SENSORIS

Sensor Interface Specification

The Sensor Interface Specification (SENSORIS) defines an interface for requesting and sending vehicle sensor data from vehicles to clouds and across clouds. The specification and its standardization focus on the content and encoding of the interface.

The documentation of the SENSORIS schema is part of the protobuf schema itself, i.e. schema definition and documentation are located together. Documentation is written as protobuf comments. The comments in the protobuf schema are taken over automatically to the auto-generated data classes by the protobuf compiler.

sensoris/protobuf/messages/data.proto

sensoris.protobuf.messages.data

DataMessage

Data message.

Field	Type	Description
envelope	DataMessage.Envelope	Envelope.
event_group	repeated EventGroup	Event group.
event_relation	repeated DataMessage.EventRelation	Event relation.
event_source	repeated DataMessage.EventSource	Event source.

DataMessage.AbsolutePaths

Absolute paths through the message structure by defined field numbers in the protobuf schema. The paths begin at message type DataMessages.

Field	Type	Description
path	repeated DataMessage.AbsolutePaths.Path	Path through the message structure by defined field numbers in the protobuf schema. The path begins at message type DataMessages.

DataMessage.AbsolutePaths.Path

Path through the message structure by defined field numbers in the protobuf schema. The path begins at message type DataMessages.

Example: [2, 2, 4, 2, 4] points to the instance of type sensoris.protobuf.types.base.Int64ValueAndAccuracy at the path data_message.event_group.weather_category.precipitation.absolute_intensity_and_accuracy.

field_number	repeated int64 Unit 1 Resolution 1 Range [1,)	Field number.

DataMessage.Envelope

Envelope.

Field	Type	Description
ids	DataMessage.Envelope.Ids	Identifiers.
field_resolution_override	repeated DataMessage.Envelope.FieldResolutionOverride	Field resolution override.
vehicle_dimensions	DataMessage.Envelope.VehicleDimensions	Vehicle dimensions in reference to SENSORIS vehicle coordinate system.
map_identification	DataMessage.Envelope.MapIdentification	Map identification. The combination of the map identification and event relations of type MAP_REFERENCE defined in the data message enable to relate events to map objects defined by map references in the map category. If the map of the vehicle is known to the cloud, then the relations can be interpreted by the cloud.
extension	repeated google.protobuf.Any	Proprietary extension.

DataMessage.Envelope.FieldResolutionOverride

Override resolution of event fields referenced by their paths.

Field	Type	Description
paths	DataMessage.Paths	Paths that are impacted by the field resolution override.
exponent	google.protobuf.Int64Value Unit 1 Resolution 1 Range (,)	Exponent of the override to the base of 10. Example: Value 2 is interpreted as factor 10^(2) = 100, e.g. the transported value 1234 results in the interpretation of 12.34.

DataMessage.Envelope.Ids

Identifiers.

Field	Type	Description
session_id	google.protobuf.StringValue	Session identifier.
message_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Message identifier.
last_message_of_session	google.protobuf.BoolValue	Flag for last message of session with the session_id. If true, then the message is the last message of the session. If false, then subsequent messages are to be expected.
vehicle_fleet_id	google.protobuf.StringValue	Vehicle fleet identifier.

vehicle_id	google.protobuf.StringValue	Vehicle identifier.
driver_id	google.protobuf.StringValue	Driver identifier.

DataMessage.Envelope.MapIdentification

Map identification. The combination of the map identification and event relations of type MAP_REFERENCE defined in the data message enable to relate events to map objects defined by map references in the map category. If the map of the vehicle is known to the cloud, then the relations can be interpreted by the cloud.

Field	Type	Description
provider_version	DataMessage.Envelope.MapIdentification.MapVersion	Map version as it is extracted from the map provider.
compiler_version	DataMessage.Envelope.MapIdentification.MapVersion	Map version in case the map is compiled through a third party.
format	DataMessage.Envelope.MapIdentification.Format	Map format.

DataMessage.Envelope.MapIdentification.MapVersion

Map version defined by source and version.

Field	Type	Description
source	google.protobuf.StringValue	Map source. Example: Value Map Provider High Definition Live Map.
version	sensoris.protobuf.types.base.Version	Map version. In case of a continuous map update service, the exact version might not be existing.
extraction_timestamp	sensoris.protobuf.types.base.Timestamp	Map extraction timestamp representing the version of the map at the timestamp. Can be set in addition or in exchange of map version. Version and extraction timestamp are redundant in case of an exact mapping between timestamp and version.

DataMessage.Envelope.VehicleDimensions

Vehicle dimensions in reference to SENSORIS vehicle coordinate system.

Field	Type	Description
distance_to_front	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Distance from SENSORIS vehicle coordinate system to vehicle front in direction of positive x-axis.
distance_to_back	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Distance from SENSORIS vehicle coordinate system to vehicle back in direction of negative x-axis.
distance_to_left	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Distance from SENSORIS vehicle coordinate system to vehicle left in direction of positive y-axis.

distance_to_right	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Distance from SENSORIS vehicle coordinate system to vehicle right in direction of negative y-axis.
distance_to_top	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Distance from SENSORIS vehicle coordinate system to vehicle top in direction of positive z-axis.
distance_to_ground	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Distance from SENSORIS vehicle coordinate system to vehicle ground in direction of negative z-axis.

DataMessage.EventRelation

Binary relation between events in a data message. Relations are allowed between events in an EventGroup and across events of different EventGroups.

Field	Type	Description
from_id	repeated google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	From id refers to event with EventEnvelope.id.
type	DataMessage.EventRelation.Type	Type.
to_id	repeated google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	To id refers to event with EventEnvelope.id.
extension	repeated google.protobuf.Any	Proprietary extension.

DataMessage.EventSource

Source of events. Source can be set for individual events or for event types in paths.

Field	Type	Description
source	sensoris.protobuf.types.source.Source	Source.
ids	DataMessage.EventSource.EventEnvelopeIds	Events referenced by their envelope ids are provided by the source.
paths	DataMessage.Paths	All events of the types in the paths are provided by the source.
extension	repeated google.protobuf.Any	Proprietary extension.

DataMessage.EventSource.EventEnvelopeIds

Event envelope ids.

Field	Type	Description
id	repeated google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Refers to EventEnvelope.id. Example: Values [1, 25, 26, 28, 45, 123] define that the six events identified by their ids are provided by the source.

DataMessage.Paths

Paths through the message structure.

Field	Type	Description
absolute_paths	DataMessage.AbsolutePaths	Absolute paths through the message structure by defined field numbers in the protobuf schema. The paths begin at message type DataMessages.

DataMessages

Data messages for transport.

Field	Type	Description
envelope	DataMessages.Envelope	Envelope.
data_message	repeated DataMessage	Data message.

DataMessages.Envelope

Envelope.

Field	Type	Description
version	sensoris.protobuf.types.base.Version	Format version.
submitter	repeated sensoris.protobuf.types.base.Entity	Information about the submitting entity which may be a fleet, a vehicle manufacturer or a specific service/software. The primary id might be the company name whereas the secondary id might be a service reason, a bilateral contract identifier or similar. Example: Values primary_id: "ABC Vehicle Manufacturer", secondary_id: "ConnectedVehicleSensorDataCollectionUnit", type: "HazardWarning".
extension	repeated google.protobuf.Any	Proprietary extension.

EventGroup

Group of events with same origin.

Field	Type	Description
envelope	EventGroup.Envelope	Envelope.
localization_category	sensoris.protobuf.categories.localization.LocalizationCategory	Localization category.
object_detection_category	sensoris.protobuf.categories.objectdetection.ObjectDetectionCategory	Object detection category.
weather_category	sensoris.protobuf.categories.weather.WeatherCategory	Weather category.
driving_behavior_category	sensoris.protobuf.categories.drivingbehavior.DrivingBehaviorCategory	Driving behavior category.

intersection_attribution_category	sensoris.protobuf.categories.intersectionattribution.IntersectionAttributionCategory	Intersection attribution category.
road_attribution_category	sensoris.protobuf.categories.roadattribution.RoadAttributionCategory	Road attribution category.
traffic_regulation_category	sensoris.protobuf.categories.trafficregulation.TrafficRegulationCategory	Traffic regulation category.
traffic_events_category	sensoris.protobuf.categories.trafficevents.TrafficEventsCategory	Traffic events category.
traffic_maneuver_category	sensoris.protobuf.categories.trafficmaneuver.TrafficManeuverCategory	Traffic maneuver category.
brake_category	sensoris.protobuf.categories.brake.BrakeCategory	Brake category.
powertrain_category	sensoris.protobuf.categories.powertrain.PowertrainCategory	Powertrain category.
map_category	sensoris.protobuf.categories.map.MapCategory	Map category.

EventGroup.Envelope

Envelope.

Field	Type	Description
origin	EventGroup.Envelope.Origin	Temporal and spatial origin.
extension	repeated google.protobuf.Any	Proprietary extension.

EventGroup.Envelope.Origin

Temporal and spatial origin.

Field	Type	Description
timestamp	sensoris.protobuf.types.base.Timestamp	Temporal origin.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy of spatial origin in absolute spatial reference system.
orientation_and_accuracy	sensoris.protobuf.types.spatial.RotationAndAccuracy	Rotation and accuracy of spatial origin in absolute spatial reference system. If orientation is not defined then orientation is East-North-Up (ENU).

DataMessage.Envelope.MapIdentification.Format

Map format.

Name	#	Description

UNKNOWN_FORMAT	0	Unknown.
OTHER	1	Other, i.e. none of the listed enum values.
NDS	2	Navigation Data Standard (NDS).

DataMessage.EventRelation.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
EQUAL	1	Same real world entity described through to and from events.
GROUP	2	Accumulation of from events without to relation.
CONTAIN	3	Accumulation of from events to whole to events.
IMPACT	4	To events add context to or enrich the from events.
START_AT	5	From events start at the to events, e.g. for spatial or temporal relations.
END_AT	6	From events end at the to events, e.g. for spatial or temporal relations.
LEFT_OF	7	From events are spatially left of the to events in the context of the spatial reference system.
RIGHT_OF	8	From events are spatially right of the to events in the context of the spatial reference system.
TRIGGERED_BY	9	From events are consequences of the to events.
DERIVED_FROM	11	To events are derivations or interpretations of the from events.
MAP_REFERENCE	12	From events reference to objects from a map.

sensoris/protobuf/categories/brake.proto

sensoris.protobuf.categories.brake

BrakeCategory

Brake category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
brake_systems_status	repeated BrakeSystemsStatus	Status of brake systems.

BrakeSystemsStatus

Status of brake systems.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
abs_status	sensoris.protobuf.types.base.SystemStatus	Status of Anti-lock Breaking System (ABS).
esc_status	sensoris.protobuf.types.base.SystemStatus	Status of Electronic Stability Control (ESC).

tcs_status	sensoris.protobuf.types.base.SystemStatus	Status of Traction Control System (TCS).
ebd_status	sensoris.protobuf.types.base.SystemStatus	Status of Electronic Brakeforce Distribution (EBD).
eba_status	sensoris.protobuf.types.base.SystemStatus	Status of Emergency Brake Assist (EBA).

Supported event relations

1..* sensoris.protobuf.categories.localization.VehicleAcceleration TRIGGERED_BY 1 sensoris.protobuf.categories.brake.BrakeSystemsStatus

1 sensoris.protobuf.categories.brake.BrakeSystemsStatus TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleAcceleration

1 sensoris.protobuf.categories.brake.BrakeSystemsStatus TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.MovableObject

1 sensoris.protobuf.categories.brake.BrakeSystemsStatus TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.StaticObject

sensoris/protobuf/categories/driving_behavior.proto

sensoris.protobuf.categories.drivingbehavior

DrivingBehaviorCategory

Driving behavior category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
parking_status	repeated ParkingStatus	Parking status.

ParkingStatus

Parking status describes parking in or parking out of a parking spot along with the parking direction and duration. The vehicle may also report additional information, if such information is available: 1) the direction of parking (longitudinal, lateral, diagonal). 2) the expected (for a park in event) or actual (for a park out event) duration. The duration may contain accuracy. The event may be related with an IMPACTS relation to TrafficSign events describing the parking regulations identified for the parking spot just occupied / vacated by the vehicle. The position of the parked vehicle is reported using one or more events VehiclePositionAndOrientation for which the ParkingStatus timestamp can be interpolated within the path of the positions. If the parking event is identified with a delay, then the original timestamp of the parking event shall be back-calculated. It is recommended to also report the vehicle heading.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
status_and_confidence	ParkingStatus.StatusAndConfidence	Status and confidence.
direction_and_confidence	ParkingStatus.DirectionAndConfidence	Direction and confidence.
duration_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** Minute **Resolution** 1 **Range** (0,)	Duration of parking in minutes: - for status PARK_IN the planned parking duration, e.g. based on time payed for parking. - for status PARK_OUT the actual duration since the vehicle parked in the location.

Supported event relations

1..* sensoris.protobuf.categories.trafficregulation.TrafficSign IMPACT 1 sensoris.protobuf.categories.drivingbehavior.ParkingStatus

1 sensoris.protobuf.categories.drivingbehavior.ParkingStatus START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.drivingbehavior.ParkingStatus END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation

ParkingStatus.DirectionAndConfidence

Direction and confidence.

Field	Type	Description
type	ParkingStatus.DirectionAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

ParkingStatus.StatusAndConfidence

Status and confidence.

Field	Type	Description
type	ParkingStatus.StatusAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

ParkingStatus.DirectionAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
LONGITUDINAL	1	Vehicle is parked along the road.
LATERAL	2	Vehicle is parked lateral to the road.
DIAGONAL	3	Vehicle is parked diagonal to the road.

ParkingStatus.StatusAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
PARK_IN	1	Vehicle parks in, i.e. vehicle occupies a parking spot.
PARK_OUT	2	Vehicle parks out, i.e. vehicle leaves a parking spot.

sensoris/protobuf/categories/intersection_attribution.proto

sensoris.protobuf.categories.intersectionattribution

IntersectionAttributionCategory

Intersection attribution category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
traffic_signal_bulb	repeated TrafficSignalBulb	Bulb of a traffic signal, i.e. the individual traffic light.
traffic_signal	repeated TrafficSignal	Traffic signal of one or more traffic lights for an intersection scenario. Traffic signals also might be part of no intersection, e.g. on pedestrian crossings.

TrafficSignal

Traffic signal of one or more traffic lights for an intersection scenario. Traffic signals also might be part of no intersection, e.g. on pedestrian crossings. The geometry of a traffic signal is defined by a rectangular box and accuracy around the traffic signal.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a traffic signal has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
rectangular_box_and_accuracy	sensoris.protobuf.types.spatial.RectangularBoxAndAccuracy	Rectangular box and accuracy.
bulb_count_and_confidence	sensoris.protobuf.types.base.CountAndConfidence	Number of bulbs and confidence. Example: Traffic signal has three bulbs with confidence 90 %.
orientation_and_confidence	TrafficSignal.OrientationAndConfidence	Orientation and confidence.

Supported event relations
1 sensoris.protobuf.categories.intersectionattribution.TrafficSignal CONTAIN 1..* sensoris.protobuf.categories.intersectionattribution.TrafficSignalBulb
1..* sensoris.protobuf.categories.intersectionattribution.TrafficSignal EQUAL 1 sensoris.protobuf.categories.objectdetection.StaticObject

TrafficSignal.OrientationAndConfidence

Orientation.

Example: Traffic signal has orientation VERTICAL with confidence 80 %.

Field	Type	Description
type	TrafficSignal.OrientationAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSignalBulb

Bulb of a traffic signal, i.e. the individual traffic light.

envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a traffic signal bulb has been detected.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy of traffic signal bulb center.
status_and_confidence	TrafficSignalBulb.StatusAndConfidence	Status and confidence.
color_and_confidence	TrafficSignalBulb.ColorAndConfidence	Color and confidence.
shape_and_confidence	TrafficSignalBulb.ShapeAndConfidence	Shape and confidence.

Supported event relations

1 sensoris.protobuf.categories.intersectionattribution.TrafficSignal CONTAIN 1..* sensoris.protobuf.categories.intersectionattribution.TrafficSignalBulb

TrafficSignalBulb.ColorAndConfidence

Color and confidence.

Example: Traffic signal bulb has the color RED with confidence 90 %.

Field	Type	Description
type	TrafficSignalBulb.ColorAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSignalBulb.ShapeAndConfidence

Shape and confidence.

Example: Traffic signal bulb has the shape ARROW_STRAIGHT with confidence 70 %.

Field	Type	Description
type	TrafficSignalBulb.ShapeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSignalBulb.StatusAndConfidence

Status and confidence.

Example: Traffic signal bulb has the status BLINKING with confidence 60 %.

Field	Type	Description
type	TrafficSignalBulb.StatusAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSignal.OrientationAndConfidence.Type

Type.

UNKNOWN_TYPE	0	Unknown.
OTHER	1	Other, i.e. none of the listed enum values.
HORIZONTAL	2	Horizontal.
VERTICAL	3	Vertical.
MIXED	4	Mixed, i.e. both horizontal and vertical.

TrafficSignalBulb.ColorAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
GREEN	1	Green.
YELLOW	2	Yellow.
RED	3	Red.

TrafficSignalBulb.ShapeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
CIRCLE	1	No shape, i.e. full bulb circle is illuminated when on.
ARROW_STRAIGHT	2	Straight arrow.
ARROW_LEFT	3	Left arrow describing left turning only.
ARROW_RIGHT	4	Right arrow describing right turning only.
ARROW_STRAIGHT_AND_LEFT	5	Straight and left arrow describing straight and left turning only.
ARROW_STRAIGHT_AND_RIGHT	6	Straight and right arrow describing straight and right turning only.

TrafficSignalBulb.StatusAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
OFF	1	Light is off.
ON	2	Light is on.
BLINKING	3	Light is blinking.

sensoris/protobuf/categories/localization.proto

sensoris.protobuf.categories.localization

LocalizationCategory

Localization category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
vehicle_position_and_orientation	repeated VehiclePositionAndOrientation	Vehicle position and rotation.
vehicle_odometry	repeated VehicleOdometry	Vehicle odometry.
vehicle_speed	repeated VehicleSpeed	Vehicle speed.
vehicle_acceleration	repeated VehicleAcceleration	Vehicle acceleration.
vehicle_rotation_rate	repeated VehicleRotationRate	Vehicle rotation rate.

VehicleAcceleration

Vehicle acceleration.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
value_and_accuracy	sensoris.protobuf.types.spatial.XyzVectorAndAccuracy Unit Meter per Second Squared Resolution 0.1 Range (,)	Value and accuracy.

Supported event relations
1..* sensoris.protobuf.categories.localization.VehicleAcceleration TRIGGERED_BY 1 sensoris.protobuf.categories.brake.BrakeSystemsStatus
1 sensoris.protobuf.categories.brake.BrakeSystemsStatus TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleAcceleration
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleAcceleration

VehicleOdometry

Vehicle odometry. A vehicle odometry describes the translation and rotation from the vehicle position at envelope.timestamp to the vehicle position at end_timestamp. The start and end vehicle position of a vehicle odometry can be set explicitly with event relations of type START and END.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
end_timestamp	sensoris.protobuf.types.base.Timestamp	End timestamp. If the end timestamp and the event relation of type END are not set, then the end timestamp is the timestamp of the vehicle position directly following the envelope.timestamp.
translation_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Translation and accuracy.
rotation_and_accuracy	sensoris.protobuf.types.spatial.RotationAndAccuracy	Rotation and accuracy.

Supported event relations

1 sensoris.protobuf.categories.localization.VehicleOdometry START 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.localization.VehicleOdometry END 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation

VehiclePositionAndOrientation

Vehicle position and orientation.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy.
orientation_and_accuracy	sensoris.protobuf.types.spatial.RotationAndAccuracy	Orientation and accuracy.
navigation_satellite_system_status	VehiclePositionAndOrientation.NavigationSatelliteSystemStatus	Status for event source sensor NavigationSatelliteSystem.

Supported event relations
1 sensoris.protobuf.categories.localization.VehicleOdometry START 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.localization.VehicleOdometry END 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.drivingbehavior.ParkingStatus START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.drivingbehavior.ParkingStatus END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.TrafficCondition START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.TrafficCondition END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWorks START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWorks END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWeatherCondition START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWeatherCondition END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehiclePositionAndOrientation

VehiclePositionAndOrientation.NavigationSatelliteSystemStatus

Status of navigation satellite system.

Field	Type	Description
fix_type	VehiclePositionAndOrientation.NavigationSatelliteSystemStatus.FixType	Fix type.

count	sensoris.protobuf.types.base.Int64Value **Unit** 1 **Resolution** 1 **Range** [1,)	Total number of satellites used for fix.
hdop	sensoris.protobuf.types.base.Int64Value **Unit** 1 **Resolution** 0.01 **Range** (0,)	Horizontal dilution of precision.
vdop	sensoris.protobuf.types.base.Int64Value **Unit** 1 **Resolution** 0.01 **Range** (0,)	Vertical dilution of precision.
pdop	sensoris.protobuf.types.base.Int64Value **Unit** 1 **Resolution** 0.01 **Range** (0,)	Position dilution of precision.
tdop	sensoris.protobuf.types.base.Int64Value **Unit** 1 **Resolution** 0.01 **Range** (0,)	Time dilution of precision.
snr	sensoris.protobuf.types.base.Int64Value **Unit** Decibel **Resolution** 0.1 **Range** (,)	Signal-to-noise ratio of the satellite signal.

VehicleRotationRate

Vehicle rotation rate.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
value_and_accuracy	sensoris.protobuf.types.spatial.RotationRateAndAccuracy	Value and accuracy.

Supported event relations

1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..*
sensoris.protobuf.categories.localization.VehicleRotationRate

VehicleSpeed

Vehicle speed.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
value_and_accuracy	sensoris.protobuf.types.spatial.XyzVectorAndAccuracy **Unit** Meter per Second **Resolution** 0.1 **Range** [0,)	Value and accuracy.

Supported event relations

1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleSpeed

VehiclePositionAndOrientation.NavigationSatelliteSystemStatus.FixType

Fix type.

Name	#	Description

UNKNOWN_FIX_TYPE	0	Unknown.
NONE	1	No fix.
TWO_D	2	2 D fix.
TWO_D_SATELLITE_BASED_AUGMENTATION	3	2 D fix using satellite based augmentation.
TWO_D_GROUND_BASED_AUGMENTATION	4	2 D fix using ground based augmentation.
TWO_D_SATELLITE_AND_GROUND_BASED_AUGMENTATION	5	2 D fix using satellite and ground based augmentation.
THREE_D	6	3 D fix using satellite based augmentation.
THREE_D_SATELLITE_BASED_AUGMENTATION	7	3 D fix using satellite based augmentation.
THREE_D_GROUND_BASED_AUGMENTATION	8	3 D fix using ground based augmentation.
THREE_D_SATELLITE_AND_GROUND_BASED_AUGMENTATION	9	3 D fix using satellite and ground based augmentation.

sensoris/protobuf/categories/map.proto

sensoris.protobuf.categories.map

MapCategory

Map category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
map_reference	repeated MapReference	Map reference.

MapReference

Map reference of an event object to a map object including its location reference. The combination of the map identification and event relations of type MAP_REFERENCE defined in the data message enable to relate events to map objects defined by map references in the map category. If the map of the vehicle is known to the cloud, then the relations can be interpreted by the cloud.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Envelope.
location_reference	sensoris.protobuf.types.spatial.MapLocationReference	Location reference of the map object.

Supported event relations
1 sensoris.protobuf.categories.objectdetection.StaticObject MAP_REFERENCE 1 sensoris.protobuf.categories.map.MapReference
1 sensoris.protobuf.categories.trafficregulation.TrafficSign MAP_REFERENCE 1 sensoris.protobuf.categories.map.MapReference

sensoris/protobuf/categories/object_detection.proto

sensoris.protobuf.categories.objectdetection

MovableObject

TRUCK or TRAILER.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
object_id	google.protobuf.Int64Value **Unit** 1 **Resolution** 1 **Range** [1,)	Movable object identifier. Identifier is unique within a DataMessage and can be used to trace movable objects.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a movable object has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	MovableObject.TypeAndConfidence	Type and confidence.
rectangular_box_and_accuracy	sensoris.protobuf.types.spatial.RectangularBoxAndAccuracy	Rectangular box and accuracy.
speed_and_accuracy	sensoris.protobuf.types.spatial.XyzVectorAndAccuracy **Unit** Meter per Second **Resolution** 0.1 **Range** [0,)	Speed.
acceleration_and_accuracy	sensoris.protobuf.types.spatial.XyzVectorAndAccuracy **Unit** Meter per Second Squared **Resolution** 0.1 **Range** (,)	Acceleration.

Supported event relations
1 sensoris.protobuf.categories.objectdetection.MovableObject CONTAIN 1..* sensoris.protobuf.categories.trafficregulation.TrafficSign
1 sensoris.protobuf.categories.brake.BrakeSystemsStatus TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.MovableObject
1..* sensoris.protobuf.categories.objectdetection.MovableObject IMPACT 1 sensoris.protobuf.categories.trafficevents.Hazard
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.MovableObject
1 sensoris.protobuf.categories.roadattribution.Lane CONTAINS 1..* sensoris.protobuf.categories.objectdetection.MovableObject
1 sensoris.protobuf.categories.objectdetection.MovableObject IMPACT 1 sensoris.protobuf.categories.powertrain.CruiseControl

MovableObject.TypeAndConfidence

Type and confidence.

Example: Detected object is a vehicle with 80 % confidence.

Field	Type	Description
type	MovableObject.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

ObjectDetectionCategory

Object detection category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.

movable_object	repeated MovableObject	Detected object, which is able to move.
static_object	repeated StaticObject	Detected object, which is not able to move.

StaticObject

Detected object, which is not able to move. Traffic signs can be related to a static object of the type POLE or SIGN_BRIDGE. Traffic lights can be related to static object of type TRAFFIC_LIGHT_BODY.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
object_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Static object identifier. Identifier is unique within a DataMessage and can be used to trace static objects.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a static object has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	StaticObject.TypeAndConfidence	Type and confidence.
rectangular_box_and_accuracy	sensoris.protobuf.types.spatial.RectangularBoxAndAccuracy	Rectangular box and accuracy.
cone_and_accuracy	StaticObject.ConeAndAccuracy	Cone shaped circular geometry defined by a lower and upper position and a lower and upper diameter.
surface_type_and_confidence	StaticObject.SurfaceTypeAndConfidence	Surface type and confidence.
surface_material_and_confidence	StaticObject.SurfaceMaterialAndConfidence	Surface material and confidence.
surface_color_and_confidence	repeated StaticObject.SurfaceColorAndConfidence	Surface color and confidence. An object may have multiple colors. If only one color is set, this is the dominant color.

Supported event relations
1 sensoris.protobuf.categories.objectdetection.StaticObject CONTAIN 1..* sensoris.protobuf.categories.trafficregulation.TrafficSign
1 sensoris.protobuf.categories.objectdetection.StaticObject CONTAIN 1..* sensoris.protobuf.categories.intersectionattribution.TrafficSignal
1 sensoris.protobuf.categories.objectdetection.StaticObject MAP_REFERENCE 1 sensoris.protobuf.categories.map.MapReference
1 sensoris.protobuf.categories.brake.BrakeSystemsStatus TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.StaticObject
1..* sensoris.protobuf.categories.intersectionattribution.TrafficSignal EQUAL 1 sensoris.protobuf.categories.objectdetection.StaticObject
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.StaticObject
1 sensoris.protobuf.categories.roadattribution.Lane CONTAINS 1..* sensoris.protobuf.categories.objectdetection.StaticObject

StaticObject.ConeAndAccuracy

Cone shaped circular geometry defined by a lower and upper position and a lower and upper diameter.

lower_position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Lower position and accuracy. The lower position is closer to the ground than the upper position.
upper_position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Upper position and accuracy.
lower_diameter_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit MilliMeter Resolution 1 Range (0,)	Lower diameter and accuracy at lower position and accuracy.
upper_diameter_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit MilliMeter Resolution 1 Range (0,)	Upper diameter and accuracy at upper position and accuracy.
extension	repeated google.protobuf.Any	Proprietary extension.

StaticObject.SurfaceColorAndConfidence

Surface color and confidence.

Field	Type	Description
type	StaticObject.SurfaceColorAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

StaticObject.SurfaceMaterialAndConfidence

Surface material and confidence.

Example: Detected object has a stone surface with 80 % confidence.

Field	Type	Description
type	StaticObject.SurfaceMaterialAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.
reflectivity_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit 1 Resolution 1 Range [0, 100]	Reflectivity. An object is reflective if there are elements on the object, that are explicitly designed to increase visibility in low light or bad light situations.

StaticObject.SurfaceTypeAndConfidence

Surface type and confidence, e.g. of a traffic island.

Example: Detected object has a flat surface with 80 % confidence.

Field	Type	Description
type	StaticObject.SurfaceTypeAndConfidence.Type	Type
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

StaticObject.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	StaticObject.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

MovableObject.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
VEHICLE	1	Any vehicle, e.g. passenger car or truck.
VEHICLE_PASSENGER_CAR	2	Passenger car.
VEHICLE_TRUCK	3	Truck.
VEHICLE_BUS	4	Bus.
VEHICLE_TRAM	5	Tram.
VEHICLE_TRAILER	6	Trailer.
TWO_WHEELER	7	Any two wheeler, e.g. motorcycle or bicycle.
TWO_WHEELER_MOTORCYCLE	8	Motorcycle.
TWO_WHEELER_BICYCLE	9	Bicycle.
PERSON	10	Person.
ANIMAL	11	Animal.

StaticObject.SurfaceColorAndConfidence.Type

Type.

Name	#	Description
UNKOWN_TYPE	0	Unknown.
OTHER	1	Other, i.e. none of the listed enum values.
WHITE	2	White.
GRAY	3	Gray.
GRAY_LIGHT	4	Light gray.
GRAY_DARK	5	Dark gray.
BLACK	6	Black.
RED	7	Red.
GREEN	8	Green.
BLUE	9	Blue.

StaticObject.SurfaceMaterialAndConfidence.Type

Type.

UNKNOWN_TYPE	0	Unknown.
METAL	1	Metal.
CONCRETE	2	Concrete.
STONE	3	Stone.
WOOD	4	Wood.
PLASTIC	5	Plastic.
ASPHALT	6	Asphalt.
ORGANIC	7	Organic.

StaticObject.SurfaceTypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
FLAT	1	Flat.
ROUGH	2	Rough.

StaticObject.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
BRIDGE	1	Bridge.
TUNNEL	2	Tunnel.
POLE	3	Any pole.
POLE_LIGHT	4	Light pole.
POLE_REFLECTOR	5	Reflector pole.
POLE_DELINEATOR	6	Delineator pole.
POLE_GANTRY	7	Gantry pole.
POLE_SIGN	8	Sign pole.
POLE_GUARD_RAIL	9	Guard rail pole.
BAR	10	Bar.
TREE	11	Tree.
BOLLARD	12	Bollard.
CONE	13	Pylon in a construction zone.
BARREL	14	Red/white striped element in a construction zone.
WALL	15	Wall.
TRAFFIC_ISLAND	16	Traffic island.
SPEED_BUMP	17	Speed bump.
POT_HOLE	18	Pot hole.

MANHOLE_COVER	19	Manhole cover.
MANHOLE_COVER_CLOSED	20	Closed manhole cover.
MANHOLE_COVER_OPEN	21	Open manhole cover.
SIGN_BRIDGE	22	Sign bridge. Traffic signs can be related to the sign bridge with event relations.
TRAFFIC_LIGHT_BODY	23	Body of a traffic light. Traffic lights can be related to the traffic light body with event relations.
BARRIER_PARKING_LOT	24	Parking lot barrier.

sensoris/protobuf/categories/powertrain.proto

sensoris.protobuf.categories.powertrain

CruiseControlStatus

Status of the longitudinal driver assistent system for keeping the selected speed and/or temporal distance towards the lead vehicle.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
type	CruiseControlStatus.Type	Type.
status	sensoris.protobuf.types.base.SystemStatus	Status.
selected_speed	sensoris.protobuf.types.base.Int64Value **Unit** Meter per Second **Resolution** 0.1 **Range** (0,)	Selected speed.
selected_time_to_lead_vehicle	sensoris.protobuf.types.base.Int64Value **Unit** Second **Resolution** 0.1 **Range** [0, 100]	Selected lead time.

Supported event relations
1 sensoris.protobuf.categories.objectdetection.MovableObject IMPACT 1 sensoris.protobuf.categories.powertrain.CruiseControl

EngineStatus

Status of engine.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
ignition_status	EngineStatus.IgnitionStatus	Ingnition status.
powertrain_status	EngineStatus.PowertrainStatus	Powertrain status.

PowertrainCategory

Powertrain category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.

engine_status	repeated EngineStatus	Status of engine.
transmission_status	repeated TransmissionStatus	Status of transmission.
cruise_control_status	repeated CruiseControlStatus	Status of cruise control.

TransmissionStatus

Status of transmission.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
gear_mode	TransmissionStatus.GearMode	Mode of gear.
drive_mode	TransmissionStatus.DriveMode	Drive mode.
current_gear	sensoris.protobuf.types.base.Int64Value Unit 1 Resolution 1 Range [1,)	Current gear in the selected mode for which 1 is the gear with the highest ratio (slowest possible speed) and the maximum number (e.g. 6) is the gear with the lowest ratio (highest possible speed). If gear mode is REVERSE, then current gear refers to the gear in reverse as vehicles might have multiple reverse gears. If gear mode is PARK or NEUTRAL, the current gear is not relevant.

CruiseControlStatus.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
SPEED	1	Cruise control.
SPEED_AND_DISTANCE	2	Adaptive cruise control.

EngineStatus.IgnitionStatus

Ignition status.

Name	#	Description
UNKNOWN_IGNITION_STATUS	0	Unknown.
IGNITION_LOCK	1	Vehicle locked.
IGNITION_OFF	2	Ignition off.
IGNITION_ACCESSORIES	3	Accessories mode on.
IGNITION_ON	4	Ignition on.
IGNITION_START	5	Ignition start.

EngineStatus.PowertrainStatus

Powertrain status.

UNKNOWN_POWERTRAIN_STATUS	0	Unknown.
POWERTRAIN_OFF	1	Powertrain is not ready.
POWERTRAIN_ECO_MODE	2	Ignition is on, but powertrain is in eco mode (i.e. eco start stop functionality for a stopped vehicle).
POWERTRAIN_READY	3	Powertrain is ready to drive (i.e. combustion engine running or hybrid/electric ready to drive).

TransmissionStatus.DriveMode

Drive mode.

Name	#	Description
UNKNOWN_DRIVE_MODE	0	Unknown.
ECO	1	Eco drive mode.
COMFORT	2	Normal or comfort mode.
SPORT	3	Sport mode.
SUPER_SPORT	4	Super sport mode.

TransmissionStatus.GearMode

Gear mode.

Name	#	Description
UNKNOWN_GEAR_MODE	0	Unknown.
DRIVE	1	Automatic gear (drive).
MANUAL	2	Manual gear.
REVERSE	3	Reverse gear.
PARK	4	Park.
NEUTRAL	5	Neutral.

sensoris/protobuf/categories/road_attribution.proto

sensoris.protobuf.categories.roadattribution

InclinationAndCurvature

Inclination and curvature.

Field	Type	Description
longitudinal_inclination_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit Degree Resolution 0.01 Range (-90, 90)	Longitudinal declination and accuracy, also referred as slope.

lateral_inclination_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** Degree **Resolution** 0.01 **Range** (-90, 90)	Lateral declination and accuracy, also referred as cross fall.
horizontal_curvature_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** 1 per KiloMeter **Resolution** 0.1 **Range** (,)	Horizontal curvature and accuracy. Negative value represents curve to the left, positive value represents curve to the right. Value of 0 represents straight road. The value is the reciproke of the radius (curvature = 1/radius) whereas high radii are represented by low values.

Lane

Lane.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
relative_lane_id	google.protobuf.Int64Value **Unit** 1 **Resolution** 1 **Range** (,)	Relative lane identifier. Identifier is 0 for ego-lane, +1 for lane directly left of vehicle, +2 for lane left of lane +1, -1 for lane directly right of vehicle, -2 for lane right of lane -1.
width_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter **Resolution** 1 **Range** (0,)	Width and accuracy.
inclination_and_curvature	InclinationAndCurvature	Inclination and curvature.

Supported event relations
1..* sensoris.protobuf.categories.roadattribution.LaneBoundary LEFT_OF 1 sensoris.protobuf.categories.roadattribution.Lane
1..* sensoris.protobuf.categories.roadattribution.LaneBoundary RIGHT_OF 1 sensoris.protobuf.categories.roadattribution.Lane
1 sensoris.protobuf.categories.roadattribution.Lane LEFT_OF 1 sensoris.protobuf.categories.roadattribution.Lane
1 sensoris.protobuf.categories.roadattribution.Lane RIGHT_OF 1 sensoris.protobuf.categories.roadattribution.Lane
1 sensoris.protobuf.categories.roadattribution.Road CONTAIN 1..* sensoris.protobuf.categories.roadattribution.Lane
1..* sensoris.protobuf.categories.roadattribution.SurfaceMarking IMPACT 1 sensoris.protobuf.categories.roadattribution.Lane
1 sensoris.protobuf.categories.roadattribution.Lane CONTAINS 1..* sensoris.protobuf.categories.objectdetection.MovableObject
1 sensoris.protobuf.categories.roadattribution.Lane CONTAINS 1..* sensoris.protobuf.categories.objectdetection.StaticObject

LaneBoundary

Lane boundary. For a single lane several lane boundaries to the left or right may be given. If a lane has several lane boundaries in one direction, then the lane boundaries shall be sorted by their distance to the lane.

Example: L1 Lane R1 R2 Lane with lane boundary L1 to the left of type LINE_SINGLE_SOLID and lane boundaries R1 and R2 to the right with R1 of type LINE_SINGLE_SOLID and R2 of type ROAD_EDGE.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.

lane_boundary_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Lane boundary identifier. Identifier is unique within a DataMessage and can be used to trace lane boundaries between LaneBoundary events.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a lane boundary has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	LaneBoundary.TypeAndConfidence	Type and confidence.
material_and_confidence	MarkingMaterialAndConfidence	Material and confidence.
color_and_confidence	MarkingColorAndConfidence	Marking color and confidence.
position_reference	LaneBoundary.PositionReference	Position reference of lane boundary marking geometry, i.e. polyline_and_accuracy represents left boundary, center line or right boundary of the lane boundary markings. Whereas for e.g. lines all values may be used, for physical barriers the geometry shall represent the boundary closest to the vehicle.
polyline_and_accuracy	sensoris.protobuf.types.spatial.PolylineAndAccuracy	Polyline geometry. Polyline can also be a single point.
width_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit MilliMeter Resolution 1 Range (0,)	Width and accuracy.
height_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit MilliMeter Resolution 1 Range [0,)	Height and accuracy.
distance_between_double_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit MilliMeter Resolution 1 Range (0,)	Distance between parallel double lines. Only applicable for types LINE_DOUBLE, LINE_DOUBLE_SOLID, LINE_DOUBLE_DASHED, LINE_DOUBLE_SOLID_DASHED and LINE_DOUBLE_DASHED_SOLID.
dash_statistics	LaneBoundary.DashStatistics	Statistics of length of single lane dashes and offset between dashes on lane boundary geometry. Only applicable for lane boundaries of type LONG_DASHED_LINE, SOLID_LINE_DASHED_LINE, DASHED_LINE_SOLID_LINE, SHORT_DASHED, DASHED_BLOCKS and DOUBLE_DASHED_LINE.
marking_offsets	LaneBoundary.MarkingOffsets	Offsets of markings as type and offset on lane boundary geometry relative to first vertex of lane boundary geometry.

Supported event relations

1..* sensoris.protobuf.categories.roadattribution.LaneBoundary LEFT_OF 1 sensoris.protobuf.categories.roadattribution.Lane

1..* sensoris.protobuf.categories.roadattribution.LaneBoundary RIGHT_OF 1 sensoris.protobuf.categories.roadattribution.Lane

1 sensoris.protobuf.categories.roadattribution.LaneBoundaryMergeSplit DERIVED_FROM 2..*
sensoris.protobuf.categories.roadattribution.LaneBoundary

LaneBoundary.DashStatistics

Statistics of length of single lane dashes and distance between single dashes on lane boundary geometry. Only applicable for lane boundaries of type LINE_SINGLE_DASHED, LINE_SINGLE_DASHED_SHORT, LINE_SINGLE_DASHED_LONG, LINE_DOUBLE_DASHED, LINE_DOUBLE_SOLID_DASHED, LINE_DOUBLE_DASHED_SOLID and BLOCKS_DASHED.

Field	Type	Description
length_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter **Resolution** 1 **Range** (0,)	Length of single lane dash.
distance_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter **Resolution** 1 **Range** (0,)	Distance between single lane dashes.

LaneBoundary.MarkingOffsets

Offsets of markings as type and offset on lane boundary geometry relative to first vertex of lane boundary geometry.

Example: S---E S--E for two lane dashes with S as START_OF_MARKING, and E as END_OF_MARKING. -O-O- N O--O for two lane dashes with O as ON_MARKING and N as NO_MARKING.

Field	Type	Description
type_and_offset	repeated LaneBoundary.MarkingOffsets.TypeAndOffset	Offset of marking as type and offset on lane boundary geometry relative to first vertex of lane boundary geometry.

LaneBoundary.MarkingOffsets.TypeAndOffset

Offset of markings as type and offset on lane boundary geometry relative to first vertex of lane boundary geometry.

Field	Type	Description
type	LaneBoundary.MarkingOffsets.TypeAndOffset.Type	Type.
offset_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Offset and accuracy.

LaneBoundary.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	LaneBoundary.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

LaneBoundaryMergeSplit

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a lane boundary merge or split has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	LaneBoundaryMergeSplit.TypeAndConfidence	Type and confidence.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy.

Supported event relations
1 sensoris.protobuf.categories.roadattribution.LaneBoundaryMergeSplit DERIVED_FROM 2..* sensoris.protobuf.categories.roadattribution.LaneBoundary

LaneBoundaryMergeSplit.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	LaneBoundaryMergeSplit.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

LaneCountAndConfidence

Number of lanes and confidence. Count may be given either as 1 count of type TOTAL or as 2 counts of types LEFT_INCLUDING_EGO_LANE and RIGHT. The count of type LEFT_INCLUDING_EGO_LANE includes the vehicle ego lane.

Example: A count of 5 lanes of type TOTAL may be given as a count of 3 lanes of type LEFT_INCLUDING_EGO_LANE and 2 lanes of type RIGHT.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy.
type	LaneCountAndConfidence.Type	Type.
count_and_confidence	sensoris.protobuf.types.base.CountAndConfidence	Number of lanes and confidence.

MarkingColorAndConfidence

Marking color and confidence.

Field	Type	Description
type	MarkingColorAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

MarkingMaterialAndConfidence

Field	Type	Description
type	MarkingMaterialAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

Road

Road.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
width_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter **Resolution** 1 **Range** [1,)	Width and accuracy.
inclination_and_curvature	InclinationAndCurvature	Inclination and curvature.

Supported event relations
1 sensoris.protobuf.categories.roadattribution.Road CONTAIN 1..* sensoris.protobuf.categories.roadattribution.Lane
1..* sensoris.protobuf.categories.roadattribution.SurfaceMarking IMPACT 1 sensoris.protobuf.categories.roadattribution.Road

RoadAttribution

Road attribution.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy.
type_and_confidence	RoadAttribution.TypeAndConfidence	Type and confidence.
change_type_and_confidence	RoadAttribution.ChangeTypeAndConfidence	Change type and confidence.

RoadAttribution.ChangeTypeAndConfidence

Change type and confidence.

Field	Type	Description
type	RoadAttribution.ChangeTypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

RoadAttribution.TypeAndConfidence

Type and confidence.

Field	Type	Description

type	RoadAttribution.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

RoadAttributionCategory

Road attribution category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
lane_boundary	repeated LaneBoundary	Lane boundary.
lane_boundary_merge_split	repeated LaneBoundaryMergeSplit	Lane boundary merge or split.
lane	repeated Lane	Lane.
road	repeated Road	Road.
surface_marking	repeated SurfaceMarking	Surface marking.
surface_attribution	repeated SurfaceAttribution	Attributes of road surface.
road_attribution	repeated RoadAttribution	Attributes of road.
detected_lane_count_and_confidence	repeated LaneCountAndConfidence	Detected number of lanes and confidence. Detected lane count may be less than the actual lane count of the road.
estimated_lane_count_and_confidence	repeated LaneCountAndConfidence	Estimated number of lanes and confidence. Estimated lane count derived from multiple lane detections, which may be higher than the detected lane count and unprecise to the actual lane count on the road.

SurfaceAttribution

Surface attribution.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
position_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Position and accuracy.
inclination_and_curvature	InclinationAndCurvature	Inclination and curvature.
material_and_confidence	repeated SurfaceMaterialAndConfidence	Material and confidence.
road_roughness_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter per KiloMeter **Resolution** 1 **Range** [0,)	International Roughness Index (IRI).

SurfaceMarking

Surface marking.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.

existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a surface marking has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	SurfaceMarking.TypeAndConfidence	Type and confidence.
text	google.protobuf.StringValue	Text on the surface if detailed specification is required additional to type.
color_and_confidence	repeated MarkingColorAndConfidence	Marking color and confidence.
material_and_confidence	repeated MarkingMaterialAndConfidence	Marking material and confidence.
rectangular_box_and_accuracy	sensoris.protobuf.types.spatial.RectangularBoxAndAccuracy	Rectangular box and accuracy.

Supported event relations
1..* sensoris.protobuf.categories.roadattribution.SurfaceMarking IMPACT 1 sensoris.protobuf.categories.roadattribution.Lane
1..* sensoris.protobuf.categories.roadattribution.SurfaceMarking IMPACT 1 sensoris.protobuf.categories.roadattribution.Road
1 sensoris.protobuf.categories.roadattribution.SurfaceMarking EQUAL 1 sensoris.protobuf.categories.trafficregulation.TrafficSign

SurfaceMarking.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	SurfaceMarking.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

SurfaceMaterialAndConfidence

Surface material and confidence.

Field	Type	Description
type	SurfaceMaterialAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

LaneBoundary.MarkingOffsets.TypeAndOffset.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
START_OF_MARKING	1	Start of marking.
END_OF_MARKING	2	End of marking.
ON_MARKING	3	On marking.
NO_MARKING	4	No marking, e.g. between two markings.

Position reference of lane boundary marking geometry, i.e. polyline_and_accuracy represents left boundary, center line or right boundary of the lane boundary markings. Whereas for e.g. lines all values may be used, for physical barriers the geometry shall represent the boundary closest to the vehicle.

Name	#	Description
UNKNOWN_POSITION_REFERENCE	0	Unknown.
LEFT_MARKING_BOUNDARY	1	Left marking boundary.
CENTER_LINE	2	Center line.
RIGHT_MARKING_BOUNDARY	3	Right marking boundary.

LaneBoundary.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
LINE	1	Any line.
LINE_SINGLE	2	Any single line.
LINE_SINGLE_SOLID	3	Single solid line.
LINE_SINGLE_DASHED	4	Any single dashed line.
LINE_SINGLE_DASHED_SHORT	5	Single dashed line with short dashes.
LINE_SINGLE_DASHED_LONG	6	Single dashed line with long dashes.
LINE_DOUBLE	7	Any double line.
LINE_DOUBLE_SOLID	8	Double line composed of two solid lines.
LINE_DOUBLE_DASHED	9	Double line composed of two dashed lines.
LINE_DOUBLE_SOLID_DASHED	10	Double line composed of solid left line and dashed right line in direction of lane boundary geometry.
LINE_DOUBLE_DASHED_SOLID	11	Double line composed of dashed left line and solid right line in direction of lane boundary geometry.
SHADED_AREA_MARKING	12	Single marking inside of shaded area.
BLOCKS_DASHED	13	Dashed blocks.
CROSSING_ALERT	14	Crossing alert.
CURB	15	Any curb.
CURB_TRAVERSABLE	16	Traversable curb, i.e. vehicle is allowed to cross traversable curbs in normal traffic situations.
CURB_NON_TRAVERSABLE	17	Non-traversable curb.
PHYSICAL_DIVIDER	18	Any physical divider.
WALL	19	Any wall.
WALL_FLAT	20	Flat wall.
WALL_CURVED	21	Curved wall, e.g. wall of a tunnel.
BARRIER	22	Any barrier.
BARRIER_JERSEY	23	Jersey barrier.
BARRIER_SOUND	24	Sound barrier.
BARRIER_CABLE	25	Cable barrier.
GUARDRAIL	26	Guardrail.

FENCE	27	Fence.
ROAD_EDGE	28	Edge of road pavement.
CLIFF	29	Cliff.
DITCH	30	Ditch.
ASPHALT_JOINT	31	Asphalt joint.

LaneBoundaryMergeSplit.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
MERGE	1	Merge.
SPLIT	2	Split.

LaneCountAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
TOTAL	1	Total lane count.
LEFT_INCLUDING_EGO_LANE	2	Left lane count including ego lane.
RIGHT	3	Right lane count.

MarkingColorAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
WHITE	1	White.
GRAY	2	Gray.
GRAY_LIGHT	3	Light gray.
GRAY_DARK	4	Dark gray.
BLACK	5	Black.
RED	6	Red.
YELLOW	7	Yellow.
GREEN	8	Green.
CYAN	9	Cyan.
BLUE	10	Blue.
ORANGE	11	Orange.

PINK	12	Pink.

MarkingMaterialAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
METAL	1	Metal.
CONCRETE	2	Concrete.
STONE	3	Stone.
WOOD	4	Wood.
PLASTIC	5	Plastic.
TRANSPARENT	6	Transparent.
VIBRATION_MARKINGS	7	Raised markings or markings cut into the road.
PAINT	8	Paint.
ASPHALT	9	Asphalt.
GRAVEL	10	Gravel.
COBBLESTONE	11	Cobblestone.

RoadAttribution.ChangeTypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
DETECTED	1	Change is detected.
START	2	Start of change.
END	3	End of change.

RoadAttribution.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
MOTORWAY	1	Motorway.
ONE_WAY_TRAFFIC	2	One way traffic.
TWO_WAY_TRAFFIC	3	Two way traffic.
OFFROAD	4	Offroad.
TUNNEL	5	Inside a tunnel.
BRIDGE	6	On a bridge.

ARTIFICIAL_ILLUMINATION	7	Artificial illumination.
ROAD_WORKS_NARROW_LANES	8	Roadworks with narrow lanes.
LANE_RIGHT	9	Lane to the right.
LANE_LEFT	10	Lane to the left.
LANE_SPLIT_MIDDLE	11	Lane split in the middle.
LANE_MERGE_MIDDLE	12	Lane merge in the middle.
CROSSWALK	13	Crosswalk.
CENTER_TURN_LANE	14	Center turn lane.

SurfaceMarking.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
SIGN	1	Sign painted on road surface. The sign can be detailed by an event relation of type EQUAL to 1 sensoris.protobuf.categories.trafficregulation.TrafficSign.
TEXT	2	Text written on road surface. The text itself may be specified in the field text.
ICON	3	Graphic icon painted on road surface if it is not recognized as sign, text or one of the below enumeration items. The icon itself is not specified.
PATTERN	4	Any patterned area painted on the road surface (e.g. chevron, crosswalk). The pattern itself is not specified.
PATTERN_CROSSWALK	5	Combination of lines making up a crosswalk.
LINE_ELEMENT	6	Rectangular element of a line, for example a dot or block.
STOP_LINE	7	Line mainly perpendicular to the driving direction indicating where to stop.

SurfaceMaterialAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
ASPHALT	1	Asphalt.
CONCRETE	2	Concrete.
COMPOSITE_PAVEMENT	3	Composite pavement.
RECYCLING	4	Recycling.
GRAVEL	5	Gravel.
COBBLESTONE	6	Cobblestone.

sensoris/protobuf/categories/traffic_events.proto

sensoris.protobuf.categories.trafficevents

Dangerous slowdown of the ego vehicle (TPEG-TEC 27.0). The cause of the slowdown may be indicated by an event relation from the cause of type IMPACT.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
speed_reduction_and_accuracy	sensoris.protobuf.types.spatial.XyzVectorAndAccuracy Unit Meter Per Second Resolution 0.1 Range (, 0)	Speed reduction and accuracy.
time_period	google.protobuf.Int64Value Unit Second Resolution 1 Range (0,)	Time period over which the speed reduction was detected.

Supported event relations
1 sensoris.protobuf.categories.trafficevents.Hazard IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown
1 sensoris.protobuf.categories.trafficevents.TrafficCondition IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown
1 sensoris.protobuf.categories.trafficevents.RoadWorks IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown
1 sensoris.protobuf.categories.trafficevents.RoadWeatherCondition IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown

Hazard

Hazard. Detailed information about the hazard may be inidcated by an event relation from an object detection of type IMPACT.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	Hazard.TypeAndConfidence	Type and confidence.
direction	Hazard.Direction	Direction describes the direction of the hazard in reference to the ego vehicle.

Supported event relations
1..* sensoris.protobuf.categories.objectdetection.MovableObject IMPACT 1 sensoris.protobuf.categories.trafficevents.Hazard
1 sensoris.protobuf.categories.trafficevents.Hazard IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown

Hazard.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	Hazard.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

RoadWeatherCondition

vehicle position and event relation of type END to another vehicle position.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	RoadWeatherCondition.TypeAndConfidence	Type and confidence.
depth_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy Unit MilliMeter Resolution 1 Range (0,)	Depth of water or snow on road and accuracy.

Supported event relations
1 sensoris.protobuf.categories.trafficevents.RoadWeatherCondition START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWeatherCondition END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWeatherCondition IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown

RoadWeatherCondition.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	RoadWeatherCondition.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

RoadWorks

Roadworks. Event is used to report the start and end of a roadworks section (TEPG_TEC 3.0). Speed limit can be reported using sign detection. May also contain a report of the number of lanes closed.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	RoadWorks.TypeAndConfidence	Type and confidence.
lanes_closed_and_confidence	sensoris.protobuf.types.base.CountAndConfidence	Total number of closed lanes.

Supported event relations
1..* sensoris.protobuf.categories.trafficregulation.TrafficSign IMPACT 1 sensoris.protobuf.categories.trafficevents.RoadWorks
1 sensoris.protobuf.categories.trafficevents.RoadWorks START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWorks END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.RoadWorks IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown

RoadWorks.TypeAndConfidence

Field	Type	Description
type	RoadWorks.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficCondition

Traffic condition. If the vehicle experiences multiple traffic conditions (e.g. few hundred meters of slow traffic, then a section of stop and go, then another section of slow traffic etc.), multiple events may be generated (see also TPEG-TEC 1.0). The spatial extent of the traffic condition can be defined by an event relation of type START to a vehicle position and event relation of type END to another vehicle position.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	TrafficCondition.TypeAndConfidence	Type and confidence.

Supported event relations
1 sensoris.protobuf.categories.trafficevents.TrafficCondition START_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.TrafficCondition END_AT 1 sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficevents.TrafficCondition IMPACT 1 sensoris.protobuf.categories.trafficevents.DangerousSlowDown

TrafficCondition.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	TrafficCondition.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficEventsCategory

Traffic events category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
hazard	repeated Hazard	Hazard.
dangerous_slow_down	repeated DangerousSlowDown	Dangerous slowdown of the ego vehicle.
traffic_condition	repeated TrafficCondition	Traffic condition.
roadworks	repeated RoadWorks	Roadworks.
road_weather_condition	repeated RoadWeatherCondition	Road weather condition.

Direction describes the direction of the hazard in reference to the ego vehicle.

Name	#	Description
UNKNOWN_DIRECTION	0	Unknown.
EGO_DIRECTION	1	In ego vehicle driving direction.
OPPOSITE_DIRECTION	2	Opposite to ego vehicle driving direction.
BOTH	3	In and opposite to ego vehicle driving direction.

Hazard.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
OBSTRUCTION	1	Obstruction such as fallen trees, parts of tires etc. (TPEG-TEC 10.0).
ACCIDENT	2	Accident (TPEG-TEC 2.0).
BROKEN_DOWN_VEHICLE	3	Vehicle breakdown (TPEG-TEC 13.2).
SLOW_VEHICLE	4	Very slow vehicle, e.g. agriculture vehicles, road service vehicles, grass cutters etc. (TPEG-TEC 16.0).
WRONG_WAY_VEHICLE	5	Vehicle driving opposite the allowed direction of travel (TPEG-TEC 14.0).
ROADWORKS	6	Roadworks (TPEG-TEC 3.0)

RoadWeatherCondition.TypeAndConfidence.Type

Type. The values follow the definitions of TPEG-TEC.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
SNOW	1	Snow (TPEG-TEC 6.4).
ICE	2	Ice (TPEG-TEC 6.5).
FREEZING_RAIN	3	Freezing rain / black ice (TPEG-TEC 6.6).
FROST	4	Frost (TPEG-TEC 6.1).
HYDROPLANING	5	Hydroplaning (TPEG-TEC 7.0)
FLOODING	6	Flooding (TPEG-TEC 5.1)

RoadWorks.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
START	1	Start.

END	2	End.

TrafficCondition.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
FREE_FLOW	1	Free flow.
HEAVY	2	Heavy traffic.
SLOW	3	Slow traffic.
QUEUING	4	Queuing traffic.
STATIONARY	5	Stationary traffic.

sensoris/protobuf/categories/traffic_maneuver.proto

sensoris.protobuf.categories.trafficmaneuver

Charging

Charging activity (maneuver).

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
type	Charging.Type	Type.
voltage_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** Volt **Resolution** 1 **Range** [0,)	Voltage and accuracy measured by the vehicle.
current_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** Ampere **Resolution** 0.1 **Range** [0,)	Current and accuracy provided to the vehicle.

Maneuver

Vehicle maneuvers on the road.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
type_and_confidence	Maneuver.TypeAndConfidence	Type and confidence.

Supported event relations
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.MovableObject
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.objectdetection.StaticObject

1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehiclePositionAndOrientation
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleSpeed
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleAcceleration
1 sensoris.protobuf.categories.trafficmaneuver.Maneuver TRIGGERED_BY 1..* sensoris.protobuf.categories.localization.VehicleRotationRate

Maneuver.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	Maneuver.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

Refueling

Refueling activity (maneuver).

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
type	Refueling.Type	Type.
quantity_to_full_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** Litre / KiloGram **Resolution** 0.1 **Range** (0,)	The amount of fuel in litres (for fuel) / kilograms (for gas) and accuracy required to achieve a full tank.

TrafficManeuverCategory

Traffic maneuver category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
maneuver	repeated Maneuver	Maneuver.
charging	repeated Charging	Charging.
refueling	repeated Refueling	Refueling.

Charging.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
PORT_J1772	1	Level 2 Port J1772 connector.

CHADEMO	2	CHAdeMO.
SAE_COMBO	3	SAE Combo CCS.
TESLA_HPWC	4	Tesla HPWC.
TESLA_SUPERCHARGER	5	Tesla supercharger.

Maneuver.TypeAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
EVASIVE	1	Evasive maneuver is used to describe a maneuver taken to avoid an obstacle or danger.
LANE_CHANGE	2	Any lane change.
LANE_CHANGE_RIGHT	3	Lane change to the right.
LANE_CHANGE_LEFT	4	Lane change to the left.
OVERTAKING	5	Overtaking.
INTERSECTION_STOP	6	Intersection stopping.
TURNING	7	Any turning.
TURNING_RIGHT	8	Turning right.
TURNING_LEFT	9	Turning left.
SHARP_TURNING_RIGHT	10	Sharp turning right.
SHARP_TURNING_LEFT	11	Sharp turning left.
ACCELERATING	12	Accelerating.
BREAKING	13	Breaking.

Refueling.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
PETROL_PREMIUM	1	Petrol - PREMIUM (95 RON).
PETROL_SUPER	2	Petrol - SUPRT (97/98 RON)
DIESEL	3	Diesel.
LPG	4	Liquefied Petroleum Gas.
CNG	5	Compressed Natural Gas.
BIO_DIESEL	6	Bio Diesel.
BIO_ETHANOL	7	Bio Ethanol.
HYDROGEN	8	Hydrogen for Fuel Cell.

sensoris.protobuf.categories.trafficregulation

TrafficRegulationCategory

Traffic regulation category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
traffic_sign	repeated TrafficSign	Traffic sign.

TrafficSign

TrafficSign. A TrafficSign includes the subcategories traffic signs, rectangular signboards, and advertisement signs.

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a main sign has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
rectangular_box_and_accuracy	sensoris.protobuf.types.spatial.RectangularBoxAndAccuracy	Rectangular box and accuracy of main sign, i.e. without supplementary sign(s).
shape_and_confidence	TrafficSign.ShapeAndConfidence	Shape and confidence of main sign.
type_and_confidence	TrafficSign.TypeAndConfidence	Type and confidence of main sign.
value_and_confidence	TrafficSign.ValueAndConfidence	Value of main sign in addition to type.
permanency_and_confidence	TrafficSign.PermanencyAndConfidence	Permanency of main sign provides information if a traffic sign is permanent of variable, e.g. LED.
validation_and_confidence	TrafficSign.ValidationAndConfidence	Validation of main sign provides information if the traffic sign was invalidated by a traffic authority.
background_color_and_confidence	TrafficSign.DominantBackgroundColorAndConfidence	Dominant background color and confidence of main sign.
supplementary_sign_and_confidence	repeated TrafficSign.SupplementarySignAndConfidence	Supplementary sign, which is an attached sign in addition to main sign.

Supported event relations
1 sensoris.protobuf.categories.trafficregulation.TrafficSign CONTAIN 1..* sensoris.protobuf.categories.trafficregulation.TrafficSign
1..* sensoris.protobuf.categories.trafficregulation.TrafficSign GROUP
1..* sensoris.protobuf.categories.trafficregulation.TrafficSign IMPACT 1 sensoris.protobuf.categories.roadattribution.Lane
1..* sensoris.protobuf.categories.objectdetection CONTAIN 1 sensoris.protobuf.categories.roadattribution.Lane
1 sensoris.protobuf.categories.trafficregulation.TrafficSign MAP_REFERENCE 1 sensoris.protobuf.categories.map.MapReference

1..* sensoris.protobuf.categories.trafficregulation.TrafficSign IMPACT 1 sensoris.protobuf.categories.drivingbehavior.ParkingStatus
1 sensoris.protobuf.categories.objectdetection.MovableObject CONTAIN 1..* sensoris.protobuf.categories.trafficregulation.TrafficSign
1 sensoris.protobuf.categories.objectdetection.StaticObject CONTAIN 1..* sensoris.protobuf.categories.trafficregulation.TrafficSign
1 sensoris.protobuf.categories.roadattribution.SurfaceMarking EQUAL 1 sensoris.protobuf.categories.trafficregulation.TrafficSign
1..* sensoris.protobuf.categories.trafficregulation.TrafficSign IMPACT 1 sensoris.protobuf.categories.trafficevents.RoadWorks

TrafficSign.DominantBackgroundColorAndConfidence

Dominant background color and confidence.

Field	Type	Description
type	TrafficSign.DominantBackgroundColorAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSign.PermanencyAndConfidence

Permanency and confidence.

Field	Type	Description
type	TrafficSign.PermanencyAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSign.ShapeAndConfidence

Shape and confidence.

Field	Type	Description
type	TrafficSign.ShapeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSign.SupplementarySignAndConfidence

Supplementary sign and confidence.

Field	Type	Description
existence_confidence	sensoris.protobuf.types.base.Confidence	Confidence that a supplementary sign has been detected.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status of supplementary sign.
type_and_confidence	TrafficSign.SupplementarySignAndConfidence.TypeAndConfidence	Type and confidence of supplementary sign.
value_and_confidence	TrafficSign.ValueAndConfidence	Value of supplementary sign in addition to type.

Type and confidence.

Field	Type	Description
type	TrafficSign.SupplementarySignAndConfidence.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.
other_text	google.protobuf.StringValue	If the type or additional information is known by the sensor, then it may be provided as string.

TrafficSign.TypeAndConfidence

Type and confidence.

Field	Type	Description
type	TrafficSign.TypeAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.
other_text	google.protobuf.StringValue	If the type or additional information is known by the sensor, then it may be provided as string.

TrafficSign.ValidationAndConfidence

Validation and confidence.

Field	Type	Description
type	TrafficSign.ValidationAndConfidence.Type	Type.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

TrafficSign.ValueAndConfidence

Value and confidence.

Field	Type	Description
value	google.protobuf.StringValue	All classified sign values which are not defined or not fully defined in type may be provided as value. Example: Value 70 for traffic sign type SPEED_LIMIT for a speed limit sign with a limit of 70.
confidence	sensoris.protobuf.types.base.Confidence	Confidence of value.

TrafficSign.DominantBackgroundColorAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.

OTHER	1	Other, i.e. none of the listed enum values.
WHITE	2	White.
RED	3	Red.
GREEN	4	Green.
BLUE	5	Blue.
YELLOW	6	Yellow.
BLACK	7	Black.
BROWN	8	Brown.

TrafficSign.PermanencyAndConfidence.Type

Type.

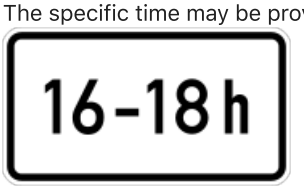
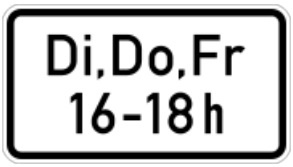
Name	#	Description
UNKNOWN_TYPE	0	Unknown.
STATIC	1	Traffic sign is static and not variable.
VARIABLE	2	Any variable traffic sign, e.g. LED sign or flip sign.
VARIABLE_ELECTRONICALLY	3	Traffic sign is a variable LED sign (this should be preferred over VARIABLE if known).
VARIABLE_MECHANICALLY	4	Traffic sign is a variable flip sign (this should be preferred over VARIABLE if known).
VARIABLE_DEACTIVATED	5	Traffic sign is variable and deactivated (e.g. LED panel switched off).

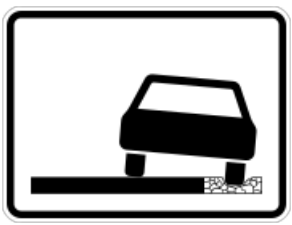
TrafficSign.ShapeAndConfidence.Type

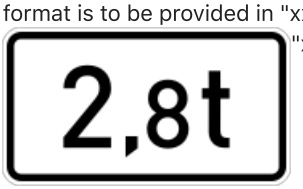
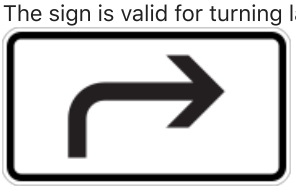
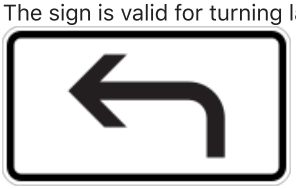
Type of the traffic sign shape.

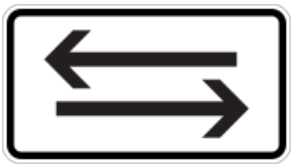
Name	#	Description
UNKNOWN_TYPE	0	Unknown.
OTHER	1	Other, i.e. none of the listed enum values.
RECTANGLE	2	Rectangle.
SQUARE	3	Square.
TRIANGLE_UP	4	Triangle pointing up.
TRIANGLE_DOWN	5	Triangle pointing down.
DIAMOND	6	Diamond.
HEXAGON	7	Hexagon.
ROUND	8	Round.
CROSS_BUCK	9	Crossbuck, e.g. at railway crossings.
OCTAGON	10	Octagon.
ELLIPSE	11	Ellipse.
PENTAGON	12	Pentagon.

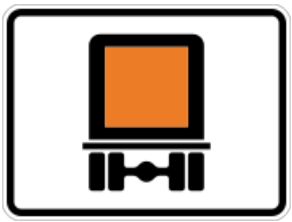
TrafficSign.SupplementarySignAndConfidence.TypeAndConfidence.Type

Name	#	Description
UNKNOWN_TYPE	0	
SUP_OTHER_AS_TEXT	1	Other, i.e. none of the listed enum values. However, if the type is known by the sensor, then it may be provided as string in the field other_text.
SUP_WET	2	
SUP_RAIN	3	
SUP_SNOW	4	
SUP_SNOW_OR_RAIN	5	
SUP_FOG	6	
SUP_TIME	7	The specific time may be provided in the field value_and_confidence. 
SUP_DAY_AND_TIME	8	The specific time may be provided in the field value_and_confidence. The format should be "Mo-Fr 16-18 h" or if available exact text format of sign. 
SUP_NIGHT	9	The specific time may be provided in the field value_and_confidence.
SUP_SEASON	10	
SUP_WORKDAYS	11	
SUP_WORKDAYS_AND_TIME	12	The specific time may be provided in the field value_and_confidence.
SUP_SCHOOL	13	

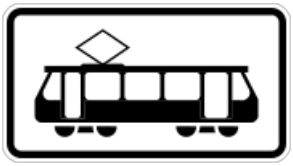
SUP_RAMP	14	
SUP_TRUCK	15	
SUP_TRUCK_WITH_TRAILER	16	
SUP_PASSENGER_CAR	17	
SUP_PASSENGER_CAR_WITH_TAILER	18	
SUP_TRACTOR_EXCEPT	19	
SUP_BUS	20	
SUP_TRUCKS_AND_BUS	21	
SUP_CARS_TRUCKS_BUS	22	
SUP_TAXI	23	
SUP_TANK	24	
SUP_ROADSIDE	25	

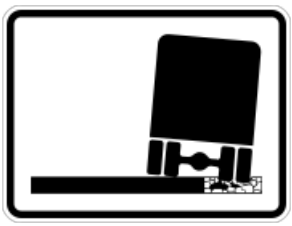
SUP_WEIGHT	26	The weight limitation may be provided in the field value_and_confidence. The format is to be provided in "xx.x t" defining the weight in xx.x tons or "xxxxxx.x lbs" defining the weight in x pounds. 
SUP_STARTING_IN	27	The start of the validity may be provided in the field value_and_confidence. The format should be "xxx m" or if available exact text format of sign. 
SUP_VALID_FOR	28	The end of the validity may be provided in the field value_and_confidence. The format should be "xxx m" or if available exact text format of sign. 
SUP_IN_RIGHT_DIRECTION	29	The sign is valid for turning lane(s) to the right side. 
SUP_IN_LEFT_DIRECTION	30	The sign is valid for turning lane(s) to the left side. 
SUP_ZONE	31	
SUP_ZONE_START	32	
SUP_ZONE_END	33	
SUP_BEGIN_OF_VALIDITY	34	The validity of the traffic signs begins at the sign (no further distance information required).
SUP_END_OF_VALIDITY	35	The validity of the traffic signs ends at the sign (no further distance information required).
SUP_FROG	36	
SUP_ALL_WAY	37	
SUP_BIKE	38	

SUP_BIKE_EXCEPT	39	
SUP_BUS_EXCEPT	40	
SUP_CAMPER	41	
SUP_CARAVAN	42	
SUP_CONSTRUCTION_GATEWAY	43	
SUP_CROSS_WAY	44	
SUP_DELIVERY_EXCEPT	45	
SUP_ELECTRONIC_CAR	46	
SUP_GATEWAY	47	

SUP_GIVE_WAY_LEFT	48	
SUP_GIVE_WAY_RIGHT	49	
SUP_GRAVEL	50	
SUP_HAZMAT	51	
SUP_HAZ_WATER	52	
SUP_KIDS	53	
SUP_LOCAL_EXCEP	54	
SUP_LOW_TREE	55	

SUP_MOTORCYCLE	56	
SUP_MOTORCYCLE_EXCEPT	57	
SUP_NEW_ROAD_BED	58	
SUP_NO_STOP_SHOULDER	59	
SUP_OIL_TRAIL	60	
SUP_PASSENGER_CAR_EXCEPT	61	
SUP_PASSENGER_CAR_WITH_TAILER_EXCEPT	62	
SUP_PEDESTRIAN	63	
SUP_PRIORITY_TURN_LEFT	64	

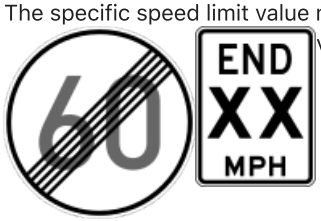
SUP_PRIORITY_TURN_RIGHT	65	
SUP_ROAD_DAMAGE	66	
SUP_RUTS	67	
SUP_TRACTOR	68	
SUP_TRACTOR_MAY_BE_OVERTAKEN	69	
SUP_TRAFFIC_JAM	70	
SUP_TRAIN	71	
SUP_TRAM	72	
SUP_TRUCK_EXCEPT	73	

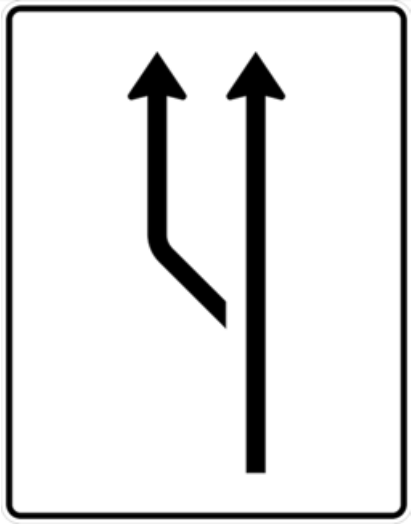
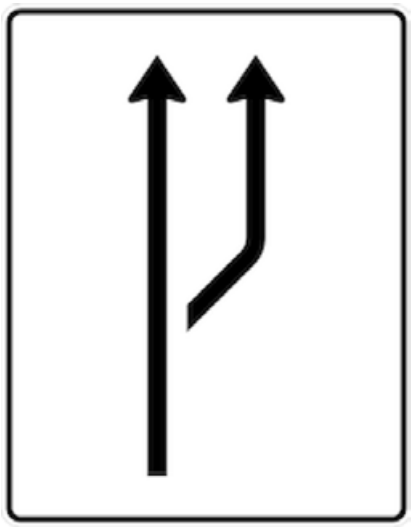
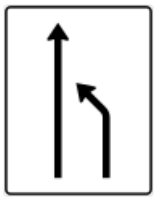
SUP_TRUCK_WITH_TRAILER_EXCEPT	74	
SUP_GET_IN_PROPER_LANE	75	
SUP_ROADSIDE_TRUCK	76	
SUP_RAPPEL	77	
SUP_RADAR_ENFORCED	78	
SUP_STOP_IN_DISTANCE	79	The distance may be provided in the field value_and_confidence. The format should be "xxx m" or if available exact text format of sign. 

TrafficSign.TypeAndConfidence.Type

Type of the traffic sign face.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
OTHER_AS_TEXT	1	Other, i.e. none of the listed enum values. The type, if known by the sensor, may be provided as string in the field other_text.

SPEED_LIMIT	2	The specific speed limit value may be provided in the field value_and_confidence. 
SPEED_LIMIT_END	3	The specific speed limit value may be provided in the field value_and_confidence. 
SPEED_LIMIT_CHANGE_UPCOMING	4	
ADVISORY_SPEED_LIMIT	5	The specific speed limit value may be provided in the field value_and_confidence. 
ADVISORY_SPEED_LIMIT_END	6	The specific speed limit value may be provided in the field value_and_confidence. 
NO_OVERTAKING	7	
NO_OVERTAKING_END	8	
PROTECTED_PASSING_START	9	If direction cannot be provided by sensor.
PROTECTED_PASSING_END	10	

PROTECTED_PASSING_LEFT_START	11	
PROTECTED_PASSING_RIGHT_START	12	
PROTECTED_PASSING_LEFT_END	13	
PROTECTED_PASSING_RIGHT_END	14	
NO_OVERTAKING_TRUCK	15	
NO_OVERTAKING_TRUCK_END	16	
ALL_RESTRICTIONS_END	17	

CITY_START	18	
CITY_END	19	
HIGHWAY	20	Highway is a major road (e.g. US Highway, German Bundesstrasse). 
HIGHWAY_END	21	
MOTORWAY	22	These roads are Class-A roads connecting cities or states (e.g. US Interstate, European E-road or German Autobahn) and in many countries have the rule of limited access. 
MOTORWAY_END	23	
CONSTRUCTION	24	
CONSTRUCTION_END	25	
LANE_MERGE	26	If direction cannot be provided by sensor.
LANE_MERGE_ON_RIGHT	27	A lane right merge can also be described as a lane ending on the right side. 
LANE_MERGE_ON_LEFT	28	A lane left merge can also be described as a lane ending on the left side. 

		A lane merge center can also be described as a lane ending on both sides left and right.
LANE_MERGE_CENTER	29	
RAILWAY_CROSSING_GENERAL	30	
RAILWAY_CROSSING_PROTECTED	31	
RAILWAY_CROSSING_UNPROTECTED	32	
ROAD_NARROWS	33	If direction cannot be provided by sensor.
ROAD_NARROWS_LEFT	34	
ROAD_NARROWS_RIGHT	35	
ROAD_NARROWS_CENTER	36	
SHARP_CURVE	37	If direction cannot be provided by sensor.
SHARP_CURVE_LEFT	38	
SHARP_CURVE_RIGHT	39	
WINDING_ROAD	40	

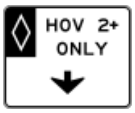
WINDING_ROAD_STARTING_LEFT	41	
WINDING_ROAD_STARTING_RIGHT	42	
STEEP_HILL	43	
STEEP_HILL_UPWARDS	44	The percentage of the slope may be provided in the field value_and_confidence. The format is to be provided in "xx %" defining the percent of inclination per 100 meter. 
STEEP_HILL_DOWNWARDS	45	The percentage of the slope may be provided in the field value_and_confidence. The format is to be provided in "xx %" defining the percent of declination per 100 meter. 
STOP_SIGN	46	
LATERAL_WIND	47	If direction cannot be provided by sensor.
LATERAL_WIND_FROM_RIGHT	48	
LATERAL_WIND_FROM_LEFT	49	
GENERAL_WARNING	50	If information about the text of the warning is available, it may be provided in the field value_and_confidence. 

RISK_OF_GROUNDING	51	
ANIMAL	52	
ICY_CONDITIONS	53	
SLIPPERY_ROAD	54	 
UNEVEN_ROAD	55	
SCHOOL_ZONE	56	
TRAMWAY_CROSSING	57	
CONGESTION_HAZARD	58	
ACCIDENT_HAZARD	59	 

BICYCLE_CROSSING	60	
PRIORITY_OVER_ONCOMING_TRAFFIC	61	
YIELD	62	
PRIORITY_ROAD	63	
PRIORITY_ROAD_END	64	
TRAFFIC_CALMING	65	
TRAFFIC_CALMING_END	66	
ENVIRONMENTAL_AREA	67	Further specification of the sign, e.g. green zone in Germany, may be provided in the field value_and_confidence. 
ENVIRONMENTAL_AREA_END	68	

INTERSECTION	69	
ROUNDABOUT	70	
PASSING_ON_LEFT	71	
PASSING_ON_RIGHT	72	
PASSING_ON_LEFT_OR_RIGHT	73	
MANDATORY_TURN_RIGHT_ONLY	74	
MANDATORY_TURN_LEFT_ONLY	75	
MANDATORY_STRAIGHT_ONLY	76	
MANDATORY_TURN_LEFT_OR_RIGHT	77	
MANDATORY_TURN_RESTRICTION	78	If sensor is not aware of left or right restriction.

MANDATORY_STRAIGHT_OR_LEFT	79	
MANDATORY_STRAIGHT_OR_RIGHT	80	
NO_LEFT_TURN	81	
NO_RIGHT_TURN	82	
NO_U_TURN	83	
NO_U_OR_LEFT_TURN	84	
U_TURN_ALLOWED	85	
MANDATORY_LEFT_TRUCK	86	This type is valid for trucks and other transportation vehicles. 
MANDATORY_RIGHT_TRUCK	87	This type is valid for trucks and other transportation vehicles. 

		This type is valid for trucks and other transportation vehicles.
MANDATORY_STRAIGHT_TRUCK	88	
NO_ENTRY	89	
DEAD_END	90	
HIGH_OCCUPANCY_VEHICLE_LANE	91	
TOLL	92	
TOLL_CAR	93	
TOLL_LANE	94	
EXPRESS_LANE	95	
SHOULDER_OPEN_FOR_TRAFFIC	96	

SHOULDER_CLOSED_FOR_TRAFFIC	97	
LANE_CLOSED	98	
LANE_CLOSED_RIGHT_MOST_LANE	99	
LANE_CLOSED_LEFT_MOST_LANE	100	
WARNING_PEDESTRIAN	101	
WARNING_CHILDREN	102	
WARNING_BICYCLE	103	
WARNING_BUS	104	
PUBLIC_TRANSPORTATION_STOP	105	

PEDESTRIAN_CROSSING	106	Directly at the sign, not the "warning of crossing ahead". 
WEIGHT_RESTRICTION	107	The weight limitation may be provided in the field value_and_confidence. The format is to be provided in "xx t" defining the weight in xx tons or "xxxxxx lbs" defining the weight in x pounds. 
HEIGHT_RESTRICTION	108	The height limitation, e.g. when driving under a bridge, may be provided in the field value_and_confidence. The format is to be provided in "xx.x m" defining the height in xx.x meter or "xx f yy in" defining the height in xx foot and yy inches. 
LENGTH_RESTRICTION	109	The length limitation may be provided in the field value_and_confidence. The format is to be provided in "xx.x m" defining the length in xx.x meter or "xx f yy in" defining the height in xx foot and yy inches. 
WIDTH_RESTRICTION	110	The width limitation may be provided in the field value_and_confidence. The format is to be provided in "xx.x m" defining the width in xx.x meter or "xx f yy in" defining the height in xx foot and yy inches. 
WARNING_TRUCK_ROLLOVER	111	
SIGNAL_AHEAD	112	

SKI_CROSSING	113	
NO_AGRICULTUR_VEHICLE	114	
NO_BICYCLE	115	
NO_BUS	116	
NO_HAUL_EXPLOSIVES	117	
NO_HAUL_HARMFUL_TO_WATER	118	
NO_HAUL_HAZARDOUS_MATERIAL	119	
NO_MOTORCYCLE	120	
NO_TRAILER	121	
NO_TRUCK_WITH_TRAILER	122	

PARK_AND_RIDE	123	
ROAD_DISTANCE	124	These signs are typical mounted on a periodical distance. The distance value itself may be provided in the field value_and_confidence. The format is to be provided in "xxx.x" defining the distance offset value in xxx.x, which is to be used without units to represent both kilometer and miles. 
EMERGENCY_PHONE	125	
SPEED_LIMIT_ENFORCEMENT	126	
TRAFFIC_LIGHT_ENFORCEMENT	127	
BOARD_DIRECTION	128	Sign board showing direction or distance to a city, location or exit. 
STREET_NAME	129	Street name - street name text provided on sign can be specified in value_and_confidence. 

TRUCK_SPEED_LIMIT	130	Speed limit only valid for trucks. The specific speed limit value may be provided in the field value_and_confidence. However, speed limit start and supplementary sign TRUCK should be preferred if two signs are mounted on sign post. 
TRUCK_SPEED_LIMIT_END	131	Speed limit only valid for trucks. The specific speed limit value may be provided in the field value_and_confidence. However, speed limit start and supplementary sign TRUCK should be preferred if two signs are mounted on sign post.
SPEED_LIMIT_NIGHT	132	Speed limit only valid at night. The specific speed limit value may be provided in the field value_and_confidence. However, speed limit start and supplementary type NIGHT should be preferred if two signs are mounted on sign post. 
SPEED_LIMIT_NIGHT_END	133	Speed limit only valid at night. The specific speed limit value may be provided in the field value_and_confidence. However, speed limit start and supplementary type NIGHT should be preferred if two signs are mounted on sign post.
MINIMUM_SPEED	134	
MINIMUM_SPEED_END	135	
PEDESTRIAN_ZONE	136	
PEDESTRIAN_ZONE_END	137	
PEDESTRIAN_PATH	138	
PEDESTRIAN_PATH_END	139	

PEDESTRIAN_BICYCLE_PATH	140	
PEDESTRIAN_BICYCLE_PATH_END	141	
BICYCLE_PATH	142	
BICYCLE_PATH_END	143	
BICYCLE_STREET	144	
BICYCLE_STREET_END	145	
CURVE_LEFT_THEN_RIGHT	146	
CURVE_RIGHT_THEN_LEFT	147	
CURVE_TRIPLE_HAIRPIN	148	
STEEP_DROP	149	
STEEP_DROP_ON_LEFT	150	
STEEP_DROP_ON_RIGHT	151	

NO_ANIMAL_CATTLE	152	
ANIMAL_DEER	153	
ANIMAL_MOOSE	154	
NO_HORSE_RIDING	155	
FALLING_ROCKS	156	
FALLING_ROCKS_LEFT	157	
FALLING_ROCKS_RIGHT	158	
YIELD_TO_ONCOMING_TRAFFIC	159	
UNPROTECTED_LEFT_TURN	160	
ONEWAY_TRAFFIC	161	If sensor is not aware of left or right restriction.
ONEWAY_TRAFFIC_TO_LEFT	162	
ONEWAY_TRAFFIC_TO_RIGHT	163	

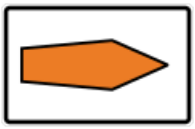
ONEWAY_TRAFFIC_TO_STRAIGHT	164	
NO_VEHICLE	165	
NO_MOTOR_VEHICLE	166	
NO_TRUCK	167	
NO_PEDESTRIAN	168	
LANE_USED_IN_BOTH_DIRECTIONS	169	
FOG_AREA	170	
TIRE_CHAINS_MANDATORY	171	

HIJACKING_HOTSPOT	172	
OVERPASS_AHEAD	173	
TUNNEL	174	
FERRY_TERMINAL	175	
NARROW_BRIDGE	176	
NO_IDLING	177	
HUMPBACK_BRIDGE	178	
EMBANKMENT	179	If sensor is not aware of left or right restriction.
EMBANKMENT_ON_THE_LEFT	180	
EMBANKMENT_ON_THE_RIGHT	181	

CROSSING_WITH_PRIORITY_OVER_MINOR_ROAD	182	
CROSSING_WITH_PRIORITY_TO_THE_RIGHT	183	
BRANCH_TO_THE_LEFT	184	
BRANCH_TO_THE_RIGHT	185	
TWO_WAY_TRAFFIC	186	
BUMP	187	
DIP	188	
ROAD_FLOODED	189	
AUDIBLE_WARNING	190	

VILLAGE_AHEAD	191	
MOVABLE_BRIDGE	192	
SLOW_DOWN	193	
INTERSECTION_T	194	If sensor is not aware of left or right restriction.
INTERSECTION_T_LEFT	195	
INTERSECTION_T_RIGHT	196	
INTERSECTION_T_LEFT_RIGHT	197	
INTERSECTION_Y	198	
USE_LOW_GEAR	199	
USE_LOW_GEAR_END	200	

NO_COMPRESSION_BRAKING	201	
NO_COMPRESSION_BRAKING_END	202	
WAITING_LINE	203	
DONT_STOP_ZONE	204	
HONKING_PROHIBITED	205	
FASTEN_SEAT_BELT	206	
HAMLET_ENTRY	207	
HAMLET_EXIT	208	

HIGHWAY_MARKER_1_STRIPE	209	
HIGHWAY_MARKER_2_STRIPES	210	
HIGHWAY_MARKER_3_STRIPES	211	
GUIDING_BEACON	212	
COUNTDOWN_MARKER_1_STRIPE	213	
COUNTDOWN_MARKER_2_STRIPES	214	
COUNTDOWN_MARKER_3_STRIPES	215	
DIVERSION_ROUTE	216	
DIVERSION_ROUTE_END	217	

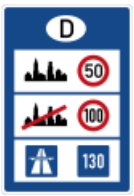
NO_STOPPING_EXCEPT_TAXI	218	
NO_STOPPING	219	
NO_STOPPING_LEFT	220	
NO_STOPPING_RIGHT	221	
NO_STOPPING_LEFT_AND_RIGHT	222	
NO_PARKING	223	If sensor is not aware of left or right restriction, or was not present on sign. 
NO_PARKING_LEFT	224	
NO_PARKING_RIGHT	225	
NO_PARKING_LEFT_AND_RIGHT	226	
RUNNAWAY_TRUCK_RAMP	227	
TURN_ON_GREEN	228	

NO_TURN_ON_RED	229	
MOTORWAY_ROAD_NUMBER	230	
HIGHWAY_ROAD_NUMBER	231	
HIGHWAY_INTERCHANGE_NUMBER	232	
EUROPEAN_ROAD_NUMBER	233	
SPEED_LIMIT_ZONE	234	
SPEED_LIMIT_ZONE_END	235	
NO_PARKING_ZONE	236	
NO_PARKING_ZONE_END	237	
PARKING_ZONE	238	

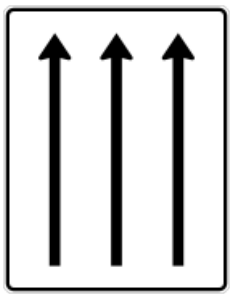
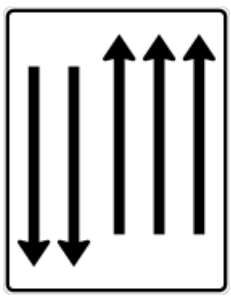
PARKING_ZONE_END	239	
PARKING	240	If sensor is not aware of left or right restriction, or was not present on sign. 
PARKING_TO_LEFT	241	
PARKING_TO_RIGHT	242	
PARKING_GARAGE	243	
PARKING_ON_SIDEWAY	244	
SAFETY_DISTANCE	245	
SAFETY_DISTANCE_VEHICLE	246	
SAFETY_DISTANCE_TRUCK	247	
DETOUR	248	 If sensor is not aware of left or right restriction.
DETOUR_END	249	
DETOUR_LEFT	250	
DETOUR_RIGHT	251	

STATION_GAS	252	
STATION_LPG	253	
STATION_CNG	254	
STATION_H2	255	
STATION_ELECTRO	256	
STATION_POLICE	257	
CAMPING_SPOT	258	
RESTROOMS	259	
INFO_POINT	260	

MOTORWAY_EXIT_AHEAD	261	
HIGHWAY_EXIT_AHEAD	262	
MOTORWAY_EXIT	263	
HIGHWAY_EXIT	264	
FIRST_AID	265	
LOW_FLYING	266	
LANE_SHIFT	267	If sensor is not aware of left or right restriction.
LANE_SHIFT_TO_LEFT	268	
LANE_SHIFT_TO_RIGHT	269	
PEDESTRIAN_UNDERPASS	270	
PEDESTRIAN_OVERPASS	271	
BREAKDOWN_BAY	272	
BUS_LANE	273	

DOUBLE_HAIRPIN	274	
COUNTRY_SPECIFIC_INFORMATION	275	
PEDESTRIAN_BICYCLE_SHARED_PATH	276	
OVERHEAD_LANE_CONTROL_CLOSED	277	
OVERHEAD_LANE_CONTROL_OPEN	278	
OVERHEAD_LANE_CONTROL_CLOSING_LEFT	279	Left lane is closing, hence arrow points to the right. 
OVERHEAD_LANE_CONTROL_CLOSING_RIGHT	280	Right lane is closing, hence arrow points to the left.
OVERHEAD_LANE_CONTROL_FLASH_ARROW_LEFT	281	Arrow pointing to left side and flashing.
OVERHEAD_LANE_CONTROL_FLASH_ARROW_RIGHT	282	Arrow pointing to right side and flashing.
TRINATURE	283	

ANIMAL_FROG	284	
GRAVEL	285	
WARNING_PEDESTRIAN_CROSSING	286	
LOW_TREE	287	
WARNING_RIDER	288	
STOP_AHEAD	289	
YIELD_AHEAD	290	
WATER_PROTECTION_AREA	291	

TOLL_DOUANE	292	
NO_CAR_OR_BIKE	293	
DRIVING_DIRECTION_ONLY_UP	294	
DRIVING_DIRECTION_UP_AND_DOWN	295	
MILITARY_SIGN	296	
SMOG	297	
ROUNDABOUT_AHEAD	298	

MANDATORY_LEFT_OR_STRAIGHT_OR_RIGHT	299	
DEAD_END_RIGHT	300	
DEAD_END_LEFT	301	
TOLL_TRUCK	302	
TOLL_TRUCK_END	303	
STAGGERED_JUNCTION	304	 
AXLE_WEIGHT_RESTRICTION	305	
TOLL_END	306	A sign notifying the general end of a toll-road.
TOLL_CAR_END	307	A sign notifying the end of a toll-road for cars.
TOLL_LANE_END	308	A sign notifying the end of a toll-lane.

TrafficSign.ValidationAndConfidence.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.

VALID	1	Traffic sign is observed as valid, i.e. traffic sign is not temporary invalidated due to road construction (e.g. crossed out by red marker).
INVALID	2	Traffic sign is observed as invalid, i.e. if the sign is temporary invalidated due to a road construction (e.g. crossed out by red marker).

sensoris/protobuf/categories/weather.proto

sensoris.protobuf.categories.weather

Precipitation

Precipitation describes precipitation type and intensity (either as a percentage or mm/h).

Field	Type	Description
envelope	sensoris.protobuf.types.base.EventEnvelope	Event envelope.
detection_status	sensoris.protobuf.types.base.EventDetectionStatus	Event detection status.
type_and_confidence	Precipitation.TypeAndConfidence	Type and confidence of type. If type is NONE, then intensity shall not be set.
relative_intensity_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** Percent **Resolution** 1 **Range** (0, 100]	Intensity as percentage of maximum intensity. Intensity as percentage is non-standardized and may vary, e.g. depending on sensor manufacturer, software and hardware version, or mounting position.
absolute_intensity_and_accuracy	sensoris.protobuf.types.base.Int64ValueAndAccuracy **Unit** MilliMeter per Hour **Resolution** 0.1 **Range** (0,)	Intensity.

Precipitation.TypeAndConfidence

Type and confidence of type.

Example: Precipitation type identified as RAIN, with 50 % confidence.

Field	Type	Description
type	Precipitation.TypeAndConfidence.Type	Type
confidence	sensoris.protobuf.types.base.Confidence	Confidence of type.

WeatherCategory

Weather category.

Field	Type	Description
envelope	sensoris.protobuf.types.base.CategoryEnvelope	Envelope.
precipitation	repeated Precipitation	Precipitation.

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
NONE	1	No precipitation.
RAIN	2	Rain.
MIXED_RAIN_SNOW	3	Mixed rain and snow.
SNOW	4	Snow.
HAIL	5	Hail, sleet or freezing rain.

sensoris/protobuf/types/base.proto

sensoris.protobuf.types.base

AbsoluteInt64Histogram

Absolute histogram of int64 values, i.e. bins contain absolute number of total number of elements.

Field	Type	Description
timestamp_interval	TimestampInterval	Timestamp interval.
total_elements	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Total elements.
bin	repeated AbsoluteInt64Histogram.Bin	Bin.
upper_endpoint_inclusive	google.protobuf.Int64Value	Upper endpoint of last bin.

AbsoluteInt64Histogram.Bin

Bin. The range of a bin is defined as [lower_endpoint_inclusive, lower_endpoint_inclusive of following bin). The range of the last bin is defined as [lower_endpoint_inclusive, upper_endpoint_inclusive]. The corresponding exponent to the attribute is also used for the bin-values.

Example: Unequal sized bins [0, 10) [10, 40) [40, 50].

Field	Type	Description
lower_endpoint_inclusive	google.protobuf.Int64Value	Lower end point of bin.
frequency	google.protobuf.Int64Value Unit 1 Resolution 1 Range [0,)	Absolute frequency.

CategoryEnvelope

Category envelope is the mandatory first field of each category.

Field	Type	Description

extension	repeated google.protobuf.Any	Proprietary extension. A category proprietary extension provides an additional event type, that is not part of the SENSORIS specification.

Confidence

Confidence.

Field	Type	Description
value	int64 Unit Percent Resolution 1 Range (0, 100]	Value.

CountAndConfidence

Count and confidence.

Field	Type	Description
count	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Count.
confidence	Confidence	Confidence of count.

Entity

Entity.

Field	Type	Description
primary_id	google.protobuf.StringValue	First level identifier.
secondary_id	google.protobuf.StringValue	Second level identifier.
type	google.protobuf.StringValue	Type.
software_version	Version	Software version.
hardware_version	Version	Hardware version.
extension	repeated google.protobuf.Any	Proprietary extension.

EventDetectionStatus

Event detection status.

Field	Type	Description
type	EventDetectionStatus.Type	Type.
confidence	Confidence	Confidence of type.

EventEnvelope

Field	Type	Description
id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Identifier, shall be unique for all events in a data message.
timestamp	Timestamp	Timestamp. This is the timestamp of when the event has been detected. In case of a longer identification cycle, the actual timestamp of detection needs to be back-calculated. Example: At time t = 10, a traffic sign is observed with the camera sensor. At time t = 15, the processing unit calculates the existence and position of the traffic sign, then the traffic sign event with t = 10 is to be created, so that the relative position fits to the localization of the vehicle at t = 10 in the sensoris.protobuf.categories.localization.VehiclePositionAndOrientation event.
extension	repeated google.protobuf.Any	Proprietary extension. An event proprietary extension provides additional information for the specific event, e.g. provides metadata for the set event fields or adds additional information that is not part of the SENSORIS specification.

Int64GaussianDistribution

Gaussian distribution of int64 values.

Field	Type	Description
timestamp_interval	TimestampInterval	Timestamp interval.
mean	google.protobuf.Int64Value	Mean.
variance	google.protobuf.Int64Value	Variance.

Int64Matrix3x3

Matrix of int64 values with dimension of 3 horizontal rows x 3 vertical columns.

Field	Type	Description
a11	google.protobuf.Int64Value	
a12	google.protobuf.Int64Value	
a13	google.protobuf.Int64Value	
a21	google.protobuf.Int64Value	
a22	google.protobuf.Int64Value	
a23	google.protobuf.Int64Value	
a31	google.protobuf.Int64Value	
a32	google.protobuf.Int64Value	
a33	google.protobuf.Int64Value	

Int64StatisticMeasure

Statistic measure of int64 value.

Field	Type	Description

timestamp_interval	TimestampInterval	Timestamp interval.
type	StatisticMeasureType	Type.
value	int64	Value.

Int64StatisticMeasureAndAccuracy

Statistic measure of int64 value and accuracy.

Field	Type	Description
timestamp_interval	TimestampInterval	Timestamp interval.
type	StatisticMeasureType	Type.
value	int64	Value.
accuracy	google.protobuf.Int64Value	Accuracy.

Int64Value

Int64 value that is either one int64 value or provides statistics of several int64 values.

Field	Type	Description
value	int64	Value.
statistic_measure	Int64StatisticMeasure	Statistic measure.
absolute_histogram	AbsoluteInt64Histogram	Absolute histogram.
relative_histogram	RelativeInt64Histogram	Relative histogram.
gaussian_distribution	Int64GaussianDistribution	Gaussian distribution.

Int64ValueAndAccuracy

Int64 value that is either one int64 value and it's accuracy or provides statistics of several int64 values.

Field	Type	Description
value_and_accuracy	Int64ValueAndAccuracy.ValueAndAccuracy	Value and accuracy.
statistic_measure_and_accuracy	Int64StatisticMeasureAndAccuracy	Statistic measure and accuracy.
absolute_histogram	AbsoluteInt64Histogram	Absolute histogram.
relative_histogram	RelativeInt64Histogram	Relative histogram.
gaussian_distribution	Int64GaussianDistribution	Gaussian distribution.

Int64ValueAndAccuracy.ValueAndAccuracy

Int64 value and accuracy.

Field	Type	Description
value	int64	Value.

accuracy	google.protobuf.Int64Value	Accuracy.

RelativeInt64Histogram

Relative histogram of int64 values, i.e. bins contain relative percentage of total number of elements.

Field	Type	Description
timestamp_interval	TimestampInterval	Timestamp interval.
total_elements	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Total elements.
bin	repeated RelativeInt64Histogram.Bin	Bin.
upper_endpoint_inclusive	google.protobuf.Int64Value	Upper endpoint of last bin.

RelativeInt64Histogram.Bin

Bin. The range of a bin is defined as [lower_endpoint_inclusive, lower_endpoint_inclusive of following bin). The range of the last bin is defined as [lower_endpoint_inclusive, upper_endpoint_inclusive]. The corresponding exponent to the attribute is also used for the bin-values.

Example: Unequal sized bins [0, 10) [10, 40) [40, 50].

Field	Type	Description
lower_endpoint_inclusive	google.protobuf.Int64Value	Lower end point of bin.
relative_frequency	google.protobuf.Int64Value Unit Percent Resolution 0.1 Range [0, 100]	Relative frequency.

Timestamp

Timestamp. Timestamp may be also used to model duration.

Field	Type	Description
posix_time	google.protobuf.Int64Value Unit MilliSecond Resolution 1 Range [0,)	POSIX time in milliseconds.
posix_time_fraction	google.protobuf.Int64Value Unit MicroSecond Resolution 1 Range [0, 1000)	Microseconds fraction of POSIX time.

TimestampInterval

Timestamp interval [start inclusive, end exclusive).

Field	Type	Description
start_inclusive	Timestamp	Start of interval inclusive.
end_exclusive	Timestamp	End of interval exclusive.

Version.

Field	Type	Description
major	google.protobuf.Int64Value Unit 1 Resolution 1 Range [0,)	Major version.
minor	google.protobuf.Int64Value Unit 1 Resolution 1 Range [0,)	Minor version.
patch	google.protobuf.Int64Value Unit 1 Resolution 1 Range [0,)	Patch version.
name	google.protobuf.StringValue	Name.

EventDetectionStatus.Type

Type.

Name	#	Description
UNKNOWN_TYPE	0	Unknown.
EXPECTED_AND_DETECTED	1	Expected and detected by vehicle.
EXPECTED_AND_NOT_DETECTED	2	Expected and not detected by vehicle, without further specification of the reason for the non detection.
EXPECTED_AND_NOT_DETECTED_ACCESS_BLOCKED	3	Expected and not detected by vehicle due to blocked access, e.g. vision of camera sensor to expected event is blocked.
EXPECTED_AND_NOT_DETECTED_ACCESS_AVAILABLE	4	Expected and not detected by vehicle although access is not blocked, e.g. vision of camera sensor to expected event is free.
NOT_EXPECTED_AND_DETECTED	5	Not expected and detected by vehicle.

StatisticMeasureType

Type of statistic measure.

Name	#	Description
UNKNOWN_STATISTIC_MEASURE_TYPE	0	Unknown.
MINIMUM	1	Minimum.
MAXIMUM	2	Maximum.
AVERAGE	3	Average.
MEDIAN	4	Median.

SystemStatus

System status.

Name	#	Description
UNKNOWN_SYSTEM_STATUS	0	Unknown.

ACTIVE	1	Active, i.e. system is on and controls vehicle.
INACTIVE	2	Inactive, i.e. system is on and doesn't control vehicle.
DISABLED	3	Disabled, i.e. system is off, e.g. disabled by driver.

sensoris/protobuf/types/source.proto

sensoris.protobuf.types.source

NavigationSatelliteSystem

Navigation satellite system.

Field	Type	Description
satellite_system	repeated NavigationSatelliteSystem.SatelliteSystem	Satellite system.
satellite_based_augmentation_system	repeated NavigationSatelliteSystem.SatelliteBasedAugmentationSystem	Satellite based augmentation system.
ground_based_augmentation_system	repeated NavigationSatelliteSystem.GroundBasedAugmentationSystem	Ground based augmentation system.
elevation_mask	google.protobuf.Int64Value **Unit** Degree **Resolution** 1 **Range** [0, 90)	Elevation mask. All satellites that have an elevation below the elevation mask are not used for determination of positions.
antenna_offset_and_accuracy	sensoris.protobuf.types.spatial.XyzVectorAndAccuracy	3 D vector describing the offset from the SENSORIS vehicle coordinate system reference point to the GNSS antenna reference point. If the antenna offset is set, then all GNSS positions measured by the sensor shall be transformed to the SENSORIS vehicle coordinate system by applying the antenna offset and the corresponding vehicle rotation. Example: Value of (x = 0, y = 0, z = 1 m) corresponds to a GNSS antenna reference point being exactly 1 meter above the SENSORIS vehicle coordinate system reference point.
extension	repeated google.protobuf.Any	Proprietary extension.

Sensor

Sensor.

mounting_position_and_orientation	Sensor.MountingPositionAndOrientation	Mounting position and orientation relative to SENSORIS vehicle coordinate system.
navigation_satellite_system	NavigationSatelliteSystem	Navigation satellite system.

Sensor.MountingPositionAndOrientation

Mounting position and orientation relative to SENSORIS vehicle coordinate system.

Field	Type	Description
translation_and_accuracy	sensoris.protobuf.types.spatial.PositionAndAccuracy	Metric translation.
orientation_and_accuracy	sensoris.protobuf.types.spatial.RotationAndAccuracy	Orientation.

SensorFusion

Sensor fusion.

Field	Type	Description
sensor_id	repeated google.protobuf.Int64Value	Fused sensors referenced by their Source.id.

Source

Source.

Field	Type	Description
id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Identifier, shall be unique for all sensors and sensor fusions in a data message.
entity	sensoris.protobuf.types.base.Entity	Information about the source entity which may be a sensor or a sensor fusion software providing the information. The primary id might be the company name as the manufacturer of the sensor whereas the secondary id might be a specific name of the sensor. Example: Values primary_id: "ABC Sensors Ltd.", secondary_id: "Mono Color Generation 8 Front", type: "Camera".
sampling_frequency	sensoris.protobuf.types.base.Int64Value Unit Hertz Resolution 0.001 Range [0,)	Sensor sampling frequency.
sensor	Sensor	Sensor.
sensor_fusion	SensorFusion	Sensor fusion.
extension	repeated google.protobuf.Any	Proprietary extension.

NavigationSatelliteSystem.GroundBasedAugmentationSystem

Ground based augmentation system.

Name	#	Description

UNKNOWN_GROUND_BASED	0	Unknown.
GROUND_BASED	1	Any ground based augmentation system.
GBAS	2	International Civil Aviation Organization Ground-Based Augmentation System (GBAS).
NDGPS	3	United States' US Nationwide Differential GPS System (NDGPS).
SAPOS	4	German Satellitenpositionierungsdienst der deutschen Landesvermessung (SAPOS).
ALF	5	German Accurate Positioning by Low Frequency (ALF).
AXIO_NET	6	Commercial AXIO-NET.
VRS_NOW	7	Commercial VRS Now.
SMART_NET	8	Commercial SmartNet.

NavigationSatelliteSystem.SatelliteBasedAugmentationSystem

Satellite based augmentation system.

Name	#	Description
UNKNOWN_SATELLITE_BASED	0	Unknown.
SATELLITE_BASED	1	Any satellite based augmentation system.
WAAS	2	United States' Wide Area Augmentation System (WAAS).
EGNOS	3	European Geostationary Navigation Overlay Service (EGNOS).
MSAS	4	Japanese Multi-functional Satellite Augmentation System (MSAS).
QZSS_SATELLITE_BASED	5	Japanese Quasi-Zenith Satellite System (QZSS).
GAGAN	6	Indian GPS-aided GEO augmented navigation (GAGAN).
SDCM	7	Russian System for Differential Correction and Monitoring (SDCM).
SNAS	8	Chinese Satellite Navigation Augmentation System (SNAS).
WAGE	9	United States' Wide Area GPS Enhancement (WAGE).
STAR_FIRE	10	Commercial StarFire.
STAR_FIX	11	Commercial Starfix.
OMNI_STAR	12	Commercial OmniSTAR.

NavigationSatelliteSystem.SatelliteSystem

Satellite system.

Name	#	Description
UNKNOWN_SATELLITE_SYSTEM	0	Unknown.
GPS	1	United States' Global Positioning System (GPS).
GLONASS	2	Russian Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS).
GALILEO	3	European Union Galileo positioning system (GALILEO).
BEIDOU_1	4	Chinese BeiDou Satellite Navigation Experimental System (BeiDou-1).
BEIDOU_2	5	Chinese BeiDou Navigation Satellite System (BDS, COMPASS, BeiDou-2).
NAVIC	6	Indian NAVigation with Indian Constellation (NAVIC).
QZSS	7	Japanese Quasi-Zenith Satellite System (QZSS).

sensoris.protobuf.types.spatial

MapLocationReference

Map location reference.

Field	Type	Description
position_and_accuracy	PositionAndAccuracy	Absolute position of the map object.
z_level	google.protobuf.Int64Value Unit 1 Resolution 1 Range [0,)	Map z-level at the absolute position of the map object.
tile_link_offset_reference	MapLocationReference.TileIdLinkIdOffset	Location reference of a map object defined by a tile id, link id and offset on link id.
map_object_id	MapLocationReference.TileIdObjectId	Location reference of a map object defined by a tile id and object id.
extension	repeated google.protobuf.Any	Proprietary extension.

MapLocationReference.TileIdLinkIdOffset

Location reference of a map object defined by a tile id, link id and offset on link id.

Field	Type	Description
tile_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Map tile id.
link_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Map link id.
offset	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Offset of the position starting from the beginning of the link id.
extension	repeated google.protobuf.Any	Proprietary extension.

MapLocationReference.TileIdObjectId

Location reference of a map object defined by a tile id and object id.

Field	Type	Description
tile_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Map tile id.
object_id	google.protobuf.Int64Value Unit 1 Resolution 1 Range [1,)	Map object id.
extension	repeated google.protobuf.Any	Proprietary extension.

PolylineAndAccuracy

Field	Type	Description
position_and_accuracy	repeated PositionAndAccuracy	Polyline vertex position and accuracy.
extension	repeated google.protobuf.Any	Proprietary extension.

PositionAndAccuracy

Geographic or metric position and metric accuracy.

Field	Type	Description
geographic_wgs84	PositionAndAccuracy.Geographic	Geographic position in World Geodetic System 84 (WGS84) reference system.
metric_vehicle	PositionAndAccuracy.Metric	Metric position in SENSORIS vehicle coordinate system.
metric_event_group	PositionAndAccuracy.Metric	Metric position in relative coordinate system, the reference coordinate system is the origin of the event group.
metric_ecef	PositionAndAccuracy.Metric	Metric position in Earth-Centered Earth-Fixed (ECEF) reference system.
combined_std_dev	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Accuracy as combined standard deviation of metric horizontal and metric vertical position.
std_dev	PositionAndAccuracy.HorizontalVerticalStdDev	Accuracy as standard deviation of metric horizontal position and metric vertical position.

horizontal_confidence_ellipse_vertical_std_dev	PositionAndAccuracy.HorizontalConfidenceEllipseVerticalStdDev	Accuracy as metric horizontal confidence ellipse and standard deviation of metric vertical position.
covariance	sensoris.protobuf.types.base.Int64Matrix3x3 **Unit** MilliMeter squared **Resolution** 1 **Range** (,)	Accuracy as 3 x 3 covariance matrix of metric position of (x, x), (x, y), (x, z), (y, x), (y, y), (y, z), (z, x), (z, y), (z, z).
extension	repeated google.protobuf.Any	Proprietary extension.

PositionAndAccuracy.Geographic

Geographic position in reference system.

Field	Type	Description
longitude	sensoris.protobuf.types.base.Int64Value **Unit** Degree **Resolution** 0.00000001 **Range** [-180, 180)	Longitude.
latitude	sensoris.protobuf.types.base.Int64Value **Unit** Degree **Resolution** 0.00000001 **Range** [-90, 90]	Latitude.
altitude	sensoris.protobuf.types.base.Int64Value **Unit** Meter **Resolution** 0.001 **Range** (,)	Altitude.

PositionAndAccuracy.HorizontalConfidenceEllipseVerticalStdDev

Accuracy as metric horizontal confidence ellipse and standard deviation of metric vertical position.

Field	Type	Description
horizontal_ellipse_major	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** (0,)	Metric length of major axis of confidence ellipse.
horizontal_ellipse_minor	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** (0,)	Metric length of minor axis of confidence ellipse.

horizontal_ellipse_major_heading	google.protobuf.Int64Value Unit Degree Resolution 0.01 Range [0, 360)	Heading of major axis of confidence ellipse, references geographic north with 0 degree north, 90 degree east, 180 degree south and 270 degree west.
vertical	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Standard deviation of metric vertical position.

PositionAndAccuracy.HorizontalVerticalStdDev

Accuracy as standard deviation of metric horizontal position and vertical position.

Field	Type	Description
horizontal	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Standard deviation of metric horizontal position.
vertical	google.protobuf.Int64Value Unit MilliMeter Resolution 1 Range [0,)	Standard deviation of metric vertical position.

PositionAndAccuracy.Metric

Metric position in reference system.

Field	Type	Description
x	sensoris.protobuf.types.base.Int64Value Unit MilliMeter Resolution 1 Range (,)	Delta on x-axis.
y	sensoris.protobuf.types.base.Int64Value Unit MilliMeter Resolution 1 Range (,)	Delta on y-axis.
z	sensoris.protobuf.types.base.Int64Value Unit MilliMeter Resolution 1 Range (,)	Delta on z-axis.

RectangularBoxAndAccuracy

Rectangular box and accuracy. A rectangular box is defined by either - three (x, y, z) corner vectors or by - position of center point of box, orientation of box in center point and size of box in direction of x-, y- and z-axis of coordinate system defined by center point and orientation. A rectangular box may be also used to represent - a bounding box oriented to the axes of the respective coordinate system or - a two-dimensional rectangle.

Field	Type	Description
corner_vectors	RectangularBoxAndAccuracy.CornerVectors	Rectangular box defined by three (x, y, z) corner vectors.

center_orientation_size	RectangularBoxAndAccuracy.CenterOrientationSize	Rectangular box defined by position of center point of box, orientation of box in center point and size of box in direction of x-, y- and z-axis of coordinate system defined by center point and orientation.
extension	repeated google.protobuf.Any	Proprietary extension.

RectangularBoxAndAccuracy.CenterOrientationSize

Rectangular box defined by position of center point of box, orientation of box in center point and size of box in direction of x-, y- and z-axis of coordinate system defined by center point and orientation. If the orientation is not set, then the rectangular box represents a bounding box oriented to the axes of the respective coordinate system. If only two dimensions of the size are set, then the box represents a two-dimensional rectangle.

Field	Type	Description
center_position_and_accuracy	PositionAndAccuracy	Position and accuracy of center point of box.
orientation_and_accuracy	RotationAndAccuracy	Orientation and accuracy of box in center point.
size_and_accuracy	XyzVectorAndAccuracy	Size and accuracy of box in direction of x-, y- and z-axis of coordinate system defined by center point as origin and orientation. The (x, y, z) values are set in the field metric origin.

RectangularBoxAndAccuracy.CornerVectors

Rectangular box defined by three (x, y, z) corner vectors. If only two (x, y, z) corner vectors are set, then the rectangular box represents a bounding box oriented to the axes of the respective coordinate system.

Field	Type	Description
first_and_accuracy	XyzVectorAndAccuracy	First (x, y, z) corner vector and accuracy.
second_and_accuracy	XyzVectorAndAccuracy	Second (x, y, z) corner vector and accuracy.
third_and_accuracy	XyzVectorAndAccuracy	Third (x, y, z) corner vector and accuracy.

RotationAndAccuracy

Rotation as Euler angles or quaternion and accuracy as Euler angles.

Field	Type	Description
euler_vehicle	RotationAndAccuracy.Euler	Euler angles yaw, pitch and roll in SENSORIS vehicle coordinate system.
euler_event_group	RotationAndAccuracy.Euler	Euler angles yaw, pitch and roll in relative coordinate system, the reference coordinate system is the origin of the event group.
quaternion_vehicle	RotationAndAccuracy.Quaternion	Quaternion in SENSORIS vehicle coordinate system.
quaternion_event_group	RotationAndAccuracy.Quaternion	Quaternion in relative coordinate system, the reference coordinate system is the origin of the event group.
combined_std_dev	google.protobuf.Int64Value **Unit** Degree **Resolution** 0.01 **Range** [0, 360)	Accuracy as combined standard deviation of yaw, pitch and roll angles.

std_dev	RotationAndAccuracy.StdDev	Accuracy as standard deviation of yaw angle, pitch angle and roll angle.
covariance	sensoris.protobuf.types.base.Int64Matrix3x3 Unit Degree squared Resolution 0.01 Range (,)	Accuracy as 3 x 3 covariance matrix of (yaw, yaw), (yaw, pitch), (yaw, roll), (pitch, yaw), (pitch, pitch), (pitch, roll), (roll, yaw), (roll, pitch), (roll, roll) angles.
extension	repeated google.protobuf.Any	Proprietary extension.

RotationAndAccuracy.Euler

Euler angles yaw, pitch and roll. Rotation order is yaw, pitch and roll.

Field	Type	Description
yaw	sensoris.protobuf.types.base.Int64Value Unit Degree Resolution 0.01 Range [0, 360)	Yaw angle.
pitch	sensoris.protobuf.types.base.Int64Value Unit Degree Resolution 0.01 Range [0, 360)	Pitch angle.
roll	sensoris.protobuf.types.base.Int64Value Unit Degree Resolution 0.01 Range [0, 360)	Roll angle.

RotationAndAccuracy.Quaternion

Quaternion. Usually sqrt(x^2 + y^2 + z^2 + w^2) = 1.

Field	Type	Description
x	sensoris.protobuf.types.base.Int64Value Resolution 0.001 Range (,)	Value of x.
y	sensoris.protobuf.types.base.Int64Value Resolution 0.001 Range (,)	Value of y.
z	sensoris.protobuf.types.base.Int64Value Resolution 0.001 Range (,)	Value of z.
w	sensoris.protobuf.types.base.Int64Value Resolution 0.001 Range (,)	Value of w.

RotationAndAccuracy.StdDev

Accuracy as standard deviation of yaw angle, pitch angle and roll angle.

Field	Type	Description
yaw	google.protobuf.Int64Value Unit Degree Resolution 0.01 Range [0, 360)	Standard deviation of yaw angle.

pitch	google.protobuf.Int64Value **Unit** Degree **Resolution** 0.01 **Range** [0, 360)	Standard deviation of pitch angle.
roll	google.protobuf.Int64Value **Unit** Degree **Resolution** 0.01 **Range** [0, 360)	Standard deviation of roll angle.

RotationRateAndAccuracy

Rotation rate as change in Euler angles over time and accuracy.

Field	Type	Description
yaw	sensoris.protobuf.types.base.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** (,)	Yaw angle rate.
pitch	sensoris.protobuf.types.base.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** (,)	Pitch angle rate.
roll	sensoris.protobuf.types.base.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** (,)	Roll angle rate.
combined_std_dev	google.protobuf.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** [0,)	Accuracy as combined standard deviation of yaw, pitch and roll angle rates.
std_dev	RotationRateAndAccuracy.StdDev	Accuracy as standard deviation of yaw angle rate, pitch angle rate and roll angle rates.
covariance	sensoris.protobuf.types.base.Int64Matrix3x3 **Unit** Degree squared per Second squared **Resolution** 0.01 **Range** (,)	Accuracy as 3 x 3 covariance matrix of (yaw, yaw), (yaw, pitch), (yaw, roll), (pitch, yaw), (pitch, pitch), (pitch, roll), (roll, yaw), (roll, pitch), (roll, roll) angle rates.
extension	repeated google.protobuf.Any	Proprietary extension.

RotationRateAndAccuracy.StdDev

Accuracy as standard deviation of yaw, pitch and roll angle rate.

Field	Type	Description
yaw	google.protobuf.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** [0,)	Standard deviation for yaw angle rate.
pitch	google.protobuf.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** [0,)	Standard deviation for pitch angle rate.
roll	google.protobuf.Int64Value **Unit** Degree per Second **Resolution** 0.01 **Range** [0,)	Standard deviation for roll angle rate.

Generic (x, y, z) vector and accuracy. The vector may contain one, two or three values, e.g. only a value in direction of x-axis.

Field	Type	Description
metric_vehicle	XyzVectorAndAccuracy.Metric	Metric (x, y, z) values in SENSORIS vehicle coordinate system.
metric_event_group	XyzVectorAndAccuracy.Metric	Metric (x, y, z) values in relative coordinate system, the reference coordinate system is the origin of the event group.
metric_origin	XyzVectorAndAccuracy.Metric	Metric (x, y, z) values in coordinate system specified by origin and orientation defined in enclosing type.
combined_std_dev	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Accuracy as combined standard deviation of x, y and z values.
std_dev	XyzVectorAndAccuracy.StdDev	Accuracy as standard deviation of x value, y value and z value.
covariance	sensoris.protobuf.types.base.Int64Matrix3x3 **Unit** MilliMeter squared **Resolution** 1 **Range** (,)	Accuracy as 3 x 3 covariance matrix of (x, x), (x,y), (x, z), (y, x), (y, y), (y, z), (z, x), (z, y), (z, z) values.
extension	repeated google.protobuf.Any	Proprietary extension.

XyzVectorAndAccuracy.Metric

Metric values in reference system.

Field	Type	Description
x	sensoris.protobuf.types.base.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** (,)	Value in direction of x-axis.
y	sensoris.protobuf.types.base.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** (,)	Value in direction of y-axis.
z	sensoris.protobuf.types.base.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** (,)	Value in direction of z-axis.

XyzVectorAndAccuracy.StdDev

Accuracy as standard deviation of x value, y value and z value.

Field	Type	Description
x	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Standard deviation of x value.
y	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Standard deviation of y value.
z	google.protobuf.Int64Value **Unit** MilliMeter **Resolution** 1 **Range** [0,)	Standard deviation of z value.

google/protobuf/any.proto

google.protobuf

Any

Any contains an arbitrary serialized protocol buffer message along with a URL that describes the type of the serialized message.

Protobuf library provides support to pack/unpack Any values in the form of utility functions or additional generated methods of the Any type.

The pack methods provided by protobuf library will by default use 'type.googleapis.com/full.type.name' as the type URL and the unpack methods only use the fully qualified type name after the last '/' in the type URL, for example "foo.bar.com/x/y.z" will yield type name "y.z".

Field	Type	Description
type_url	string	A URL/resource name whose content describes the type of the serialized protocol buffer message.
value	bytes	Must be a valid serialized protocol buffer of the above specified type.

google/protobuf/wrappers.proto

google.protobuf

BoolValue

Wrapper message for bool.

Field	Type	Description
value	bool	The bool value.

BytesValue

Wrapper message for bytes.

Field	Type	Description
value	bytes	The bytes value.

Int64Value

Wrapper message for int64.

Field	Type	Description
value	int64	The int64 value.

StringValue

Field	Type	Description
value	string	The string value.

Scalar Value Types

google.protobuf

Scalar Value Types

Protobuf scalar value types.

Type	Notes	C++ Type	Java Type	Python Type
int64	Uses variable-length encoding.	int64	long	int/long
bool		bool	boolean	boolean
string	A string must always contain UTF-8 encoded or 7-bit ASCII text.	string	String	str/unicode
bytes	May contain any arbitrary sequence of bytes.	string	ByteString	str