip distance (OBD2-SPEED-DISTANCE)  
; 15: reserved  
; 16: payload is OBD2 learning result (OBD2-LEARNING-RESULT)

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OPT-GSM-INFO:= OPT-TYPE OPT-LEN PLMN LAC CI  
PLMN:=  
; 4 bytes, operator  
LAC:=  
; 2 bytes, LAC  
CI:=  
; 2 bytes, CI

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;-----
OPT-RPM-TEMP:= OPT-TYPE OPT-LEN RPM COOLANT
RPM:=
; 2 bytes
COOLANT:=
; 1 byte, coolant temperature
; Original value= COOLANT-40
;-----
OPT-VOLTAGE:= OPT-TYPE OPT-LEN MAIN-POWER-VOL BATTERY-VOL
MAIN-POWER-VOL:=
; 2 bytes, main power voltage
; Original value= MAIN-POWER-VOL/10
BATTERY-VOL:=
; 2 bytes, battery voltage
; Original value= BATTERY-VOL/100
;-----
OPT-DI:= OPT-TYPE OPT-LEN DIN
DIN:= {0x00..0xFF}
; 1 byte
; Digital input, bitmask
;-----
OPT-DO OPT-FUELLEVEL:= OPT-TYPE OPT-LEN DOUT
DOUT:= {0x00..0xFF}
; 1 byte
; Digital output, bitmask fuel level in percentage
;-----
OPT-SPEED-THRESH:= OPT-TYPE OPT-LEN SPEED-THRESH
SPEED-THRESH:= {0x00..0xFFFF}
; 2 bytes, km/h
; Speed threshold
;-----
OPT-GEO-ID:= OPT-TYPE OPT-LEN GEO-ID
GEO-ID:= {0..255}
; 1 byte
; Geofencing reference ID
;-----
OPT-MAX-ACCE:= OPT-TYPE OPT-LEN LAC CI MAX-ACCE
MAX-ACCE:= FLOAT

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; Acceleration max. value
; 4 bytes(float)
;-----
OPT-CALI-DATA:= OPT-TYPE OPT-LEN CALI-DATA
CALI-DATA:= 9(CALI-COEF)
; Calibration data array[3][3]
CALI-COEF:= INTEGER
; 4 bytes
; Relative coefficient of calibration x 100000
;-----
OPT-GPS-STATE:= OPT-TYPE OPT-LEN COR-FLAG GPS-DATA1
COR-FLAG:= {0x00..0xFF}
; 1 byte
; bit0: reserved
; bit1: GPS_Valid indicator (1:valid, 0:invalid)
; bit2: reserved
; bit3: VACC state (1:On, 0:Off)
; bit4: ACC state (1:On, 0:Off)
; bit5: reserved
; bit6: reserved
; bit7: reserved
;-----
OPT-ENGINE-LOAD:= OPT-TYPE OPT-LEN ENGINE-LOAD-DATA
ENGINE-LOAD-DATA:= {0..255}
; 1 byte
; Engine load

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;-----
OBD2-SPEED-DISTANCE format:
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+++++
| OPT-TYPE | OPT-LEN | OSD-FLAG | OBD-SPEED | OBD-DISTNACE |
+++++
OBD2-SPEED-DISTANCE:= OPT-TYPE OPT-LEN OSD-FLAG OBD-SPEED
OBD-DISTANCE
OSD-FLAG:=
; 1 byte
; reserved

```

OBD-SPEED:= {0..255}

; 1 byte

; Vehicle speed from ECU

OBD-DISTANCE:= {0..0xFFFFFFFF}

; 4 bytes

; Trip distance from ECU

-----

OBD2-LEARNING-RESULT format:

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+++++

| OPT-TYPE | OPT-LEN | OLR-FLAG | LEARNING-RESULT | PROTO-TYPE |

+++++

OBD2-LEARNING-RESULT:= OPT-TYPE OPT-LEN OLR-FLAG

LEARNING-RESULT PROTO-TYPE

OLR-FLAG:=

; 1 byte, reserved

LEARNING-RESULT:= {1|2|3|4|5|6|7|8}

; 1 byte

; {1}: OBD2 module learning has completed (OK)

; {2}: OBD2 module start learning.

; {3}: OBD2 module learning has failed. In this case the module stops trying to learn until next protocol command (\$SETOBDDATA)

; {4}: OBD2 module cancels learning because vehicle is moving.

; {5}: OBD2 module has connected with ECU.

; {6}: OBD2 module has disconnected with ECU.

; {7}: Vehicle is moving so the OBD2 should not start learning.

; {8}: OBD2 module is trying to learn from next protocol number when OBD2 can not read valid data from ECU in 20 seconds.

; {9}: OBD2 module cancels learning when main power is off.

; {10}: OBD2 module stops learning when receiving remote command (\$SETOBDDATA).

; Ignition on is required before OBD2 try to start learning.

; When vehicle is moving, OBD2 module will cancel learning, but will retry learning again if the vehicle keeps still for few (>5) seconds.

; Tracker uses the GPS speed to determine whether the vehicle keeps moving or still.

; This option-data will be included in User-Log Event LOBD.

PROTO-TYPE:= {0..255}



; 1 byte

; OBD2 communication protocol, for example 01->TOYOTA, 04->ISO9141 ...etc,  
please refer to relative document

; This field value is valid only after learning was OK.

-----  
OPT-OTHERS:= OPT-TYPE OPT-LEN OPT-PAYLOAD-OTHERS  
OPT-PAYLOAD-OTHERS:=  
; reserved  
-----

-----  
; User Log Data Syntax  
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USERLOG-DATA:= USERLOG-HDR USERLOG-COMMON USER-LOGS  
USER-LOGS:= 1\*N(USER-LOG)  
USER-LOG:= (SPEED-ALERT | TRACKING | OBD-DISC-NOTIFICATION  
| GEOFENCING | REALTIME-POS | USERLOG-OTHERS)  
USERLOG-HDR:= {0x01..0xFF}  
; 1 byte, header of the User log data  
; bitmask bit0-bit4) number of the user log in this packet, range from 1~N  
; bitmask bit6) 1:Tracker requires Server to ack the packet, 0:Tracker doesn't need the  
ACK  
USERLOG-COMMON:= UNIT-ID  
UNIT-ID:= {0x0..0xFFFFFFFF}  
; 4 bytes  
RTC-TIME:= YY MM DD hh mm ss  
; 6 bytes  
SPEED-ALERT:= {USER-LOG-EVENT-ID LOG-LEN ALERT-FLAG GPS-DATA1  
RTC-TIME MILEAGE  
OPT-NUM OPT-SPEED-THRESH [OPTION-DATA-GROUP]}  
LOG-LEN:= {1..255}  
; 1 byte  
; Total length of the USER-LOG(include all option data), in byte  
OPT-NUM:= {1..255}  
; Number of the optional data (include OPT-SPEED-THRESH and  
OPTION-DATA-GROUP)  
ALERT-FLAG:= ALERT-FLAG1 ALERT-FLAG2

ALERT-FLAG1:= {0x00..0xFF}  
; 1 byte  
; bit0: OPTION-DATA is valid  
; bit1: GPS\_Valid indicator (1: valid, 0: invalid)  
; bit2: ODB2\_Valid indicator (1: valid, 0: invalid)  
; bit3: VACC state (1: On, 0:Off)  
; bit4: ACC state (1: On, 0:Off)  
; bit5: reserved  
; bit6: reserved  
; bit7: Battery using indicator (1: use battery, 0: use main power)

ALERT-FLAG2:= {0x00..0x03}

; 1 byte  
; bit0~bit7: reserved

MILEAGE:= {0x00..0xFFFFFFFF}

; 4 bytes  
; Original value = MILEAGE/10 km

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; [Geofencing Data Syntax](#)

-----

GEOFENCING:= {USER-LOG-EVENT-ID LOG-LEN GEO-FLAG GPS-DATA1  
RTC-TIME MILEAGE OPT-NUM OPT-GEO-ID [OPTION-DATA-GROUP]}

OPT-NUM:= {1.255}

; Number of the optional data(include OPT-GEO-ID and OPTION-DATA-GROUP)

GEO-FLAG:= GEO-FLAG1 GEO-FLAG2

GEO-FLAG1:= {0x00..0xFF}

; 1 byte  
; bit0: OPTION-DATA is valid  
; bit1: GPS\_Valid indicator (1:valid, 0:invalid)  
; bit2: ODB2\_Valid indicator (1:valid, 0:invalid)  
; bit3: VACC state (1:On, 0:Off)  
; bit4: ACC state (1:On, 0:Off)  
; bit5: reserved  
; bit6: reserved  
; bit7: Battery using indicator (1:use battery, 0:use main power)

GEO-FLAG2:= {0x00..0x03}

; 1 byte  
; bit0~bit7: reserved

-----

**; Tracking Data Syntax**

-----

TRACKING:= {USER-LOG-EVENT-ID LOG-LEN TRACKING-FLAG GPS-DATA1  
RTC-TIME MILEAGE OPT-NUM [OPTION-DATA-GROUP]}

OPT-NUM:= {0.255}

; Number of the optional data (include OPTION-DATA-GROUP)

TRACKING-FLAG:= TRACKING-FLAG1 TRACKING-FLAG2

TRACKING-FLAG1:= {0x00..0xFF}

; 1 byte

; bit0: OPTION-DATA is valid

; bit1: GPS\_Valid indicator (1:valid, 0:invalid)

; bit2: ODB2\_Valid indicator (1:valid, 0:invalid)

; bit3: VACC state (1:On, 0:Off)

; bit4: ACC state (1:On, 0:Off)

; bit5: reserved

; bit6: reserved

; bit7: Battery using indicator (1:use battery, 0:use main power)

TRACKING-FLAG2:= {0x00..0x03}

; 1 byte

; bit0~ bit7: reserved

-----

**; OBD Disconnection Notification Syntax**

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OBD-DISC-NOTIFICATION:= TRACKING

-----

**; Real-time Position Syntax**

-----

REALTIME-POS:= TRACKING

-----

**; Ack Packet Syntax**

-----

ACK-PACKET := R-HDR R-NO R-CRC

R-HDR:= '\*'

; 1 byte  
R-CRC:=  
; 2 bytes  
; Must equal to the PKT-CRC in GPRS Packet (GPRS-PACKET)  
R-NO:=  
; 1 byte  
; Must equal to the PKT-NO in GPRS Packet (GPRS-PACKET)

-----  
; **SYSLOG-DATA Syntax**  
-----

SYSLOG-DATA:= SYSLOG-HDR UNIT-ID SYSLOG-LEN SYS-TIMESTAMP  
FLAG-RESERVED DESCRIPTION  
SYSLOG-HDR:= SYS-CATEGORY(bit5~bit7) SYSHDR-RESERVED (bit0~bit4)  
; 1 byte  
; SYSLOG-DATA header  
SYS-CATEGORY:= {0..5}  
; The category of the syslog report  
; 0: Critical  
; 1: Emergency  
; 2: Error  
; 3: Warning  
; 4: Informational  
; 5: Debug  
SYSHDR-RESERVED:=  
; reserved  
SYSLOG-LEN:= {0x00..0xFFFF}  
; 2 bytes  
; total length of the SYSLOG-DATA, in byte  
FLAG-RESERVED:=  
; 1 byte  
; reserved  
SYS-TIMESTAMP:=  
; 4 bytes  
; System time  
; Local time in seconds since 0 hours, 0 minutes, 0 seconds, January 1, 1970  
DESCRIPTION:= PLAIN-TEXT  
; Description for this syslog report

-----  
; Harsh Event Syntax  
-----

HARSH EVENT:= {USER-LOG-EVENT-ID LOG-LEN ACCI-FLAG GPS-DATA1  
RTC-TIME MILEAGE OPT-NUM **OPT-MAX-ACCE** [PREV-GPS-STATE]  
[OPTION-DATA-GROUP]}

OPT-NUM:= {1.255}

; number of the optional data(include **OPT-MAX-ACCE**, PREV-GPS-STATE and  
OPTION-DATA-GROUP)

; PREV-GPS-STATE might be absent

ACCI-FLAG:= ACCI-FLAG1 ACCI-FLAG2

ACCI-FLAG1:= {0x00..0xFF}

; 1 byte

; bit0: OPTION-DATA is valid

; bit1: GPS\_Valid indicator(1:valid, 0:invalid)

; bit2: ODB2\_Valid indicator(1:valid, 0:invalid)

; bit3: VACC state(1:On, 0:Off)

; bit4: ACC state(1:On, 0:Off)

; bit5: Privacy(1:On, 0:Off)

; bit6: Privacy Level(1:hard, 0:soft)

; bit7: Battery using indicator(1:use battery, 0:use main power)

ACCI-FLAG2:= := {0x00..0xFF}{0x00..0x03}

; 1 byte, not used yet

; bit0~bit1: not used yet

; bit2~bit7: reserved

PREV-GPS-STATE:= 1\*5(OPT-GPS-STATE)

; include 1~5 previous GPS data and relative states