# CAN Interface Manual

Measure with confidence

OXTS

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# Introduction

This document describes the CAN bus interface and message format used on OxTS inertial navigation systems (INS). Not all products support CAN, refer to the individual product user manuals for their interface details.

## Related documents

Additional manuals provide further information on the OxTS software and communication types. Table 1 lists related manuals and where to find them.

Table 1: Supplementary manuals

| Manual | Description |
|---|---|
| NCOM Manual | Description of the OxTS NCOM format. https://support.oxts.com/hc/en-us/articles/360011890040-NCOM-Manual |
| NCOM C Code Drivers | A collection of C functions to decode the binary protocol NCOM format. https://github.com/OxfordTechnicalSolutions/NCOMdecoder |
| NMEA 0183 Description | NMEA description manual for the NMEA outputs. https://support.oxts.com/hc/en-us/articles/360011890180-NMEA-Manual |

# CAN messages and signals

In the default configuration the CAN bus uses identifiers 500h to 5FFh for status information; 600h to 60Fh for navigation information; 610h to 613h for RT-ANA messages and 620h to 623h for the additional slip points.

Using the configuration software NAVconfig it is possible to change the default message identifiers.

Only one status message is output per cycle (100 Hz or 250 Hz output rate) you do not get each status message at the specified rate.

All values from the INS are encoded in little-endian format (Intel-style).

## Termination resistor

The CAN bus output does not include a termination resistor. It is essential to include a 120 Ω resistor at each end of your CAN bus – otherwise the CAN bus will not work.

## CAN-DBC file

NAVconfig can output a CAN-DBC file that contains all the measurements the INS is configured to output.

## CAN bus messages

Table 1 lists all the messages the INS outputs on the CAN bus and the identifiers that are used for each message. The signals in each message are listed in the tables that follow.

Table 1: CAN bus messages

| Default identifier | Message name | Data contents | See table |
|---|---|---|---|
| 1536 (600h) | DateTime | Date and time | Table 2 |
| 1537 (601h) | LatitudeLongitude | Latitude and longitude | Table 3 |
| 1538 (602h) | Altitude | Altitude | Table 4 |
| 1539 (603h) | Velocity | OxTS NED frame velocity | Table 5 |
| 1540 (604h) | VelocityLevel | OxTS horizontal frame velocity | Table 6 |
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| 1542 (606h) | AccelLevel | OxTS horizontal frame IMU acceleration | Table 8 |
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| | | | |
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| 1551 (60Fh) | AngAccelLevel | OxTS horizontal frame IMU angular acceleration | Table 17 |
| 1552..1555 (620h…613h) | | Reserved for RT-ANA signals | |
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| 1569 (621h) | TrackSlipCurvaturePoint2 | Measurement point 2 track, slip and curvature | Table 19 |
| 1570 (622h) | TrackSlipCurvaturePoint3 | Measurement point 3 track, slip and curvature | Table 20 |
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| 1574 (626h) | TrackSlipCurvaturePoint6 | Measurement point 6 track, slip and curvature | Table 24 |
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| 1579 (62Bh) | ApproxVelocity | Approximate OxTS NED frame velocity | Table 29 |
| 1580 (62Ch) | Reserved | | |
| 1581 (62Dh) | FallingTrigger | Trigger 1 falling edge | Table 30 |
| 1582 (62Eh) | RisingTrigger | Trigger 1 rising edge | Table 31 |
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| 1584 (630h) | MilliTime | Absolute GPS time | Table 33 |
| 1585 (631h) | Reserved | | |
| 1586 (632h) | Reserved | | |
| 1587 (633h) | IsoOrientation | ISO 8855 orientation | Table 34 |
| 1588 (634h) | IsoVsVelocity | ISO 8855 vehicle system velocity | Table 35 |
| 1589 (635h) | IsoVsAcceleration | ISO 8855 vehicle system acceleration | Table 36 |

| | | | |
|---|---|---|---|
| 1590 (636h) | IsoVsAngularVelocity | ISO 8855 vehicle system angular velocity | Table 37 |
| 1591 (637h) | IsoVsAngularAcceleration | ISO 8855 vehicle system angular acceleration | Table 38 |
| 1592 (638h) | IsoIsVelocity | ISO 8855 intermediate system velocity | Table 39 |
| 1593 (639h) | IsoIsAcceleration | ISO 8855 intermediate system | Table 40 |
| 1594 (63Ah) | IsoAngularVelocity | ISO 8855 intermediate system angular velocity | Table 41 |
| 1595 (63Bh) | IsoIsAngularAcceleration | ISO 8855 intermediate system angular acceleration | Table 42 |
| 1596 (63Ch) | IsoEfsVelocity | ISO 8855 earth-fixed system velocity | Table 43 |
| 1597 (63Dh) | IsoEfsAcceleration | ISO 8855 earth-fixed system acceleration | Table 44 |

The status information in NCOM is output over the CAN bus on Identifiers 500h to 5FFh. The offset from 500h is the same as the Channel number in the NCOM message definition. The bytes 0 to 7 are the same in the CAN message as in the NCOM packet.

## Table heading definitions

The fields in the tables have the following meanings.

**Offset (bits).** This is the offset into the message where the signal starts. To compute the offset in bytes divide the value by 8.

**Length (bits).** This is the length of the signal in bits. To compute the length of the signal in bytes, divide the value by 8.

**Type.** This specifies either an unsigned value (U) or a signed value (S).

**Units.** This is the units for the signal.

**Factor.** This is the factor that the integer unit should be multiplied by to get the signal into the units given in the table.

**Offset.** This is the value of the signal when the integer value in the CAN message is zero. It is zero for all the RT signals and can usually be discarded.

## Signals

The following tables describe the signals in each of the messages.

Table 2: Identifier 600h (1536), DateTime

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 8 | U | year | 1 | 0 | Year within century (e.g. '16' during year 2016) | TimeYear |
| 8 | 8 | U | year | 100 | 0 | Century (e.g. '20' during 2016) | TimeCentury |
| 16 | 8 | U | month | 1 | 0 | Month | TimeMonth |
| 24 | 8 | U | day | 1 | 0 | Day | TimeDay |
| 32 | 8 | U | S | 0.01 | 0 | Hundredths of current second | TimeHSecond |
| 40 | 8 | U | S | 1 | 0 | Seconds | TimeSecond |
| 48 | 8 | U | min | 1 | 0 | Minutes | TimeMinute |
| 56 | 8 | U | hour | 1 | 0 | Hours | TimeHour |

Note: time is always reported as GPS time. Currently this is 16 s different from UTC.

Table 3: Identifier 601h (1537), LatitudeLongitude

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | S | ° | 1e-7 | 0 | Latitude | PosLat |
| 32 | 32 | S | ° | 1e-7 | 0 | Longitude | PosLon |

Table 4:Identifier 602h (1538), Altitude

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | S | m | 0.001 | 0 | Altitude | Altitude |

By default the altitude is output relative to mean sea level, not WGS 84. The datum can be changed using NAVconfig.

Table 5: Identifier 603h (1539), Velocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | OxTS NED frame north velocity | VelNorth |
| 16 | 16 | S | m/s | 0.01 | 0 | OxTS NED frame east velocity | VelEast |
| 32 | 16 | S | m/s | 0.01 | 0 | OxTS NED frame vertical (down) velocity | VelDown |
| 48 | 16 | S | m/s | 0.01 | 0 | Horizontal speed | Speed2D |

The horizontal speed is the vector addition of north and east velocities. For forward speed (which can go negative) see message 604h.

Table 6: Identifier 604h (1540), Velocity level

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | OxTS horizontal frame longitudinal (forward) velocity | VelForward |
| 16 | 16 | S | m/s | 0.01 | 0 | OxTS horizontal frame lateral (right) velocity | VelLateral |

The forward velocity can go negative when driving backwards.

Table 7: Identifier 605h (1541), AccelVehicle

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $m/s^2$ | 0.01 | 0 | OxTS output frame longitudinal (forward) IMU acceleration | AccelX |
| 16 | 16 | S | $m/s^2$ | 0.01 | 0 | OxTS output frame lateral (right) IMU acceleration | AccelY |
| 32 | 16 | S | $m/s^2$ | 0.01 | 0 | OxTS output frame vertical (down) IMU acceleration | AccelZ |

Table 8: Identifier 606h (1542), AccelLevel

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | OxTS horizontal frame longitudinal (forward) IMU acceleration | AccelForward |
| 16 | 16 | S | m/s | 0.01 | 0 | OxTS horizontal frame lateral (right) IMU acceleration | AccelLateral |
| 32 | 16 | S | m/s | 0.01 | 0 | OxTS horizontal frame vertical (down) IMU acceleration | AccelDown |
| 48 | 16 | S | m/s | 0.01 | 0 | Slip rate | AccelSlip |

Table 9: Identifier 607h (1543), HeadingPitchRoll

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Heading angle | AngleHeading |
| 16 | 16 | S | ° | 0.01 | 0 | Pitch angle | AnglePitch |
| 32 | 16 | S | ° | 0.01 | 0 | Roll angle | AngleRoll |

Note: the range of the heading angle is 0 to 359.99, the range of the pitch angle is ±90° and the range of the roll angle is ±180°.

Table 10: Identifier 608h (1544), RateVehicle

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | °/s | 0.01 | 0 | OxTS output frame longitudinal (forward) IMU angular rate | AngRateX |
| 16 | 16 | S | °/s | 0.01 | 0 | OxTS output frame lateral (right) IMU angular rate | AngRateY |
| 32 | 16 | S | °/s | 0.01 | 0 | OxTS output frame vertical (down) IMU angular rate | AngRateZ |

Table 11: Identifier 609h (1545), RateLevel

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | °/s | 0.01 | 0 | OxTS horizontal frame longitudinal (forward) IMU angular rate | AngRateForward |
| 16 | 16 | S | °/s | 0.01 | 0 | OxTS horizontal frame lateral (right) IMU angular rate | AngRateLateral |
| 32 | 16 | S | °/s | 0.01 | 0 | OxTS horizontal frame vertical (down) IMU angular rate | AngRateDown |

See message 608h for roll angular rate. The definition of roll rate used in this manual is consistent with the Euler angles used to output roll, pitch and heading; therefore the roll angular rate is the same as the pitched x-angular rate or the body x-angular rate. The forward angular rate is the rotation about the axis which is horizontal.

Table 12: Identifier 60Ah (1546), TrackSlipCurvature

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Track angle | AngleTrack |
| 16 | 16 | S | ° | 0.01 | 0 | Slip angle | AngleSlip |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Curvature | Curvature |

Note that the slip angle will be close to 180° when driving backwards.

Table 13: Identifier 60Bh (1547), Distance

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | U | m | 0.001 | 0 | Horizontal distance with hold | DistanceWithHold |
| 32 | 32 | U | m | 0.001 | 0 | Horizontal distance without hold | Distance |

Note: Distance with hold will not increase when the INS measures a speed less than 0.2 m/s whereas the Distance field will drift by the noise of the INS when stationary. The distances start from zero when the INS is powered up.

Table 14: Identifier 60Ch (1548), PosLocal

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | S | m | 0.0001 | 0 | Distance from origin along x-axis | PosLocalX |
| 32 | 32 | S | m | 0.0001 | 0 | Distance from origin along y-axis | PosLocalY |

Note: The origin is set using the local co-ordinates option in NAVconfig. The convention used for the local co-ordinates uses a right-handed set with the z-axis up.

Table 15: Identifier 60Dh (1549), VelYawLocal

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | Velocity along the x-axis | VelLocalX |
| 16 | 16 | S | m/s | 0.01 | 0 | Velocity along the y-axis | VelLocalY |
| 32 | 16 | S | ° | 0.01 | 0 | Yaw angle | AngleLocalYaw |
| 48 | 16 | S | ° | 0.01 | 0 | Track angle in local coordinates | AngleLocalTrack |

Note: The convention used for the local co-ordinates uses a right-handed set with the z-axis up.

Table 16: Identifier 60Eh (1550), AngAccelVehicle

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $°/s^2$ | 0.1 | 0 | OxTS output frame longitudinal (forward) IMU angular acceleration | AngAccelX |
| 16 | 16 | S | $°/s^2$ | 0.1 | 0 | OxTS output frame lateral (right) IMU angular acceleration | AngAccelY |
| 32 | 16 | S | $°/s^2$ | 0.1 | 0 | OxTS output frame vertical (down) IMU angular acceleration | AngAccelZ |

Table 17: Identifier 60Fh (1551), AngAccelLevel

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $°/s^2$ | 0.1 | 0 | OxTS horizontal frame longitudinal (forward) IMU angular acceleration | AngAccelForward |
| 16 | 16 | S | $°/s^2$ | 0.1 | 0 | OxTS horizontal frame lateral (right) IMU angular acceleration | AngAccelLateral |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32 | 16 | S | °/s² | 0.1 | 0 | OxTS horizontal frame vertical (down) IMU angular acceleration | AngAccelDown |

Table 18: Identifier 620h (1568), TrackSlipCurvaturePoint1

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 1 track angle | AngleTrackPoint1 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 1 slip angle | AngleSlipPoint1 |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 1 curvature | CurvaturePoint1 |

Note that the slip angle of point 1 will be close to 180° when driving backwards.

Table 19: Identifier 621h (1569), TrackSlipCurvaturePoint2

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 2 track angle | AngleTrackPoint2 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 2 slip angle | AngleSlipPoint2 |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 2 curvature | CurvaturePoint2 |

Note that the slip angle of point 2 will be close to 180° when driving backwards.

Table 20: Identifier 622h (1570), TrackSlipCurvaturePoint3

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 3 track angle | AngleTrackPoint3 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 3 slip angle | AngleSlipPoint3 |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 3 curvature | CurvaturePoint3 |

Note that the slip angle of point 3 will be close to 180° when driving backwards.

Table 21: Identifier 623h (1571), TrackSlipCurvaturePoint4

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 4 track angle | AngleTrackPoint4 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 4 slip angle | AngleSlipPoint4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 4 curvature | CurvaturePoint4 |

Note that the slip angle of point 4 will be close to 180° when driving backwards.

Table 22: Identifier 624h (1572), HeadingPitchRollFromSurf

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Heading relative to the road surface | AngleHeadingFromSurf |
| 16 | 16 | S | ° | 0.01 | 0 | Pitch relative to the road surface | AnglePitchFromSurf |
| 32 | 16 | S | ° | 0.01 | 0 | Roll relative to the road surface | AngleRollFromSurf |

Note: the range of heading is 0 to 360°; the range of pitch is ±90°; the range of roll is ±180°. The road surface angle needs to be defined in order for these measurements to be active.

Table 23: Identifier 625h (1573), TrackSlipCurvaturePoint5

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 5 track angle | AngleTrackPoint5 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 5 slip angle | AngleSlipPoint5 |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 5 curvature | CurvaturePoint5 |

Note that the slip angle of point 5 will be close to 180° when driving backwards.

Table 24: Identifier 626h (1574), TrackSlipCurvaturePoint6

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 6 track angle | AngleTrackPoint6 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 6 slip angle | AngleSlipPoint6 |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 6 curvature | CurvaturePoint6 |

Note that the slip angle of point 6 will be close to 180° when driving backwards.

Table 25: Identifier 627h (1575), TrackSlipCurvaturePoint7

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 7 track angle | AngleTrackPoint7 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 7 slip angle | AngleSlipPoint7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 7 curvature | CurvaturePoint7 |

Note that the slip angle of point 7 will be close to 180° when driving backwards.

Table 26: Identifier 628h (1576), TrackSlipCurvaturePoint8

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | U | ° | 0.01 | 0 | Measurement point 8 track angle | AngleTrackPoint8 |
| 16 | 16 | S | ° | 0.01 | 0 | Measurement point 8 slip angle | AngleSlipPoint8 |
| 32 | 16 | S | 1/m | 0.0001 | 0 | Measurement point 8 curvature | CurvaturePoint8 |

Note that the slip angle of point 8 will be close to 180° when driving backwards.

Table 27: Identifier 629h (1577), ApproxLatitudeLongitude

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | S | ° | le-7 | 0 | Approximate latitude | ApproxPosLat |
| 32 | 32 | S | ° | le-7 | 0 | Approximate longitude | ApproxPosLon |

Before initialisation the approximate latitude and longitude message will have the GNSS measurement of latitude and longitude (at the GNSS antenna location). After initialisation it will contain the same latitude and longitude as message 601h.

Table 28: Identifier 62Ah (1578), ApproxAltitude

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | S | m | 0.001 | 0 | Approximate altitude | ApproxPosAlt |

By default, the altitude is output relative to mean sea level, not WGS 84. See altitude in the NCOM description for information on how to change this. Before initialisation the approximate altitude message will have the GNSS measurement of altitude (at the GNSS antenna location). After initialisation it will contain the same altitude as message 602h.

Table 29: Identifier 62Bh (1579), ApproxVelocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | Approximate OxTS NED frame north velocity | ApproxVelNorth |
| 16 | 16 | S | m/s | 0.01 | 0 | Approximate OxTS NED frame east velocity | ApproxVelEast |
| 32 | 16 | S | m/s | 0.01 | 0 | Approximate OxTS NED vertical (down) velocity | ApproxVelDown |
| 48 | 16 | U | m/s | 0.01 | 0 | Approximate horizontal speed | ApproxSpeed2D |

Before initialisation, the approximate velocity message will have the GNSS measurement of velocity (at the GNSS antenna location). After initialisation it will contain the same altitude as message 603h.

Table 30: Identifier 62Dh (1581), FallingTrigger

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 8 | U | | 1 | 0 | TTL signal level (0 low, 1 high, 255 unknown) | SignalLevelFalling |
| 8 | 8 | U | | 1 | 0 | Trigger count, increments with each new trigger | TriggerCountFalling |
| 16 | 16 | U | s | 0.0002 | 0 | Time since last trigger | TriggerTimeFalling |
| 32 | 32 | U | m | 0.001 | 0 | Distance with hold since last trigger | TriggerDistanceFalling |

Table 31: Identifier 62Eh (1582), RisingTrigger

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 8 | U | | 1 | 0 | TTL signal level (0 low, 1 high, 255 unknown) | SignalLevelRising |
| 8 | 8 | U | | 1 | 0 | Trigger count, increments with each new trigger | TriggerCountRising |
| 16 | 16 | U | s | 0.0002 | 0 | Time since last trigger | TriggerTimeRising |
| 32 | 32 | U | m | 0.001 | 0 | Distance with hold since last trigger | TriggerDistanceRising |

Table 32: Identifier 62Fh (1583), PosLocalNE

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 32 | S | m | 0.0001 | 0 | Northing | PosLocalNorth |
| 32 | 32 | S | m | 0.0001 | 0 | Easting | PosLocalEast |

Table 33: Identifier 630h (1584), MilliTime

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 48 | S | ms | 1 | 0 | Milliseconds since the start of GPS time | MilliTime |
| 0 | 48 | S | s | 0.001 | 0 | Seconds since the start of GPS time | MilliTimeSeconds |
| 48 | 8 | S | s | 1 | 0 | GPS UTC offset | UtcOffset |

Note: MilliTime and MilliTimeSeonds both refer to the same bits on the CAN bus—however they are decoded twice with a different scale in the DBC file. MilliTime needs to be stored as a signed 64-bit integer value as the current value already exceeds the limits of a 32-bit integer, however this is not supported by all CAN software. To overcome that problem MilliTimeSeconds can be stored as a 32-bit double-precision value, however limitations in the double-precision format mean there may be an error

of up to 5 ms and the resulting decimal numbers may contain rounding errors. Where possible MilliTime should be used, otherwise use MilliTimeSeconds with care.

Table 34: Identifier 633h (1587), IsoOrientation

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | ° | 0.01 | 0 | ISO 8855 yaw angle | IsoYawAngle |
| 16 | 16 | S | ° | 0.01 | 0 | ISO 8855 pitch angle | IsoPitchAngle |
| 32 | 16 | S | ° | 0.01 | 0 | ISO 8855 roll angle | IsoRollAngle |

Table 35: Identifier 634h (1588), IsoVsVelocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | ISO 8855 vehicle system longitudinal (forward) velocity | IsoVsLongitudinalVelocity |
| 16 | 16 | S | m/s | 0.01 | 0 | ISO 8855 vehicle system lateral (left) velocity | IsoVsLateralVelocity |
| 32 | 16 | S | m/s | 0.01 | 0 | ISO 8855 vehicle system vertical (up) velocity | IsoVsVerticalVelocity |

Table 36: Identifier 635h (1589), IsoVsAcceleration

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 vehicle system longitudinal (forward) velocity | IsoVsLongitudinalAcceleration |
| 16 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 vehicle system lateral (left) velocity | IsoVsLateralAcceleration |
| 32 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 vehicle system vertical (up) velocity | IsoVsVerticalAcceleration |

Table 37: Identifier 636h (1590), IsoVsAgularVelocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | º/s | 0.01 | 0 | ISO 8855 vehicle system roll (longitudinal angular) velocity | IsoVsRollVelocity |
| 16 | 16 | S | º/s | 0.01 | 0 | ISO 8855 vehicle system pitch (lateral angular) velocity | IsoVsPitchVelocity |
| 32 | 16 | S | º/s | 0.01 | 0 | ISO 8855 vehicle system yaw (vertical angular) velocity | IsoVsYawVelocity |

Table 38: Identifier 637h (1591), IsoVsAgularAcceleration

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | º/s$^2$ | 0.1 | 0 | ISO 8855 vehicle system roll (longitudinal angular) velocity | IsoVsRollAcceleration |
| 16 | 16 | S | º/s$^2$ | 0.1 | 0 | ISO 8855 vehicle system pitch (lateral angular) velocity | IsoVsPitchAcceleration |
| 32 | 16 | S | º/s$^2$ | 0.1 | 0 | ISO 8855 vehicle system yaw (vertical angular) velocity | IsoVsYawAcceleration |

Table 39: Identifier 638h (1592), IsoIsVelocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.1 | 0 | ISO 8855 intermediate system longitudinal (forward) velocity | IsoIsLongitudinalVelocity |
| 16 | 16 | S | m/s | 0.1 | 0 | ISO 8855 intermediate system pitch lateral (left) velocity | IsoIsLateralVelocity |
| 32 | 16 | S | m/s | 0.1 | 0 | ISO 8855 ISO 8855 intermediate system vertical (up) velocity | IsoIsVerticalVelocity |

Table 40: Identifier 639h (1593), IsoIsAcceleration

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 intermediate system longitudinal (forward) acceleration | IsoIsLongitudinalAcceleration |
| 16 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 intermediate system pitch lateral (left) acceleration | IsoIsLateralAcceleration |
| 32 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 ISO 8855 intermediate system vertical (up) acceleration | IsoIsVerticalAcceleration |

Table 41: Identifier 63Ah (1594), IsoIsAngularVelocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | °/s | 0.01 | 0 | ISO 8855 intermediate system roll (longitudinal angular) velocity | IsoIsRollVelocity |
| 16 | 16 | S | °/s | 0.01 | 0 | ISO 8855 intermediate system pitch (lateral angular) velocity | IsoIsPitchVelocity |
| 32 | 16 | S | °/s | 0.01 | 0 | ISO 8855 ISO 8855 intermediate system yaw (vertical angular) velocity | IsoIsYawVelocity |

Table 42: Identifier 63Bh (1595), IsoIsAngularAcceleration

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $°/s^2$ | 0.1 | 0 | ISO 8855 intermediate system roll (longitudinal angular) acceleration | IsoIsRollAcceleration |
| 16 | 16 | S | $°/s^2$ | 0.1 | 0 | ISO 8855 intermediate system pitch (lateral angular) acceleration | IsoIsPitchAcceleration |
| 32 | 16 | S | $°/s^2$ | 0.1 | 0 | ISO 8855 ISO 8855 intermediate system yaw (vertical angular) acceleration | IsoIsYawAcceleration |

Table 43: Identifier 63Ch (1596), IsoEfsVelocity

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | m/s | 0.01 | 0 | ISO 8855 earth-fixed system east velocity | IsoEfsEastVelocity |
| 16 | 16 | S | m/s | 0.01 | 0 | ISO 8855 earth-fixed system north velocity | IsoEfsNorthVelocity |
| 32 | 16 | S | m/s | 0.01 | 0 | ISO 8855 earth-fixed system vertical (up) velocity | IsoEfsVerticalVelocity |

Table 44: Identifier 63Dh (1597), IsoEfsAcceleration

| Offset (bits) | Length (bits) | Type | Units | Factor | Offset | Description | Signal name |
|---|---|---|---|---|---|---|---|
| 0 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 earth-fixed system east acceleration | IsoEfsEastAcceleration |
| 16 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 earth-fixed system north acceleration | IsoEfsNorthAcceleration |
| 32 | 16 | S | $m/s^2$ | 0.01 | 0 | ISO 8855 earth-fixed system vertical (up) acceleration | IsoEfsVerticalAcceleration |

# Revision history

Table 45: Revision history

| Revision | Comments |
|---|---|
| 210723 | Initial version – separated from RT manual into standalone manual |
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| | |

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