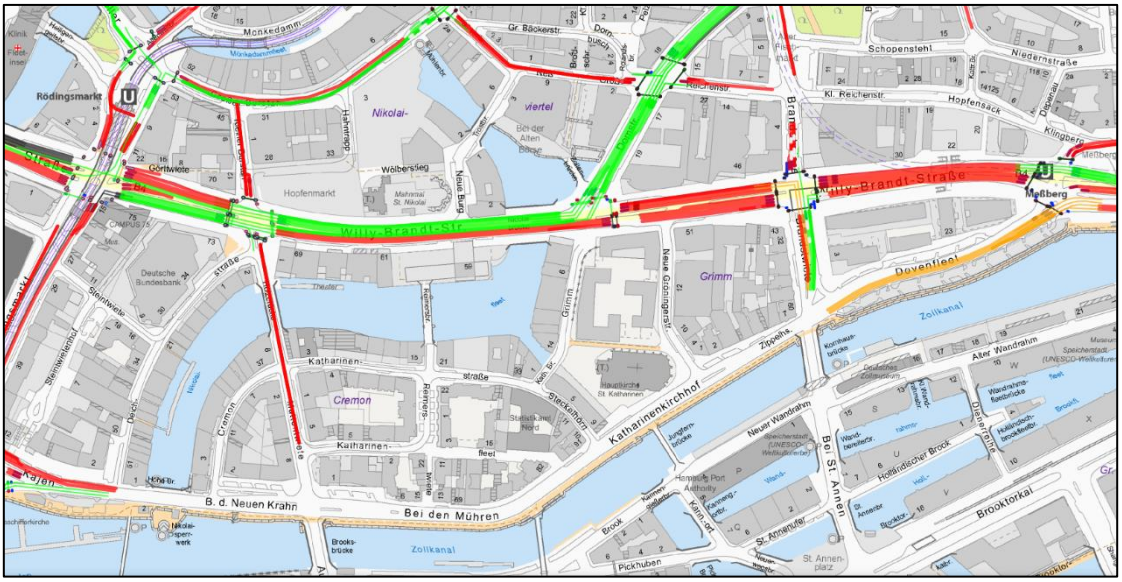
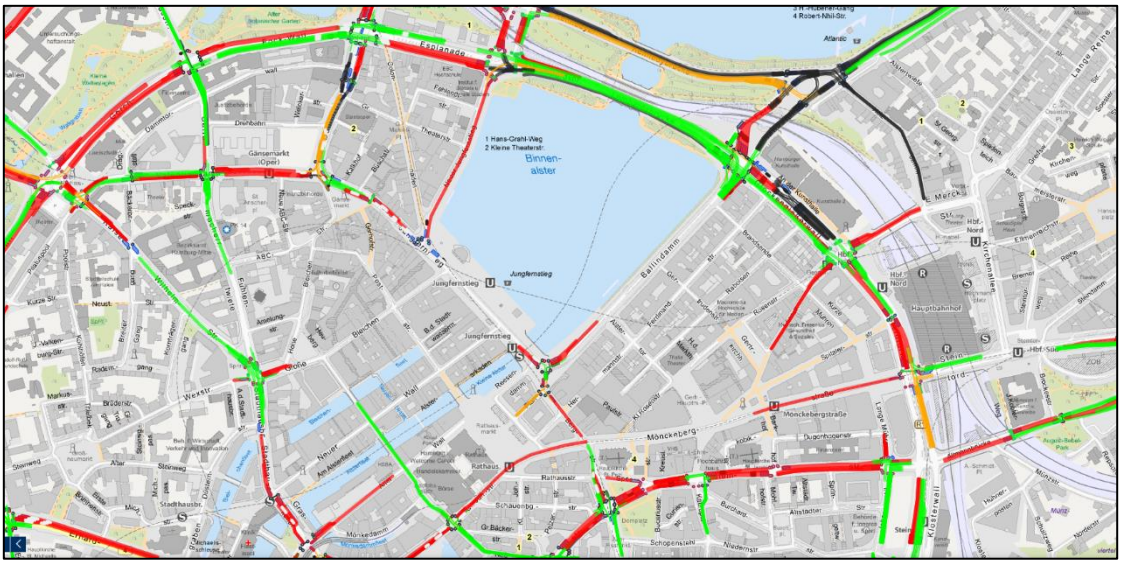
Traffic Lights Data Hamburg – Usage Guide





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Version	Datum	Änderungen	Autor
1.0	01.09.2022		Heller
1.1	12.10.2022	Bicycle, pedestrian, acoustic traffic request → Observation → Result	Heller

Content

Introduction

The data set includes LSA[1] process data for a large number of intersections in Hamburg and contains current signal characteristics in real time. In addition, data on detectors such as bicycles, pedestrians, car requests and bus messages are transmitted.

Currently the free dataset is in beta. The following points should be considered using the data:

1. The system is still in test operation and is being evaluated, so it is possible that:
   1.1. unpredictable failures in data transmission occure
   1.2. breakdowns in data refresh occure
   1.3. declines in performance occure

2. A final quality assurance has not yet taken place.
   2.1. Data may be incorrect, especially location data.
   2.2. The description of the entities is partly still incomplete.
   2.3. possible inconsistency of the timestamps in the observations, such as resultTime (time stamp of the TLD-system[2]) BEFORE phenomenonTime (time stamp of the signal from the traffic light system).

Further information and sample queries can be found at:

https://metaver.de/trefferanzeige?docuuid=AB32CF78-389A-4579-9C5E-867EF31CA225#detail_description

How to read the tables

- Information in {curly braces} are placeholders information that is specific for each data item.
- This dataset contains traffic lights signals for a variety of signal types, detectors and traffic participants.
- According to the SensorThings API specification the dataset is organized in entities. These entities are:

Name	Description
Datastreams	groups observations of traffic signal types for a specific lane connections' signal group all Datastreams for a specific signal type are organized through properties/layerName key the provided signal types and its Datastreams are listed in signal types table
Things	a single lane connection that is subject to a signal head
Locations	the location of a Thing (here: lane connection) in GeoJSON format as MultiLineString
Observations	reports the current signal or detector value, observations can be matched to a specific lane connection by its associated Datastream
ObservedProperties	contains metadata about the type of an Observation
Sensor	contains overall information about the signaling devices
FeatureOfInterest (FOI)	contains the location of the point where a traffic participant has to wait until a permitted route is signaled. Every lane connection has a FeatureOfInterest the FOI is not directly linked to a specific datastream but through an observation, every Observation has a matching FOI A FOI can be matched to its specific lane connection (Thing) by its name.

[1] Traffic light system
[2] Traffic light data

- All signal types (Datastreams) have a unique lane connection (Thing); all lane connections (Things) have a Location.
- Signals (Observations) have a matching signal type (Datastream) and lane connection (Thing) through which they can be identified.
- Entities are connected with each other: e.g. to get all the Datastreams for a specific Thing, you can use the "Datastreams@iot.navigationLink" link on this Thing
- more information on how to use the OGC SensorThings API can be found here: https://www.ogc.org/standards/sensorthings
- For better understanding most TLD signal types (Datastreams) are depicted in Figure 1 and listed in this table in the appendix.

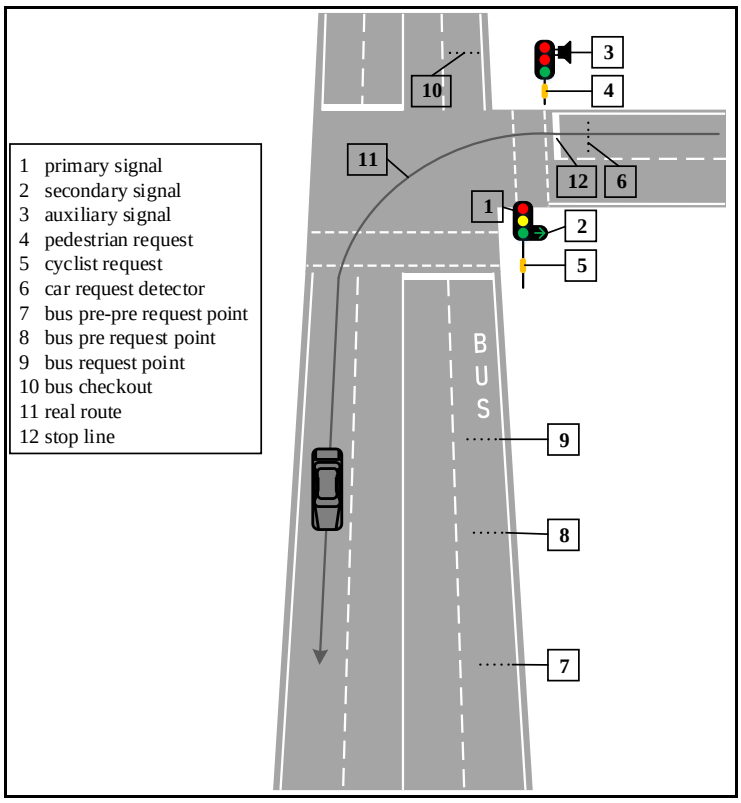

Figure 1. Schematic representation of an intersection with all TLD signal types

MQTT – How to find and subscribe specific topics

For example, to get a list of Datastreams which host the primary signals for intersection *Dammtor/Theodor-Heuss-Platz*, type:

```
https://tld.iot.hamburg.de/v1.0/Datastreams
?$filter=properties/layerName+eq+'primary_signal'
+and+Thing/properties/trafficLightsID+eq+'1556'
&$select=id,name,Observations
&$count=true
```

into your browser.

The Observations@iot.navigationLink contains host, Path and Datastream-ID information which can be used for entering subscription information into MQTT clients, e.g.:

Variant 1: pure MQTT

Host: tld.iot.hamburg.de
Port: 1883
Subscription topic: `v1.0/Datastreams(70554)/Observations`

Variant 2: MQTT via WebSocket

Host: tld.iot.hamburg.de
Path: /mqtt
Port: 443
Subscription topic: `v1.0/Datastreams(70554)/Observations`

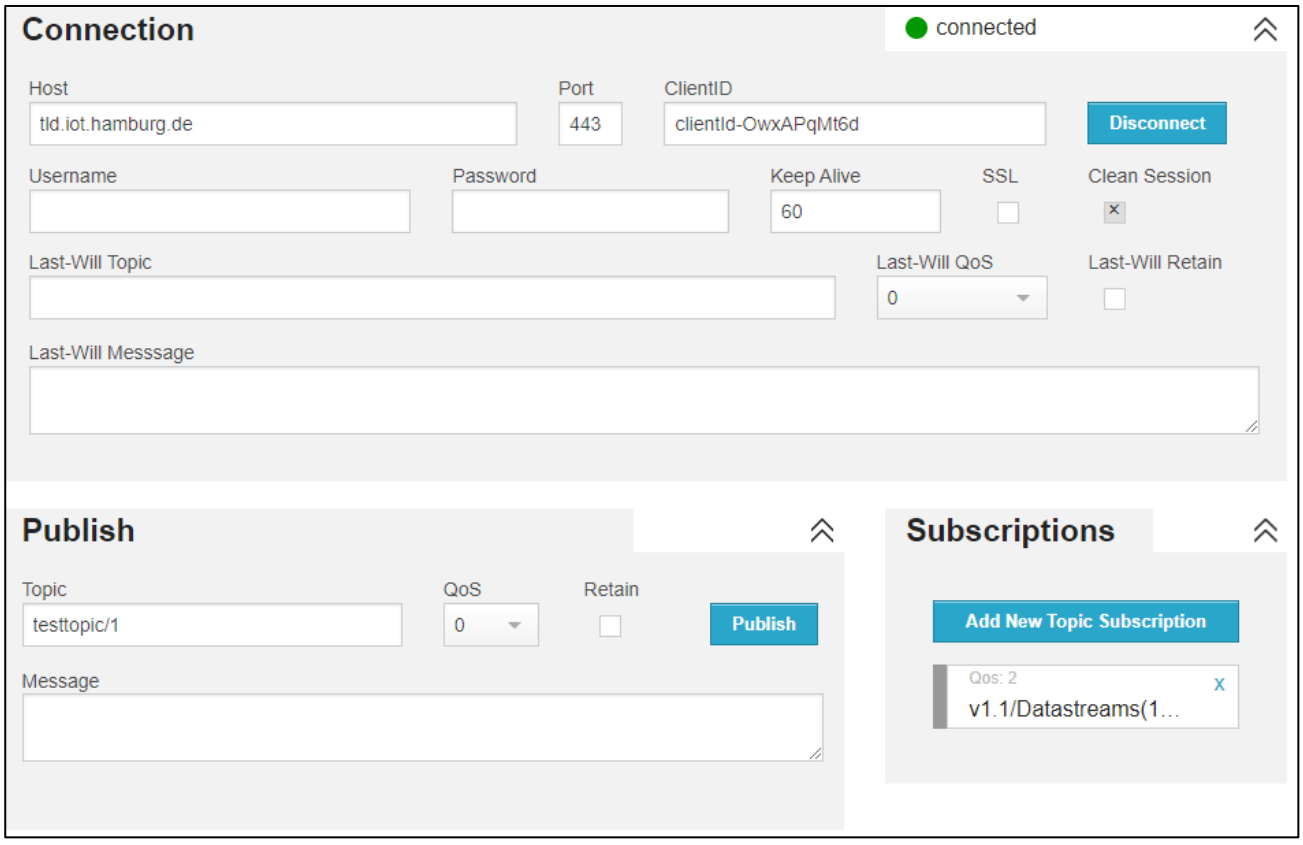

Figure 2. Connecting via Websocket, using HiveMQ Websocket Client. Source: MQTT Websocket Client (hivemq.com)

Appendix

Signal types (datastreams)

Name of datastream	**Description**	**linked ObservedProperty (name)**	**linked Sensor (name)**	**identified by Datastream/ properties/ layerName**
Primary signal	Main signal head, e.g. red-amber-green	Signal	Signal heads of traffic lights	primary_ signal
Secondary signal	Additional signal head, e.g. direction signal head	Signal	Signal heads of traffic lights	secondary_ signal
Auxiliary signal	Additional signal, e.g. one face flashing signal head for warning	Signal	Signal heads of traffic lights	auxiliary_ signal
Acoustic signal	Acoustic signal for blind and visually impaired pedestrians	Signal	Acoustic equipment at traffic lights	acoustic_ signal
Car request	Signal of the automated detections of cars	Occupation level	Traffic participant detector	detector_ car
Cyclists request	Signal of the permission request of cyclists	Detector status	Traffic participant detector	detector_ cyclists
Pedestrian request	Signal of the permission request of pedestrians	Detector status	Traffic participant detector	detector_ pedestrian
Acoustic traffic request	Signal of the permission request for blind and visually impaired pedestrians	Detector status	Traffic participant detector	detector_ acoustic_ traffic_request
Bus pre request point	Signal of the automated permission request of buses, e.g. third request, reported will be the bus line number	Detector status	Traffic participant detector	bus_pre-request_point
Bus request point	Signal of the automated permission request of buses, e.g. main request, reported will be the bus line number	Detector status	Traffic participant detector	bus_ request_point
Bus checkout	Signal of the automated checkout, reported will be the bus line number	Detector status	Traffic partic ipant detector	bus_checkout
Signal program	The signal program is the current control setting of the traffic light. The hereby transmitted value indicates the number/name of the signal program, not the entire signal program.	Signalprogram status	Signal program indicator	signal_ program
Cycle second	During normal operation: current second in the traffic signal cycle	Time	Cycle second indicator	cycle_second

Primary signal

Primary signal - Datastream

Key	Value	Value Type	additional information
Name	Primary signal heads at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	{signal group id}	string	e.g. "K6", …
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	primary_signal	string	

Primary signal - Thing

Key	Value	Value Type	additional information
Name	{TrafficLightsID}_{Connection ID}	string	
properties/topic	Transportation and traffic	string	
properties/assetID	Connection name in the traffic control center	string	information currently not available
properties/ownerThing	Free and Hanseatic City of Hamburg	string	
properties/keywords	TLF, LSA, Hamburg	list	
properties/language	EN	string	
properties/infoLastUpdate	{Timestamp UTC (ISO 8601)}	datetime	timestamp
properties/connectionID	{Connection ID}	string	ID of the connection between the related ingress and egress lane
properties/trafficLightsID	{Name/number of traffic light}	string	
properties/ingressLaneID	{Name of ingress lane}	string	
properties/egressLaneID	{Name of egress lane}	string	
properties/laneType	{"Radfahrer" | "KFZ/Bus" | "KFZ" | "Fußgänger" | „Bus“ | "KFZ/Radfahrer“ | KFZ/Bus/Radfahrer“}	string	

Primary signal - Location

Key	Value	Value Type	additional information
Name	{trafficLightsID_Connection ID}		
encodingType	Application/vnd.geo+json	string	the encoding type of the provided feature

Primary signal - Feature Of Interest

Key	Value	Value Type	additional information
Name	{trafficLightsID_ingressLaneID}_Stop	string	
encodingType	application/vnd.geo+json	string	the encoding type of the provided feature

Primary signal - Sensor

Key	Value	Value Type	additional information
name	Signal heads of traffic lights	string	

Primary signal - Observed Property

Key	Value	Value Type	additional information
name	Signal	string	

Primary signal - Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{[0-9]}	integer	0=dark, 1=red, 2=amber, 3=green, 4=red-amber, 5=amber-flashing, 6=green-flashing, 9=unknown

Secondary signal

Secondary signal - Datastream

Key	Value	Value Type	additional information
Name	Secondary signal heads at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	Not yet available
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	secondary_signal	string	

Secondary signal – Thing, Location, Feature Of Interest, Sensor, Observed Property

Secondary signal – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{[0-6, 9]}	integer	0=dark, 1=red, 2=amber, 3=green, 4=red-amber, 5=amber-flashing, 6=green-flashing, 9=unknown

Auxiliary signal

Auxiliary signal - Datastream

Key	Value	Value Type	additional information
Name	Auxiliary signal heads at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	Not yet available
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	auxiliary_signal	string	

Auxiliary signal – Thing, Location, Feature Of Interest, Sensor, Observed Property

Auxiliary signal – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{[0, 5, 9]}	integer	currently not provided

Acoustic signal

Acoustic signal - Datastream

Key	Value	Value Type	additional information
Name	Acoustic signal at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	Not yet available
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	acoustic_signal	string	

Acoustic signal – Thing, Location, Feature Of Interest, Sensor, Observed Property

Acoustic signal – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{[0, 3, 9]}	integer	0=dark, 3=green, 9=unknown

Car request

Car request – Datastream

Key	Value	Value Type	additional information
Name	Signal change request – car at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	Not yet available
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	detector_car	string	

Car request – Thing, Location, Feature Of Interest

Car request – Sensor

Key	Value	Value Type	additional information
name	Traffic participant detector	string	

Car request – Observed Property

Key	Value	Value Type	additional information
name	Occupation level	string	

Car request – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{[0-100]}	integer	the result is the occupation mean value in percent over a second, internally the occupation is measured in 10th of a second

Bicycle request

Bicycle request – Datastream

Key	Value	Value Type	additional information
Name	Signal change request – cyclist at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	detector_cyclists	string	

Bicycle request – Thing, Location, Feature Of Interest, Sensor, Observed Property

Bicycle request – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{[true, false]}	boolean	the result means the detector was activated or not

Pedestrian request

Pedestrian request – Datastream

Key	Value	Value Type	additional information
Name	Signal change request – pedestrian at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	detector_pedestrian	string	

Pedestrian request – Thing, Location, Feature Of Interest, Sensor, Observed Property, Observation

Acoustic traffic request

Acoustic traffic request – Datastream

Key	Value	Value Type	additional information
Name	Acoustic traffic request at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	detector_ acoustic_traffic_ request	string	

Acoustic traffic request – Thing, Location, Feature Of Interest, Sensor, Observed Property, Observation

Bus pre-request point

Bus pre-request point – Datastream

Key	Value	Value Type	additional information
Name	Bus pre-request point at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	bus_pre-request_point	string	

Bus pre-request point – Thing, Location, Feature Of Interest,Sensor, Observed Property

Bus pre-request point – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{line_number}	integer	bus line number

Bus request point

Bus request point – Datastream

Key	Value	Value Type	additional information
Name	Bus request point at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	bus_request_point	string	

Bus request point – Thing, Location, Feature Of Interest, Sensor, Observed Property

Bus request point – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{line_number}	integer	bus line number

Bus checkout

Bus checkout – Datastream

Key	Value	Value Type	additional information
Name	Bus checkout at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	bus_checkout	string	

Bus checkout – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{line_number}	integer	bus line number

Bus checkout – Thing , Location, Feature Of Interest, Sensor, Observed Property

Signal program

Signal program – Datastream

Key	Value	Value Type	additional information
Name	Signal program ID at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	{signal group id}	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	Not yet available
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	signal_program	string	
properties/lastUpdateSignalProgram	{date}	datetime	

Signal program – Sensor

Key	Value	Value Type	additional information
name	Signal program indicator	string	

Signal program – Observed Property

Key	Value	Value Type	additional information
name	Signal program status	string	

Signal program – Observation

Key	Value	Value Type	additional information
phenomenonTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp according to the clock inside traffic light system
resultTime	{Timestamp UTC (ISO 8601)}	datetime	timestamp computed immediately prior to saving to tld.iot.hamburg.de
Result	{signal program id}	integer	

Signal program – Thing, Location, Feature Of Interest

Cycle second

Cycle second – Datastream

Key	Value	Value Type	additional information
Name	Cycle second at {trafficLightsID}_{Connection ID}	string	
properties/signalGroupID	Name of a signal group	string	
properties/resultsNature	Primary	string	State of the result of an observation according to INSPIRE, see: https://inspire.ec.europa.eu/codelist/ResultNatureValue
properties/mediaMonitored	Transport	string	
properties/metadata	https://registry.gdi-de.org/id/de.hh/fa5588ec-bc36-4070-8871-6bf69365fe79	string	
properties/ownerData	Free and Hanseatic City of Hamburg	string	
properties/serviceName	HH_STA_traffic_lights	string	
properties/layerName	cycle_second	string	
properties/lastUpdateCycleSecond	{date}	datetime	

Cycle second – Sensor

Key	Value	Value Type	additional information
name	Cycle second indicator	string	

Cycle second – Observed Property

Key	Value	Value Type	additional information
name	Time	string	

Cycle second – Thing, Location, Feature Of Interest, Observation