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# Introduction

This is the documentation for the [Signal K Specification](#) master (latest) version.

- [html](#) (this document)
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## What is Signal K?

**Signal K** is a modern and open data format for marine use. It is an Internet friendly standard built on standard web technologies, such as JSON and WebSockets. Signal K is Free and Open Source software. This document is licensed under the Creative Commons [CC-BY-SA](#) license. All Signal K source code is licensed under the [Apache License, Version 2.0](#). Signal K is developed in the open with help from the marine community. Your ideas and feedback are valuable and welcome.

**Signal K** consists of the Signal K Data Model and the Signal K Message Format.

## Signal K Data Model (A.K.A. The Schema)

The Signal K Data Model or schema defines a universal model for marine related information and it is specified as a JSON schema. See the [Signal K Data Model](#) section for details.

In traditional marine standards there are many tightly defined messages, each with a specific purpose, but there is no data model to relate them. Furthermore, any device which needs to decode those messages must have a copy of the data dictionary in order to do so. By defining a data model in JSON we can make the messaging layer simpler, and easily extensible. We define consistent units and meta data for each data point in the model. This means that a specific data point (e.g. COG) will always be found at a predictable address.

It also means that a display device such as a chartplotter implementing Signal K does not need to know about the data model beforehand. It can query the central Signal K server on the boat to get all the information it needs to display any data point. This

**metadata** may include information such as the unit of measure, minimum and maximum permissible values, alarm thresholds and localized display name for every data point in the model.

## Signal K Message Format

Signal K defines methods for combining arbitrary data from the Data Model into valid messages. These messages are in UTF-8 JSON format.

Rather than define hundreds of specific messages, Signal K has a few common message formats which can contain any combination of data from the Data Model. This means that we don't need new messages for every new case, just extra data in the payload. It means that any device can read any message and a device can introduce a new data point which can be understood by existing devices without the need for firmware upgrades.

## Signal K Transport Layer

Signal K does not define the transport or wire protocol. Signal K messages are JSON text and can be sent over almost any transport layer. However, we do provide guidance on how to make an initial connection, handle negotiation, subscription, and disconnection for a given transport (e.g. TCP/IP or serial).

Where possible we use well established standards like HTTPS, REST, WebSockets, MQTT, STOMP, etc. But within each method there are always many options in message addressing, formatting, or transfer (GET, POST), etc.

The goal is to try to establish sensible conventions for each protocol, to make development and interconnection more predictable.

## Signal K Implementations

The Signal K project has many implementations of servers, clients, and utilities. These are both proof of concept tests and reference code. The goal is to provide a range of software and utilities to simplify development.

# Getting Started Using Signal K

You can start using Signal K by

- connecting to the [demo server](#) on the Internet with any web browser
- installing either the [Node](#) or [Java](#) server on any computer
- getting some hardware for your boat, such as a [Raspberry Pi](#), suitable USB adapters for your boat's network ([NMEA 0183](#), [NMEA 2000](#) or roll your own with [I2C](#) sensors) and installing Node or Java server
- purchasing a commercial Signal K gateway such as an [iKommunicate](#) by Digital Yacht
- installing OpenPlotter, which includes a Signal K server

Once you have a server running (or you start by using the demo server) you can install some Signal K supporting mobile apps such as

- [NMEARemote](#) by Zapfware (iOS)
- [OceanIX](#) (Android)

# Getting Started in Developing with Signal K

- [Example HTML5 Applications](#)
- [Signal K JavaScript Client](#)
- [iKommunicate Developer's Guide](#)

# Signal K Data Model

Signal K defines two data formats, full and delta, for representing and transmitting data.

In addition the 'sparse' format is the same as the full format, but doesn't contain a full tree, just parts of the full tree.

## Full format

The simplest format is the full format, which is the complete Signal K data model sent as a JSON string. Abbreviated for clarity it looks like this:

```
{"vessels":{"9334562":{"navigation":{"courseOverGroundTrue":{"value":11.9600000381}, "courseOverGroundMagnetic":{"value":93.0000000000}, "more":"a lot more data here. .", "waterTemp":{"value":0.0000000000}, "wind":{"speedAlarm":{"value":0.0000000000}, "directionChangeAlarm":{"value":0.0000000000}, "directionApparent":{"value":0.0000000000}, "directionTrue": {"value":0.0000000000}, "speedApparent":{"value":0.0000000000}, "speedTrue": {"value":0.0000000000}}}}}}}
```

Formatted for ease of reading:

```
{
  "vessels": {
    "9334562": {
      "version": "0.1",
      "name": "motu",
      "mmsi": "2345678",
      "source": "self",
      "timezone": "NZDT",
      "navigation": {
        "state": {
          "value": "sailing",
          "source": "self",
          "timestamp": "2014-03-24T00:15:41Z"
        },
        "headingTrue": {
          "value": 23,
          "source": {
            "pgn": "128275",
            "device": "/dev/actisense",
            "timestamp": "2014-08-15-16:00:05.538",
            "src": "115"
          },
          "timestamp": "2014-03-24T00:15:41Z"
        },
        "more": "a lot more data here...",
        "roll": {
          "value": 0,
          "source": "self",
          "timestamp": "2014-03-24T00:15:41Z"
        },
        "rateOfTurn": {
          "value": 0,
          "source": "self",
          "timestamp": "2014-03-24T00:15:41Z"
        }
      }
    }
  }
}
```

The message is UTF-8 ASCII text, and the top-level attribute(key) is always "vessels". Below this level is a list of vessels, identified by their MMSI number or a generated unique id. There may be many vessels, if data has been received from AIS or other sources. The format for each vessel's data uses the same standard Signal K structure, but may not have the same content, i.e. you won't have as much data about other vessels as you have about your own.

The values are always SI units, and always the same units for the same key. I.e.

`speedOverGround` is always meters per second, never knots, km/hr, or miles/hr. This means you never have to send 'units' with data, the units are specific for a key, and defined in the data schema.

The ordering of keys is also not important, they can occur in any order. In this area Signal K follows normal JSON standards.

The full format is useful for backups, and for populating a secondary device, or just updating all data, a kind of 'this is the current state' message.

However sending the full data model will be wasteful of bandwidth and CPU, when the majority of data does not change often. So we want to be able to send parts of the model (i.e. parts of the hierarchical tree).

## Sparse format

The sparse format is the same as the full format but only contains a limited part of the tree. This can be one or more data values.

```
{"vessels":{"self":{"navigation":{"position":{"latitude":{"value":-41.2936935424}}}}}}  
  
{"vessels":{"self":{"navigation":{"position":{"longitude":{"value":173.2470855712}},  
"source":"self","timestamp":"2014-03-24T00:15:41Z"}}}}}
```

or, more efficiently (and formatted):



```
{
  "vessels": {
    "self": {
      "navigation": {
        "position": {
          "latitude": {
            "value": -41.2936935424
          },
          "longitude": {
            "value": 173.2470855712
          }
        }
      }
    }
  }
}
```

Mix and match of misc values are also valid:

```
{
  "vessels": {
    "self": {
      "navigation": {
        "courseOverGroundTrue": {
          "value": 11.9600000381
        },
        "position": {
          "latitude": {
            "value": -41.2936935424
          },
          "longitude": {
            "value": 173.2470855712
          },
          "altitude": {
            "value": 0
          }
        }
      }
    }
  }
}
```

This mix of any combination of values means we don't need to create multiple message types to send different combinations of data. Just assemble whatever you want and send it. When parsing an incoming message a device should skip values it has no

interest in, or doesn't recognise. Hence we avoid the problem of multiple message definitions for the same or similar data, and we avoid having to decode multiple messages with fixed formats.

## Delta format

While building the reference servers and clients it was apparent that a third type of message format was useful. This format specifically sends changes to the full data model. This was useful for a number of technical reasons, especially in clients or sensors that did not hold a copy of the data model.

The format looks like this (pretty printed):

```
{
  "context": "vessels.230099999",
  "updates": [
    {
      "source": {
        "pgn": "128275",
        "device": "/dev/actisense",
        "timestamp": "2014-08-15-16:00:05.538",
        "src": "115"
      },
      "values": [
        {
          "path": "navigation.logTrip",
          "value": 43374
        },
        {
          "path": "navigation.log",
          "value": 17404540
        }
      ]
    },
    {
      "source": {
        "device": "/dev/actisense",
        "timestamp": "2014-08-15-16:00:00.081",
        "src": "115",
        "pgn": "128267"
      },
      "values": [
        {
          "path": "navigation.courseOverGroundTrue",
          "value": 172.9
        },
        {
          "path": "navigation.speedOverGround",
          "value": 3.85
        }
      ]
    }
  ]
}
```

In more detail we have the header section:

```
{
  "context": "vessels.230099999",
  "updates": [
    ...data goes here...
  ]
}
```

The message can be recognised from the other types by the topmost level having "context" and "updates" rather than "vessels".

Context is a path from the root of the full tree. In this case 'vessels.230099999'. All subsequent data is relative to that location. The context could be much more specific, e.g. 'vessels.230099999.navigation', whatever is the common root of the updated data.

The 'updates' holds an array (JSON array) of updates, each of which has a 'source' and JSON array of 'values'.

```
{
  "source": {
    "device": "/dev/actisense",
    "timestamp": "2014-08-15-16:00:00.081",
    "src": "115",
    "pgn": "128267"
  },
  "values": [
    {
      "path": "navigation.courseOverGroundTrue",
      "value": 172.9
    },
    {
      "path": "navigation.speedOverGround",
      "value": 3.85
    }
  ]
}
```

The 'source' values is the same and applies to each of the 'values' items, which removes data duplication. It also allows rich data to be included with minimal impact on message size.

Each 'value' item is then simply a pair of 'relative path', and 'value'.

## Message Integrity

Many messaging systems specify checksums or other forms of message integrity checking. In Signal K we assume a reliable transport will guarantee a valid message. This is true of TCP/IP and some other transports but not always the case. For other transports (eg RS232 serial) a specific extended data format will apply, which is suited to that transport. Hence at the message level no checksum or other tests need to be made.

## Encoding/Decoding

The JSON message format is supported across most programming environments and can be handled with any convenient library.

On micro-controllers with limited RAM it is wise to read and write using streaming rather than hold the whole message in precious RAM. There is an implementation of Signal K JSON streaming on an Arduino Mega (4K RAM) in the related Freeboard project, which will be released in Signal K eventually.

# Multiple Values for a Key

There are two use cases for multiple data:

- Multiple versions of a common device - eg two engines
- Multiple devices providing duplicate data - multiple values for the same signalk key from different sensors, eg COG from both compass and gps

## Multiple versions of a common device

Consider the data point `temperature`. There are many versions of temperature: air, water, engineRoom, fridge, freezer, main cabin, etc. Some are well-known, and in common usage, some will be very vessel specific.

So we need a structure that provides a flexible way to hold lots of sub-items. The simple solution is an array of `temperature` objects however

<https://github.com/SignalK/specification/wiki/Arrays-are-Evil>.

So instead we simply put the individual temperature objects in as children of `temperature`

```
{
  "temperature": {
    "air": {
      "value": 26.7,
      "source": "vessels.self.sources.n2k.n2k1-12-0"
    },
    "water": {
      "value": 18.2,
      "source": "vessels.self.sources.n2k.n2k1-12-1"
    }
  }
}
```

And in `vessels.self.sources`

```
{
  "n2k":{
    "n2k1-12-0": {
      "timestamp": "2014-08-15-16: 00: 00.081",
      "source": {
        "label": "Outside Ambient Masthead",
        "bus": "/dev/ttyUSB1"
      },
      "value":"dump the raw n2k data here"
    },
    "n2k1-12-1": {
      "timestamp": "2014-08-15-16: 00: 00.081",
      "value": 18.2,
      "source": {
        "label": "Water Temperature",
        "bus": "/dev/ttyUSB1"
      }
    },
    "n2k2-201-0": {
      "timestamp": "2014-08-15-16: 00: 00.081",
      "value": 66.7,
      "source": {
        "label": "Engine Room",
        "bus": "/dev/ttyUSB2"
      }
    }
  }
}
```

This scheme allows for both well-known keys `temperature.air` and vessel specific `temperature.aftFreezer` . It is also valid in the following form, but makes it more difficult to refer to the source if it maps to multiple signalk keys (eg NMEA 0183 RMC sentence <https://github.com/SignalK/specification/wiki/Samples---NMEA-0183-RMC>):

```
{
  "temperature": {
    "air": {
      "value": 26.7,
      "source": "n2k1-12-0",
      "n2k1-12-0": {
        "timestamp": "2014-08-15-16: 00: 00.081",
        "value": 26.7,
        "source": {
          "label": "Outside Ambient Masthead",
          "bus": "/dev/ttyUSB1"
        }
      }
    },
    "water": {
      "value": 18.2,
      "source": "n2k1-12-1",
      "n2k1-12-1": {
        "timestamp": "2014-08-15-16: 00: 00.081",
        "value": 18.2,
        "source": {
          "label": "Water Temperature",
          "bus": "/dev/ttyUSB1"
        }
      }
    }
  }
}
```

It maintains the primary requirement that a given data value have a fixed and unique uri, but gives flexibility in the structure and complexities of data. It also fulfils the requirement for discovery of data keys, vessel specific sources, and provides the ability to navigate the structure in a consistent progamatical way.

## Multiple devices providing duplicate data

It is quite possible for a key value to come from more than one device. eg position (lat/lon) could come from several gps enabled devices, and multiple depth sounders are not uncommon. We need a consistent way to handle this.

All the incoming values may well be valid in their own context, and it is feasible that all of them may be wanted, for instance, displaying depth under each hull on a catamaran.

Hence discarding or averaging is not a solution, and since signalk is unable to derive the best way to handle multiple values it must always fall to a default action, with human over-ride when needed.



The solution presented below has flaws. See <https://github.com/SignalK/specification/issues/48> for discussion.

---

In signal K we can leverage the above method and simply store all the devices in the tree under the main item, and have the main items `source` reference the options. Lets consider this for `courseOverGroundTrue`

If its the first value for the key, it becomes the default value and looks like this:

```
{
  "vessels": {
    "self": {
      "navigation": {
        "courseOverGroundTrue": {
          "value": 102.29,
          "source": "vessels.self.sources.n2k.actisense-115-129026"
        }
      },
      "sources": {
        "n2k": {
          "actisense-115-129026": {
            "value": 102.29,
            "bus": "/dev/actisense",
            "timestamp": "2014-08-15-16: 00: 01.083",
            "src": "115",
            "pgn": "129026"
          }
        }
      }
    }
  }
}
```

It has come from device `vessels.self.sources.n2k.actisense-115-129026` , where further details can be found.

If another value with different source arrives, we add the source with a unique name, so both values are in there - if its our preferred source (from persistent config) we auto-switch to it, otherwise we just record it. It look like this:

```
{
  "vessels": {
    "self": {
      "navigation": {
        "courseOverGroundTrue": {
          "timestamp": "2014-08-15-16: 00: 01.083",
          "value": 102.29,
          "source": "vessels.self.sources.n2k.actisense-115-129026"
        }
      },
      "sources": {
        "n2k": {
          "actisense-115-129026": {
            "value": 102.29,
            "bus": "/dev/actisense",
            "timestamp": "2014-08-15-16: 00: 01.083",
            "src": "115",
            "pgn": "129026"
          },
          "actisense-201-130577": {
            "value": 102.29,
            "bus": "/dev/actisense",
            "timestamp": "2014-08-15-16: 00: 00.085",
            "src": "201",
            "pgn": "130577"
          }
        }
      }
    }
  }
}
```

## Rules

Now simple rules can apply to obtain the default, or any specific value:

- The implementation must ensure that the `key.value` holds an appropriate value. This will be easy if there is only one, and will probably be user configured if more.
- If the `source` value is `string` then it is a reference key to the source object, and can be a relative or absolute signalk key.
- The `source` (as a reference string) also provides a mechanism to handle deprecated keys.
- If the `source` value is a `json object` then it holds meta data on the source of the value.
- Alternate sources must be discovered manually, or by implementation specific meta-data.

To see all the entries, use the REST api or subscribe to the parent object. A given device may choose to subscribe to a specific entry in the object, allowing multiple displays of the key, or users of the various values. The 'list' verb used in a query message can provide available keys.

## Unique names

The identifier for each device should be unique within the server, and possibly be constructed as follows:

```
n2k: producerid-sourceid-pgn (producer id from server configuration, others from n2k data) - NOTE: will change, currently under discussion.  
nmea0183: producerid-talkerid-sentence (like n2k)  
signalk: any valid string matching regex [a-zA-Z0-9-]. eg alphabet, hyphens, and 0 to 9
```

(The nmea0183 talker id is not in the schema as I write this, it will be added shortly)

# Metadata

## The Use Cases

Let's assume we have engine1.rpm as a key/value in Signal K. We want to display it on our dashboard, and monitor alarms for temp, oil, rpm etc.

We can drop a generic dial gauge on our dash and display rpm, but it can't know maxRpm, or alarms unless its an engine-specific gauge, and knows where to look in the Signal K schema. So we will end up with a profusion of role specific gauges to maintain. We also have non standard key names for max, min, high, low, etc. which pollute the schema.

Currently the Signal K server has a set of specific alarm keys. These grow over time and are becoming awkward. The server can only monitor these specific keys at present as there is no mechanism for arbitrary alarm definition.

## Metadata for a Data Value

Each data key should have an optional `.meta` object. This holds data in a standard way which enables the max/min/alarm and display to be automatically derived.

```
{
  "displayName": "Tachometer, Engine 1",
  "shortName": "RPM",
  "warnMethod": "visual",
  "warnMessage": "any text",
  "alarmMethod": "sound",
  "alarmMessage": "any text",
  "zones": [
    {"lower":0.0,"upper":500,"state":"alarm", "message":"Stopped or very slow Rpm"},
    {"lower":500,"upper":3000,"state":"normal", "message":""},
    {"lower":3000,"upper":3500,"state":"warn", "message":"Approaching maximum rpm"},
    {"lower":3500,"upper":9999,"state":"alarm", "message":"Exceeding maximum rpm"}
  ]
}
```

Since the settings object is always the same, the tachometer can now limit its range, and display green, yellow, and red sectors. The generic gauge can now perform this role, with correct labels etc.

The alarms problem is also improved, as the server can run a background process to monitor any key that has a `.meta` object, and raise a generic alarm event. By recursing the tree the alarm monitoring can find the source (engine1), giving the alarm context. See [\[\[Alarm Handling\]\]](#)

The alarms functionality then becomes generic, and grows with the spec. This is may be the case for other functionality also.

## Default Configuration

Other than a few standard keys it is unlikely that the `.meta` can have global defaults, as it is very vessel specific (e.g. a sail boat will have speeds from 0-15kts, a ski boat will have 0-50kts). So the values will have to be configured by the user on the individual vessel as required.

It is probably possible to have profiles that set a range of default `.meta`, e.g. sail vessel, or motor vessel, and if two vessels have the same engine, then the engine profiles will also tend to be the same.

## Alarm Management

An alarm watch is set by setting the `meta.zones` array appropriately. A background process on the server checks for alarm conditions on any attribute with a `meta.zones` array. If the keys value is within a zone the server sets an alarm key similar to

```
vessels.self.notifications.[original_key_suffix] , eg an alarm set on
```

```
vessels.self.navigation.courseOverGroundTrue will become
```

```
vessels.self.notifications.navigation.courseOverGroundTrue .
```

The object found at this key should contain the following:

```
{
  "message": "any text",
  "state": "[normal|alert|warn|alarm|emergency]"
}
```

## Other Benefits

The common profiles should be exportable and importable. This would allow manufacturers or other users to create profiles for specific products or use cases, which could then be imported to a vessel.

This may also have possibilities for race control or charter management. For instance a limit on lat/lon would raise an 'Out of Bounds' email on a charter vessel.

A lot of the current max/min/alarm values could be removed to simplify and standardise the spec.

# Permissions Model

The permissions model for Signal K is based on the UNIX file permissions model. This was first developed in the late 1970's and is still perfectly suited to the internet today, so its got to be a pretty sound model!.

So we adapted it for Signal K. See <http://www.tutorialspoint.com/unix/unix-file-permission.htm>

Each key in Signal K has an optional `_attr` value.

```
"vessels": {
  "self": {
    //the usual signal k keys, navigation, environment, etc

    "_attr": {                                // filesystem specific data, eg security, possibly more later
      "_mode": 640,                          // unix style permissions, often written in `owner:group:other` form, `-rw-r-----`
      "_owner" : "self",                    // owner, surprisingly. The user who created the item, sometimes a virtual user like 'self'
      "_group": "self"                     // group
    }
  }
}
```

By default the `vessels.self` key has the above `_attr`. This effectively means that only the current vessels 'owner' can read and write from this key or any of its sub-keys. It also allows users in group `self` to read the data. This provides a way to give additional programs or users read-only access. In the above case an external user connecting from outside the vessel and requesting vessel data would receive `{}`, eg nothing.

**Note: keys beginning with `_` are always stripped from signal k messages**

Since the above is a default, Signal K devices that lack the resources to implement security should always be installed behind a suitable gateway that can provide security. Again, the simplest security is the default read-write only within the local vessel (typically the current network). This makes a basic implementation as simple as possible.

The permissions apply recursively to all sub-keys, unless specifically overwritten. You can only provide a **narrowing** change in permissions, eg less than the parent directory. In the above case if the permissions for `vessels.self.navigation.position` were set to

`"_mode" : 644` , it would have no effect as access is blocked at the `vessels.self` key. The `vessels.self _attr` must now also be `"_mode" : 644` , and all its other subkeys explicitly set to `"_mode" : 640`

Hence setting complex permissions are likely beyond the typical user. For this reason we believe there should be a choice of default permission 'templates' for the signal K tree. Users would select their preference from a config screen. A paranoid user may prefer the above setup, another may chose to allow basic data similar to AIS (position, cog, speed, etc), and others may expose much more.

Templates also allow sharing of data for specific uses or needs, like a social group, or a marina.

Exposing everything ( `"_mode" : 666` ) would be dangerous - it would potentially allow external users to gain control of the vessels systems, however it is useful for demos and software development. All signal K implementations should always consider the potential danger of such permissions, and protect users if possible.

**The implementation of proper security is the responsibility of the Signal K software implementation provider.**

By manipulating the `_attr` values for the Signal K keys, and creating suitable users and groups a sophisticated and well proven security model for vessel data can be created.



# Ports, Urls and Versioning

## Short Names

- `self` refers to the current vessel. Normally used in `vessels.self...`.

## Ports

The Signal K HTTP and WebSocket services SHOULD be found on the usual HTTP/S ports (80 or 443). The services SHOULD be found on the same port, but may be configured for independent ports and MAY be configured for ports other than HTTP/S.

A Signal K server MAY offer Signal K over TCP or UDP, these services SHOULD be on port 55555[1].

If an alternate port is needed it SHOULD be an arbitrary high port in the range 49152–65535[2].

## URL Prefix

The Signal K applications start from the `/signalk` root. This provides some protection against name collisions with other applications on the same server. Therefore the Signal K entry point will always be found by loading `http(s)://«host»:«port»/signalk`.

## Versioning

The version(s) of the Signal K API that a server supports SHALL be available as a JSON object available at `/signalk`:

```
{
  "endpoints": {
    "v1": {
      "version": "1.1.2",
      "signalk-http": "http://192.168.1.2/signalk/v1/api/",
      "signalk-ws": "ws://192.168.1.2:34567/signalk/v1/stream"
    },
    "v3": {
      "version": "3.0",
      "signalk-http": "signalk/v3/api/",
      "signalk-ws": "ws://192.168.1.2/signalk/v3/stream",
      "signalk-tcp": "tcp://192.168.1.2:34568"
    }
  }
}
```

This response is defined by the `discovery.json` schema. In this example, the server supports two versions of the specification: `1.1.2` and `3.0`. For each version, the server indicates which transport protocols it supports and the URL that can be used to access that protocol's endpoint; in the example, the `1.1.2` REST endpoint is located at `http://192.168.1.2/signalk/v1/api/`. Clients should use one of these published endpoints based on the protocol version they wish to use.

The server must only return valid URLs and should use IANA standard protocol names such as `http`. However, a server may support unofficial protocols and may return additional protocol names; for example, the response above indicates the server supports a `signalk-tcp` stream over TCP at on port `34568`.

A server may return relative URIs that the client must resolve against the base of the original request.

## Streaming WebSocket API: `/signalk/v1/stream`

Initiates a WebSocket connection that will start streaming the server's updates as Signal K delta messages. You can specify the contents of the stream by using a specific URL:

- `ws://hostname/signalk/v1/stream?subscribe=self`
- `ws://hostname/signalk/v1/stream?subscribe=all`
- `ws://hostname/signalk/v1/stream?subscribe=none`

With no query parameter the default is `self` , which will stream the data related to the `self` object. `all` will stream all the updates the server sees and `none` will stream only the heartbeat, until the client issues subscribe messages in the WebSocket stream.

If a server does not support some streaming options listed in here it must respond with http status code `501 Not Implemented` .

See [Subscription Protocol](#) for more details.

### Connection Hello

Upon connection a 'hello' message is sent as follows:

```
{
  "version": "1.1.2",
  "timestamp": "2015-04-13T01:13:50.524Z",
  "self": "123456789"
}
```

## REST/HTTP API: /signalk/v1/api/

Note the trailing slash in the path.

The base URL MUST provide a Signal K document that is valid according to the full Signal K [schema specification](#). The contents SHOULD be all the current values of the data items the server knows.

If the path following the base is a valid Signal K path `GET` MUST retrieve the Signal K branch named by the path; e.g.

`/signalk/v1/api/vessels/123456789/navigation/speedThroughWater` returns

```
{
  "value": 2.55,
  "source": {
    "type": "NMEA0183",
    "src": "VHW",
    "label": "signalk-parser-nmea0183"
  },
  "timestamp": "2015-08-31T05:45:36.000Z"
}
```

## Streaming WebSocket API: /signalk/v1/stream

Initiates a WebSocket connection that will start streaming the server's updates as Signal K delta messages. You can specify the contents of the stream by using a specific URL:

- `ws://hostname/signalk/v1/stream?subscribe=self`
- `ws://hostname/signalk/v1/stream?subscribe=all`
- `ws://hostname/signalk/v1/stream?subscribe=none`

With no query parameter the default is `self`, which will stream the data related to the `self` object. `all` will stream all the updates the server sees and `none` will stream only the heartbeat, until the client issues subscribe messages in the WebSocket stream.

If a server does not support some streaming options listed in here it must respond with http status code `501 Not Implemented`.

See [Subscription Protocol](#) for more details.

### Connection Hello

Upon connection a 'hello' message is sent as follows:

```
{
  "version": "1.1.2",
  "timestamp": "2015-04-13T01:13:50.524Z",
  "self": "123456789"
}
```

# Discovery and Connection Establishment

## Service Discovery

A Signal K server SHOULD advertise its services over mDNS/Bonjour. The server MUST use the service types

- `_signalk-http._tcp` for http API
- `_signalk-ws._tcp` for WebSocket
- `_signalk-https._tcp` for HTTPS API
- `_signalk-wss._tcp` for secure WebSocket

Furthermore a server SHOULD advertise its web interface with normal Bonjour convention `_http._tcp` and `_https._tcp`.

A sample Bonjour record output, dumped using avahi-discover:

```
Service data for service 'signalk-http (2)' of type '_signalk-http._tcp' in domain 'local' on 4.0:
```

```
Host 10-1-1-40.local (10.1.1.40),  
port 8080,
```

```
TXT data: [  
  'vessel_uuid=urn:mrn:signalk:uuid:6b0e776f-811a-4b35-980e-b93405371bc5',  
  'version=v1.0.0',  
  'vessel_name=urn:mrn:signalk:uuid:6b0e776f-811a-4b35-980e-b93405371bc5',  
  'vessel_mmsi=urn:mrn:signalk:uuid:6b0e776f-811a-4b35-980e-b93405371bc5',  
  'server=signalk-server',  
  'path=/signalk'  
]
```

```
Service data for service 'signalk-ws (2)' of type '_signalk-ws._tcp' in domain 'local' on 4.0:
```

```
Host 10-1-1-40.local (10.1.1.40),  
port 3000,
```

```
TXT data: [  
  'vessel_uuid=urn:mrn:signalk:uuid:6b0e776f-811a-4b35-980e-b93405371bc5',  
  'version=v1.0.0',  
  'vessel_name=urn:mrn:signalk:uuid:6b0e776f-811a-4b35-980e-b93405371bc5',  
  'vessel_mmsi=urn:mrn:signalk:uuid:6b0e776f-811a-4b35-980e-b93405371bc5',  
  'server=signalk-server',  
  'path=/signalk'  
]
```

## Connection Establishment

Using the information above a web client or http capable device can discover and connect to a Signal K server using the following process:

- Listen for Signal K services using Bonjour/mDns.
- Use the Bonjour record to find the REST api interface `signalk-http`
- Make a GET call to (eg `http://10.1.1.40:8080/signalk` from above)
- And get the endpoints json

```
{
  "endpoints": {
    "v1": {
      "version": "1.1.2",
      "signalk-http": "http://192.168.1.2/signalk/v1/api/",
      "signalk-ws": "ws://192.168.1.2:34567/signalk/v1/stream"
    }
  }
}
```

- Make further REST calls for more specific data, or open a websocket connection and subscribe to data

# Subscription Protocol

*Subscription protocol is currently available only on the Java server.*

## Introduction

By default a Signal K server will provide a new WebSocket client with a delta stream of the `vessels.self` record, as updates are received from sources. E.g.

`/signalk/v1/stream` will provide the following delta stream, every time the log value changes .

```
{
  "context": "vessels",
  "updates": [{
    "source": {
      "pgn": "128275",
      "device": "/dev/actisense",
      "timestamp": "2014-08-15-16:00:05.538",
      "src": "115"
    },
    "values": [
      {
        "path": "navigation.logTrip",
        "value": 43374
      },
      {
        "path": "navigation.log",
        "value": 17404540
      }
    ]
  }
]
```

Below we refer to WebSockets, but the same process works in the same way over any transport. E.g. for a raw TCP connection the connection causes the above message to be sent, and sending the subscribe messages will have the same effect as described here.

This can be a lot of messages, many you may not need, especially if `vessel.self` has many sensors, or other data sources. Generally you will want to subscribe to a much smaller range of data.



First you will want to unsubscribe from the current default (or you may have already connected with `ws://hostname/signalk/v1/stream?subscribe=none` ). To unsubscribe all create an `unsubscribe` message and send the message over the websocket connection:

```
{
  "context": "vessels.self",
  "unsubscribe": [
    {
      "path": "*",
    }
  ]
}
```

To subscribe to the required criteria send a suitable subscribe message:

```
{
  "context": "vessels.self",
  "subscribe": [
    {
      "path": "navigation.speedThroughWater",
      "period": 1000,
      "format": "delta",
      "policy": "ideal",
      "minPeriod": 200
    },
    {
      "path": "navigation.logTrip",
      "period": 10000
    }
  ]
}
```

- `path=[path.to.key]` is appended to the context to specify subsets of the context. The path value can use `jsonPath` syntax.

The following are optional, included above only for example as it uses defaults anyway:

- `period=[milliseconds]` becomes the transmission rate, e.g. every `period/1000` seconds. Default=1000
- `format=[delta|full]` specifies delta or full format. Default: delta
- `policy=[instant|ideal|fixed]` . Default: ideal
  - `instant` means send all changes as fast as they are received, but no faster than `minPeriod` . With this policy the client has an immediate copy of the

current state of the server.

- `ideal` means use `instant` policy, but if no changes are received before `period`, then resend the last known values. eg send changes asap, but send the value every `period` millisecs anyway, whether changed or not.
- `fixed` means simply send the last known values every `period`.
- `minPeriod=[millisecs]` becomes the fastest message transmission rate allowed, e.g. every `minPeriod/1000` seconds. This is only relevant for policy='instant' to avoid swamping the client or network.

You can subscribe to multiple data keys multiple times, from multiple apps or devices. Each app or device simply subscribes to the data it requires, and the server and/or client implementation may combine subscriptions to avoid duplication as it prefers on a per connection basis. At the same time it is good practice to open the minimum connections necessary, for instance one websocket connection shared between an instrument panel with many gauges, rather than one websocket connection per gauge.

When data is required once only, or upon request the `subscribe/unsubscribe` method should not be used. If the client is http capable the REST api is a good choice, or use `get/list/put` messages over websockets or tcp.

The `get/list/put` messages work in the same way as their `GET/PUT` REST equivalents, returning a json result for the requested path.

## Use Cases and Proposed Solutions

### Local boat individual instruments

A gauge-type display for just one or a few data items for the 'self' vessel should be able to specify that it only wants those items for the self vessel.

This can be achieved by a default WebSocket connection `/signalk/v1/stream?subscribe=none`, then sending a JSON message:

```
{
  "context": "vessels.self",
  "subscribe": [
    {
      "path": "environment.depth.belowTransducer",
    },
    {
      "path": "navigation.speedThroughWater",
    }
  ]
}
```

The JSON format is also viable over a simple TCP or serial transport, and is therefore supported as the primary subscription method.

### **Map display with all known vessel positions & directions, served over 3G cellular connection**

```
{
  "context": "vessels.*",
  "subscribe": [
    {
      "path": "navigation.position",
      "period": 120000,
      "policy": "fixed"
    },
    {
      "path": "navigation.courseOverGround",
      "period": 120000,
      "policy": "fixed"
    }
  ]
}
```

The result is a delta message of the Signal K data with just position and courseOverGround branches for all known vessels, sent every 2 minutes (120 seconds) even if no data has been updated.

### **Position of a certain vessel, immediately it changes, but once per minute at most**

```
{
  "context": "vessels.230029970",
  "subscribe": [
    {
      "path": "navigation.position",
      "minPeriod": 60000,
      "policy": "instant"
    }
  ]
}
```

The result will be delta position messages for vessel 230029970, broadcast whenever it changes, but with minimum interval of 60 seconds. Messages are delayed to meet the minimum interval with newer messages overriding the previous message in the buffer.

# Background and Design Rationale

## Arrays Are Evil

In Signal K every datapoint should have a predictable and unique uri (address). What we want to maintain is to know that `vessels.self.data.temp` is always at that uri, and what the json form is. So if its an array thats workable. If its a json object with many instance keys, each which has a arbitrary name and the same internal structure that works too.

In fact the two forms represent the same data but have different uris and thats the crux. Essentially the first is `data.item[collection]`, where `data.item[1]` is instance 1, eg the second (0 based) item in the array.

This is no different from `data.item` as the json object, and `data.item.1` as the instance, with the name '1'.

From a code perspective its similar too, the object just has an array of keys. But with objects `data.temp.instanceName.value` is reliable and always the same.

Does that apply for `data.temp[1].value`? eg how do you reliably get `data.temp.air.value` with arrays?

In signalk or java or js, if I have two values in the array, and add one, then remove the first, suddenly the subscriptions are all wrong. The `temp[1]` did point to the second (0 based) object in the array, but after removing the first its now `temp[0]`. Subscriptions to `temp[1]` are now broken.

For an object `temp[air]` always gets the `temp.air`. Adding or removing other keys does not affect 'air'.

The array problem can be overcome by programming - but basically thats just fixing a problem that can be easily avoided by not using arrays.

This is a quick start for any-one that would like to contribute. Its roughly from technically unskilled to skilled, top to bottom. Dont be afraid to ask for help. Each task will probably start with a new thread for more details on the Google groups (<https://groups.google.com/forum/#!forum/signalk>). Be patient, civil, and persistent :-)

Completely unskilled at boat electronics:

- Join <https://groups.google.com/forum/#!forum/signalk> - as the user base grows, so does awareness.
- Tell others, spread the word
- Fly a Signal K flag from your boat
- If you have special skills (eg motors, batteries, navigation, etc) help us extend the Signal K protocol by identifying what we need to cover.
- Ask manufacturers about Signal K support
- Ask questions about what you dont understand, and collate the answers for us to put on the website.

Can do own installs, handyman, but not IT skilled.

- Try an install of Raspberry Pi and WIFI, document exactly how you did it, so others can follow.

Website or documentation skills

- Help us maintain the website, and improve the documents

Good computer skills, but not programming

- Download and try the java server (<https://github.com/SignalK/signalk-server-java>) and node server (<https://github.com/SignalK/signalk-server-node>) and the various apps and clients. Help test and identify issues, help improve documents so others can follow easier.
- Help with User manuals!

Systems engineer

- Help other users, help with scripts, develop and maintain install processes, managing our web sites, etc.
- Examples:
  - Create Debian packages of the Signal K software for easy installation to Raspbian

Software developer

- Download and test/fix our stuff, add improvements, join the team and help code, develop support in your own software.

### Microprocessors

- Improve our Arduino stuff, add your own, incorporate Signal K into your products.

# Signal K Data Model Reference

This document is meant as the human-oriented reference to accompany the actual JSON Schema specification and is produced from the schema files. Any changes to the reference material below should be made to the original schema files.

Signal K uses [SI units](#) almost everywhere, with the exception of geographic coordinates. The following units are in use:

- A : Ampere
- C : Coulomb
- Hz : Hertz
- ISO-8601 (UTC) : ISO-8601 string representation of time in Universal Time Coordinated
- J : Joule
- K : Kelvin
- Pa : Pascal
- V : Volt
- W : Watt
- deg : Degree
- kg : Kilogram
- m : Meter
- m/s : Meters per second
- m<sup>2</sup> : Square meter
- m<sup>3</sup> : Cubic meter
- m<sup>3</sup>/s : Cubic meter per second
- rad : Radian
- rad/s : Radian per second
- ratio : Ratio
- s : Second

## Keys

**/self**



**Description:** This holds the key (UUID, MMSI or URL) of this vessel, the actual data is in the vessels array.

---

## **/vessels**

**Description:** A wrapper object for vessel objects, each describing vessels in range, including this vessel.

---

## **/vessels/<RegExp>**

**Title:** vessel

**Description:** An object describing an individual vessel. It should be an object in vessels, named using MMSI or a UUID

---

## **/vessels/<RegExp>/url**

**Description:** URL based identity of the vessel, if available.

---

## **/vessels/<RegExp>/mmsi**

**Description:** MMSI number of the vessel, if available.

---

## **/vessels/<RegExp>/uuid**

**Description:** A unique Signal K flavoured maritime resource identifier, assigned by the server.

---

## **/vessels/<RegExp>/name**

**Description:** The common name of the vessel

---

## **/vessels/<RegExp>/flag**

**Description:** The country of ship registration, or flag state of the vessel

---

## **/vessels/<RegExp>/port**

**Description:** The home port of the vessel

---

## **/vessels/<RegExp>/registrations**

**Description:** The various registrations of the vessel.

---

## **/vessels/<RegExp>/registrations/imo**

**Description:** The IMO number of the vessel.

---

## **/vessels/<RegExp>/registrations/national**

**Description:** The national registration number of the vessel.

---

## **/vessels/<RegExp>/registrations/national/<RegExp>**

**Description:** This regex pattern is used for validating the identifier for the registration

---

## **/vessels/<RegExp>/registrations/national/<RegExp>/country**

**Description:** The ISO 3166-2 country code.

---

## **/vessels/<RegExp>/registrations/national/<RegExp>/registration**

**Description:** The registration code

---

## **/vessels/<RegExp>/registrations/national/<RegExp>/description**

**Description:** The registration description

---

## **/vessels/<RegExp>/registrations/local**

**Description:** A local or state registration number of the vessel.

---

## **/vessels/<RegExp>/registrations/local/<RegExp>**

**Description:** This regex pattern is used for validating the identifier for the registration

---

## **/vessels/<RegExp>/registrations/local/<RegExp>/registration**

**Description:** The registration code

---

## **/vessels/<RegExp>/registrations/local/<RegExp>/description**

**Description:** The registration description

---

## **/vessels/<RegExp>/registrations/other**

**Description:** Other registration or permits for the vessel.

---

## **/vessels/<RegExp>/registrations/other/<RegExp>**

**Description:** This regex pattern is used for validating the identifier for the registration

---

## **/vessels/<RegExp>/registrations/other/<RegExp>/registration**

**Description:** The registration code

---

## **/vessels/<RegExp>/registrations/other/<RegExp>/description**

**Description:** The registration description

---

## **/vessels/<RegExp>/communication**

**Title:** communication

**Description:** Communication data including Radio, Telephone, E-Mail, etc.

---

## **/vessels/<RegExp>/communication/callsignVhf**

**Description:** Callsign for VHF communication

---

## **/vessels/<RegExp>/communication/callsignHf**

**Description:** Callsign for HF communication

---

## **/vessels/<RegExp>/communication/phoneNumber**

**Description:** Phone number of skipper

---

---

## **/vessels/<RegExp>/communication/emailHf**

**Description:** Email address to be used for HF email (Winmail, Airmail, Sailmail)

---

## **/vessels/<RegExp>/communication/email**

**Description:** Regular email for the skipper

---

## **/vessels/<RegExp>/communication/satPhoneNumber**

**Description:** Satellite phone number for vessel.

---

## **/vessels/<RegExp>/communication/skipperName**

**Description:** Full name of the skipper of the vessel.

---

## **/vessels/<RegExp>/communication/crewNames**

**Description:** Array with the names of the crew

---

## **/vessels/<RegExp>/environment**

**Title:** environment

**Description:** Environmental data measured locally including Depth, Wind, Temp, etc.

---

## **/vessels/<RegExp>/environment/outside**

**Description:** [missing]

---

## **/vessels/<RegExp>/environment/outside/temperature**

**Units:** K (Kelvin)

**Description:** Current outside air temperature

---

## **/vessels/<RegExp>/environment/outside/dewPointTemperature**

**Units:** K (Kelvin)

**Description:** Current outside dew point temperature

---

## **/vessels/<RegExp>/environment/outside/apparentWindChillTemperature**

**Units:** K (Kelvin)

**Description:** Current outside apparent wind chill temperature

---

## **/vessels/<RegExp>/environment/outside/theoreticalWindChillTemperature**

**Units:** K (Kelvin)

**Description:** Current outside theoretical wind chill temperature

---

## **/vessels/<RegExp>/environment/outside/heatIndexTemperature**

**Units:** K (Kelvin)

**Description:** Current outside heat index temperature

---

## **/vessels/<RegExp>/environment/outside/pressure**

**Units:** Pa (Pascal)

**Description:** Current outside air ambient pressure

---

**/vessels/<RegExp>/environment/outside/humidity**

**Units:** ratio (Ratio)

**Description:** Current outside air relative humidity

---

**/vessels/<RegExp>/environment/inside**

**Description:** [missing]

---

**/vessels/<RegExp>/environment/inside/temperature**

**Units:** K (Kelvin)

**Description:** Current inside air temperature

---

**/vessels/<RegExp>/environment/inside/humidity**

**Units:** ratio (Ratio)

**Description:** Current inside air relative humidity

---

**/vessels/<RegExp>/environment/inside/engineRoom**

**Description:** Current engine room air temperature

---

**/vessels/<RegExp>/environment/inside/mainCabin**

**Description:** Current main cabin air temperature

---

---

## **/vessels/<RegExp>/environment/inside/refrigerator**

**Description:** Current refrigerator temperature

---

## **/vessels/<RegExp>/environment/inside/freezer**

**Description:** Current freezer temperature

---

## **/vessels/<RegExp>/environment/inside/heating**

**Description:** Current heating temperature

---

## **/vessels/<RegExp>/environment/water**

**Description:** [missing]

---

## **/vessels/<RegExp>/environment/water/temperature**

**Units:** K (Kelvin)

**Description:** Current water temperature

---

## **/vessels/<RegExp>/environment/water/salinity**

**Units:** ratio (Ratio)

**Description:** Water salinity

---

## **/vessels/<RegExp>/environment/water/liveWell**

**Description:** Current livewell temperature

---



---

## **/vessels/<RegExp>/environment/water/baitWell**

**Description:** Current baitwell air temperature

---

## **/vessels/<RegExp>/environment/depth**

**Title:** depth

**Description:** Depth related data

---

## **/vessels/<RegExp>/environment/depth/belowKeel**

**Units:** m (Meter)

**Description:** Depth below keel

---

## **/vessels/<RegExp>/environment/depth/belowTransducer**

**Units:** m (Meter)

**Description:** Depth below Transducer

---

## **/vessels/<RegExp>/environment/depth/belowSurface**

**Units:** m (Meter)

**Description:** Depth from surface

---

## **/vessels/<RegExp>/environment/depth/transducerToKeel**

**Units:** m (Meter)

**Description:** Depth from the transducer to the bottom of the keel

---

## **/vessels/<RegExp>/environment/depth/surfaceToTransducer**

**Units:** m (Meter)

**Description:** Depth transducer is below the water surface

---

## **/vessels/<RegExp>/environment/current**

**Title:** current

**Description:** Direction and strength of current affecting the vessel

---

## **/vessels/<RegExp>/environment/tide**

**Title:** tide

**Description:** Tide data

---

## **/vessels/<RegExp>/environment/tide/heightHigh**

**Units:** m (Meter)

**Description:** Next high tide height relative to lowest astronomical tide (LAT/Chart Datum)

---

## **/vessels/<RegExp>/environment/tide/heightNow**

**Units:** m (Meter)

**Description:** The current tide height relative to lowest astronomical tide (LAT/Chart Datum)

---

## **/vessels/<RegExp>/environment/tide/heightLow**

**Units:** m (Meter)

**Description:** The next low tide height relative to lowest astronomical tide (LAT/Chart Datum)

---

## **/vessels/<RegExp>/environment/tide/timeLow**

**Units:** ISO-8601 (UTC) (ISO-8601 string representation of time in Universal Time Coordinated)

**Description:** Time of the next low tide in UTC

---

## **/vessels/<RegExp>/environment/tide/timeHigh**

**Units:** ISO-8601 (UTC) (ISO-8601 string representation of time in Universal Time Coordinated)

**Description:** Time of next high tide in UTC

---

## **/vessels/<RegExp>/environment/heave**

**Units:** m (Meter)

**Description:** Vertical movement of the vessel due to waves

---

## **/vessels/<RegExp>/environment/wind**

**Title:** wind

**Description:** Wind data.

---

## **/vessels/<RegExp>/environment/wind/angleApparent**

**Units:** rad (Radian)

**Description:** Apparent wind angle, negative to port

---

---

## **/vessels/<RegExp>/environment/wind/angleTrueGround**

**Units:** rad (Radian)

**Description:** True wind angle based on speed over ground, negative to port

---

## **/vessels/<RegExp>/environment/wind/angleTrueWater**

**Units:** rad (Radian)

**Description:** True wind angle based on speed through water, negative to port

---

## **/vessels/<RegExp>/environment/wind/directionChangeAlarm**

**Units:** rad (Radian)

**Description:** The angle the wind needs to shift to raise an alarm

---

## **/vessels/<RegExp>/environment/wind/directionTrue**

**Units:** rad (Radian)

**Description:** The wind direction relative to true north

---

## **/vessels/<RegExp>/environment/wind/directionMagnetic**

**Units:** rad (Radian)

**Description:** The wind direction relative to magnetic north

---

## **/vessels/<RegExp>/environment/wind/speedTrue**

**Units:** m/s (Meters per second)

---

**Description:** Wind speed over water (as calculated from speedApparent and vessel's speed through water)

---

## **/vessels/<RegExp>/environment/wind/speedOverGround**

**Units:** m/s (Meters per second)

**Description:** Wind speed over ground (as calculated from speedApparent and vessel's speed over ground)

---

## **/vessels/<RegExp>/environment/wind/speedApparent**

**Units:** m/s (Meters per second)

**Description:** Apparent wind speed

---

## **/vessels/<RegExp>/environment/time**

**Description:** A time reference onboard.

---

## **/vessels/<RegExp>/environment/time/millis**

**Title:** Epoch time

**Description:** Milliseconds since the UNIX epoch (1970-01-01 00:00:00)

---

## **/vessels/<RegExp>/environment/time/timezone**

**Title:** Timezone offset

**Description:** Timezone offset in hours and minutes (-)hhmm

---

## **/vessels/<RegExp>/environment/mode**

---

**Description:** Mode of the vessel based on the current conditions. Can be combined with navigation.state to control vessel signals eg switch to night mode for instrumentation and lights, or make sound signals for fog.

---

## **/vessels/<RegExp>/navigation**

**Title:** navigation

**Description:** Navigation data including Position, Course to next WP information, etc.

---

## **/vessels/<RegExp>/navigation/lights**

**Title:** Navigation lights

**Description:** Current state of the vessels navigation lights

---

## **/vessels/<RegExp>/navigation/courseOverGroundMagnetic**

**Units:** rad (Radian)

**Description:** Course over ground (magnetic)

---

## **/vessels/<RegExp>/navigation/courseOverGroundTrue**

**Units:** rad (Radian)

**Description:** Course over ground (true)

---

## **/vessels/<RegExp>/navigation/courseRhumbline**

**Description:** Course information computed with Rhumbline

---

## **/vessels/<RegExp>/navigation/courseGreatCircle**

**Description:** Course information computed with Great Circle

---

## **/vessels/<RegExp>/navigation/racing**

**Description:** [missing]

---

## **/vessels/<RegExp>/navigation/racing/startLineStb**

**Description:** [missing]

---

## **/vessels/<RegExp>/navigation/racing/startLinePort**

**Description:** [missing]

---

## **/vessels/<RegExp>/navigation/racing/distanceStartline**

**Units:** m (Meter)

**Description:** The current distance to the start line

---

## **/vessels/<RegExp>/navigation/racing/timeToStart**

**Units:** s (Second)

**Description:** Time left before start

---

## **/vessels/<RegExp>/navigation/racing/timePortDown**

**Units:** s (Second)

**Description:** Time to arrive at the start line on port, turning downwind

---

---

## **/vessels/<RegExp>/navigation/racing/timePortUp**

**Units:** s (Second)

**Description:** Time to arrive at the start line on port, turning upwind

---

## **/vessels/<RegExp>/navigation/racing/timeStbdDown**

**Units:** s (Second)

**Description:** Time to arrive at the start line on starboard, turning downwind

---

## **/vessels/<RegExp>/navigation/racing/timeStbdUp**

**Units:** s (Second)

**Description:** Time to arrive at the start line on starboard, turning upwind

---

## **/vessels/<RegExp>/navigation/racing/distanceLayline**

**Units:** m (Meter)

**Description:** The current distance to the layline

---

## **/vessels/<RegExp>/navigation/magneticVariation**

**Units:** rad (Radian)

**Description:** The magnetic variation (declination) at the current position

---

## **/vessels/<RegExp>/navigation/magneticVariationAgeOfService**

**Units:** s (Second)

---



**Description:** Seconds since the 1st Jan 1970 that the variation calculation was made

---

## **/vessels/<RegExp>/navigation/destination**

**Title:** destination

**Description:** The intended destination of this trip

---

## **/vessels/<RegExp>/navigation/destination/eta**

**Units:** ISO-8601 (UTC) (ISO-8601 string representation of time in Universal Time Coordinated)

**Description:** ISO-8601 (UTC) string representing date and time.

---

## **/vessels/<RegExp>/navigation/destination/waypoint**

**Description:** UUID of destination waypoint

---

## **/vessels/<RegExp>/navigation/gnss**

**Title:** gnss

**Description:** Global satellite navigation meta information

---

## **/vessels/<RegExp>/navigation/gnss/methodQuality**

**Description:** Quality of the satellite fix

---

## **/vessels/<RegExp>/navigation/gnss/integrity**

**Description:** Integrity of the satellite fix

---

## **/vessels/<RegExp>/navigation/gnss/satellites**

**Description:** Number of satellites

---

## **/vessels/<RegExp>/navigation/gnss/antennaAltitude**

**Units:** m (Meter)

**Description:** Altitude of antenna

---

## **/vessels/<RegExp>/navigation/gnss/horizontalDilution**

**Description:** Horizontal Dilution of Precision

---

## **/vessels/<RegExp>/navigation/gnss/positionDilution**

**Description:** Positional Dilution of Precision

---

## **/vessels/<RegExp>/navigation/gnss/geoidalSeparation**

**Description:** Difference between WGS84 earth ellipsoid and mean sea level

---

## **/vessels/<RegExp>/navigation/gnss/differentialAge**

**Units:** s (Second)

**Description:** Age of DGPS data

---

## **/vessels/<RegExp>/navigation/gnss/differentialReference**

**Description:** ID of DGPS base station

---

## **/vessels/<RegExp>/navigation/headingMagnetic**

**Units:** rad (Radian)

**Description:** Current magnetic heading of the vessel

---

## **/vessels/<RegExp>/navigation/headingTrue**

**Units:** rad (Radian)

**Description:** The current true heading of the vessel

---

## **/vessels/<RegExp>/navigation/position**

**Description:** The position of the vessel in 2 or 3 dimensions (WGS84 datum)

---

## **/vessels/<RegExp>/navigation/attitude**

**Title:** Attitude

**Description:** Vessel attitude: roll, pitch and yaw

---

## **/vessels/<RegExp>/navigation/rateOfTurn**

**Units:** rad/s (Radian per second)

**Description:** Rate of turn (+ve is change to starboard)

---

## **/vessels/<RegExp>/navigation/speedOverGround**

**Units:** m/s (Meters per second)

**Description:** Vessel speed over ground

---

## **/vessels/<RegExp>/navigation/speedThroughWater**

**Units:** m/s (Meters per second)

**Description:** Vessel speed through the water

---

## **/vessels/<RegExp>/navigation/log**

**Units:** m (Meter)

**Description:** Log value

---

## **/vessels/<RegExp>/navigation/logTrip**

**Units:** m (Meter)

**Description:** Trip log value

---

## **/vessels/<RegExp>/navigation/state**

**Title:** state

**Description:** Current navigational state of the vessel

---

## **/vessels/<RegExp>/navigation/anchor**

**Title:** anchor

**Description:** The anchor data, for anchor watch etc

---

## **/vessels/<RegExp>/navigation/anchor/maxRadius**

**Units:** m (Meter)

**Description:** Radius of anchor alarm boundary. The distance from anchor to the center of the boat

---

---

## **/vessels/<RegExp>/navigation/anchor/currentRadius**

**Units:** m (Meter)

**Description:** Current distance to anchor

---

## **/vessels/<RegExp>/navigation/anchor/position**

**Description:** The actual anchor position of the vessel in 3 dimensions, probably an estimate at best

---

## **/vessels/<RegExp>/navigation/datetime**

**Description:** [missing]

---

## **/vessels/<RegExp>/propulsion**

**Title:** propulsion

**Description:** Engine data, each engine identified by a unique name i.e. Port\_Engine

---

## **/vessels/<RegExp>/propulsion/<RegExp>**

**Description:** This regex pattern is used for validation of the identifier for the propulsion unit

---

## **/vessels/<RegExp>/propulsion/<RegExp>/label**

**Description:** Human readable label for the propulsion unit

---

## **/vessels/<RegExp>/propulsion/<RegExp>/state**

---

**Description:** The current state of the engine

---

**/vessels/<RegExp>/propulsion/<RegExp>/revolutions**

**Units:** Hz (Hertz)

**Description:** Engine revolutions (x60 for RPM)

---

**/vessels/<RegExp>/propulsion/<RegExp>/temperature**

**Units:** K (Kelvin)

**Description:** Engine temperature

---

**/vessels/<RegExp>/propulsion/<RegExp>/oilTemperature**

**Units:** K (Kelvin)

**Description:** Oil temperature

---

**/vessels/<RegExp>/propulsion/<RegExp>/oilPressure**

**Units:** Pa (Pascal)

**Description:** Oil pressure

---

**/vessels/<RegExp>/propulsion/<RegExp>/alternatorVoltage**

**Units:** V (Volt)

**Description:** Alternator voltage

---

**/vessels/<RegExp>/propulsion/<RegExp>/runTime**

---

**Units:** s (Second)

**Description:** Total running time for engine (Engine Hours in seconds)

---

**/vessels/<RegExp>/propulsion/<RegExp>/coolantTemperature**

**Units:** K (Kelvin)

**Description:** Coolant temperature

---

**/vessels/<RegExp>/propulsion/<RegExp>/coolantPressure**

**Units:** Pa (Pascal)

**Description:** Coolant pressure

---

**/vessels/<RegExp>/propulsion/<RegExp>/boostPressure**

**Units:** Pa (Pascal)

**Description:** Engine boost (turbo, supercharger) pressure

---

**/vessels/<RegExp>/propulsion/<RegExp>/engineLoad**

**Units:** ratio (Ratio)

**Description:** Engine load ratio,  $0 \leq \text{ratio} \leq 1$ , 1 is 100%

---

**/vessels/<RegExp>/propulsion/<RegExp>/engineTorque**

**Units:** ratio (Ratio)

**Description:** Engine torque ratio,  $0 \leq \text{ratio} \leq 1$ , 1 is 100%

---

---

## **/vessels/<RegExp>/propulsion/<RegExp>/transmission**

**Description:** [missing]

---

## **/vessels/<RegExp>/propulsion/<RegExp>/transmission/gear**

**Description:** [missing]

---

## **/vessels/<RegExp>/propulsion/<RegExp>/transmission/gearRatio**

**Units:** ratio (Ratio)

**Description:** Gear ratio, engine rotations per propeller shaft rotation

---

## **/vessels/<RegExp>/propulsion/<RegExp>/transmission/oil Temperature**

**Units:** K (Kelvin)

**Description:** Oil temperature

---

## **/vessels/<RegExp>/propulsion/<RegExp>/transmission/oil Pressure**

**Units:** Pa (Pascal)

**Description:** Oil pressure

---

## **/vessels/<RegExp>/propulsion/<RegExp>/drive**

**Description:** [missing]

---



## **/vessels/<RegExp>/propulsion/<RegExp>/drive/type**

**Description:** [missing]

**Enum values:**

- saildrive
  - shaft
  - outboard
  - jet
  - pod
  - other
- 

## **/vessels/<RegExp>/propulsion/<RegExp>/drive/trimState**

**Units:** ratio (Ratio)

**Description:** Trim/tilt state,  $0 \leq \text{ratio} \leq 1$ , 1 is 100% up

---

## **/vessels/<RegExp>/propulsion/<RegExp>/drive/thrustAngle**

**Units:** rad (Radian)

**Description:** Current thrust angle for steerable drives, +ve is thrust to Starboard

---

## **/vessels/<RegExp>/propulsion/<RegExp>/drive/propeller**

**Description:** [missing]

---

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel**

**Description:** [missing]

---

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel/type**

**Description:** Fuel type

**Enum values:**

- diesel
  - petrol
  - electric
  - coal/wood
  - other
- 

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel/used**

**Units:** m3 (Cubic meter)

**Description:** Used fuel since last reset. Resetting is at user discretion

---

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel/pressure**

**Units:** Pa (Pascal)

**Description:** Fuel pressure

---

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel/rate**

**Units:** m3/s (Cubic meter per second)

**Description:** Fuel rate of consumption

---

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel/economyRate**

**Units:** m3/s (Cubic meter per second)

**Description:** Economy fuel rate of consumption

---

## **/vessels/<RegExp>/propulsion/<RegExp>/fuel/averageRate**

**Units:** m3/s (Cubic meter per second)

**Description:** Average fuel rate of consumption

---

## **/vessels/<RegExp>/propulsion/<RegExp>/exhaustTemperature**

**Units:** K (Kelvin)

**Description:** Exhaust temperature

---

## **/vessels/<RegExp>/electrical**

**Title:** electrical

**Description:** Electrical data, each electrical device indentified by a unique name i.e. Battery\_1

---

## **/vessels/<RegExp>/electrical/batteries**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>/temperature**

**Title:** temperature

**Description:** Additional / unique temperatures associated with a battery

---

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>/temperature/limitDischargeLower**

**Units:** K (Kelvin)

**Description:** Operational minimum temperature limit for battery discharge, in degrees Celsius

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>/temperature/limitDischargeUpper**

**Units:** K (Kelvin)

**Description:** Operational maximum temperature limit for battery discharge, in degrees Celsius

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>/temperature/limitRechargeLower**

**Units:** K (Kelvin)

**Description:** Operational minimum temperature limit for battery recharging, in degrees Celsius

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>/temperature/limitRechargeUpper**

**Units:** K (Kelvin)

**Description:** Operational maximum temperature limit for battery recharging, in degrees Celsius

---

## **/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity**

---

**Title:** capacity

**Description:** [missing]

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity/nominal**

**Units:** J (Joule)

**Description:** The capacity of battery as specified by the manufacturer

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity/actual**

**Units:** J (Joule)

**Description:** The measured capacity of battery. This may change over time and will likely deviate from the nominal capacity.

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity/remaining**

**Units:** J (Joule)

**Description:** Capacity remaining in battery

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity/dischargeLimit**

**Units:** J (Joule)

**Description:** Minimum capacity to be left in the battery while discharging

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity/stateOfCharge**

---

**Units:** ratio (Ratio)

**Description:** State of charge, 1 = 100%

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity  
/stateOfHealth**

**Units:** ratio (Ratio)

**Description:** State of Health, 1 = 100%

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity  
/dischargeSinceFull**

**Units:** C (Coulomb)

**Description:** Cumulative discharge since battery was last full

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/capacity  
/timeRemaining**

**Units:** s (Second)

**Description:** Time to discharge to discharge limit at current rate

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/lifetime  
Discharge**

**Units:** C (Coulomb)

**Description:** Cumulative charge discharged from battery over operational lifetime of battery

---

**/vessels/<RegExp>/electrical/batteries/<RegExp>/lifetime  
Recharge**

---

**Units:** C (Coulomb)

**Description:** Cumulative charge recharged into battery over operational lifetime of battery

---

## **/vessels/<RegExp>/electrical/inverters**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/inverters/<RegExp>**

**Title:** Inverter

**Description:** DC to AC inverter, one or many, within the vessel

---

## **/vessels/<RegExp>/electrical/inverters/<RegExp>/dc**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/inverters/<RegExp>/ac**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/inverters/<RegExp>/mode**

**Description:** Mode of inverter

---

## **/vessels/<RegExp>/electrical/chargers**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/chargers/<RegExp>**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/chargers/<RegExp>/mode**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/ac**

**Description:** AC buses

---

## **/vessels/<RegExp>/electrical/ac/<RegExp>**

**Title:** AC bus

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/ac/<RegExp>/phase**

**Description:** [missing]

---

## **/vessels/<RegExp>/electrical/ac/<RegExp>/phase/(single)|([A-C])**

**Description:** [missing]

---

## **/vessels/<RegExp>/notifications**

**Title:** notifications

**Description:** Notifications currently raised. Major categories have well-defined names, but the tree can be extended by any hierarchical structure

---



## **/vessels/<RegExp>/notifications/mob**

**Title:** notifications

**Description:** Man overboard

---

## **/vessels/<RegExp>/notifications/mob/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot speparated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/fire**

**Title:** notifications

**Description:** Fire onboard

---

## **/vessels/<RegExp>/notifications/fire/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot speparated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/sinking**

**Title:** notifications

**Description:** Vessel is sinking

---

## **/vessels/<RegExp>/notifications/sinking/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot speparated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/flooding**

**Title:** notifications

**Description:** Vessel is flooding

---

## **/vessels/<RegExp>/notifications/flooding/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot spearated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/collision**

**Title:** notifications

**Description:** In collision with another vessel or object

---

## **/vessels/<RegExp>/notifications/collision/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot spearated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/grounding**

**Title:** notifications

**Description:** Vessel grounding

---

## **/vessels/<RegExp>/notifications/grounding/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot spearated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/listing**

**Title:** notifications

**Description:** Vessel is listing

---

## **/vessels/<RegExp>/notifications/listing/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot spearated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/adrift**

**Title:** notifications

**Description:** Vessel is adrift

---

## **/vessels/<RegExp>/notifications/adrift/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot spearated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/piracy**

**Title:** notifications

**Description:** Under attack or danger from pirates

---

## **/vessels/<RegExp>/notifications/piracy/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot spearated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/abandon**

**Title:** notifications

**Description:** Abandon ship

---

## **/vessels/<RegExp>/notifications/abandon/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot speparated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/notifications/<RegExp>**

**Title:** notifications

**Description:** Notifications, their state, and actions. The notification limits are set in any Signal K key.meta.zones array.

---

## **/vessels/<RegExp>/notifications/<RegExp>/<RegExp>**

**Description:** Reference to the source under vessel's sources. A dot speparated path to the data. eg [type].[bus].[device]

---

## **/vessels/<RegExp>/steering**

**Title:** steering

**Description:** Vessel steering data for steering controls (not Autopilot 'Nav Data')

---

## **/vessels/<RegExp>/steering/rudderAngle**

**Units:** rad (Radian)

**Description:** Current rudder angle, +ve is rudder to Starboard

---

## **/vessels/<RegExp>/steering/rudderAngleTarget**

**Units:** rad (Radian)

**Description:** The angle the rudder should move to, +ve is rudder to Starboard

---

## **/vessels/<RegExp>/steering/autopilot**

**Title:** autopilot

**Description:** Autopilot data

---

## **/vessels/<RegExp>/steering/autopilot/state**

**Description:** Autopilot state

---

## **/vessels/<RegExp>/steering/autopilot/mode**

**Description:** Operational mode

---

## **/vessels/<RegExp>/steering/autopilot/targetHeadingNorth**

**Units:** rad (Radian)

**Description:** Target heading for autopilot, relative to true North

---

## **/vessels/<RegExp>/steering/autopilot/targetHeadingMagnetic**

**Units:** rad (Radian)

**Description:** Target heading for autopilot, relative to magnetic North

---

## **/vessels/<RegExp>/steering/autopilot/headingSource**

**Description:** Current source of heading information

---

## **/vessels/<RegExp>/steering/autopilot/deadZone**

**Units:** rad (Radian)

**Description:** Dead zone to ignore for rudder corrections

---

## **/vessels/<RegExp>/steering/autopilot/backlash**

**Units:** rad (Radian)

**Description:** Slack in the rudder drive mechanism

---

## **/vessels/<RegExp>/steering/autopilot/gain**

**Description:** Auto-pilot gain, higher number equals more rudder movement for a given turn

---

## **/vessels/<RegExp>/steering/autopilot/maxDriveCurrent**

**Units:** A (Ampere)

**Description:** Maximum current to use to drive servo

---

## **/vessels/<RegExp>/steering/autopilot/maxDriveRate**

**Units:** rad/s (Radian per second)

**Description:** Maximum rudder rotation speed

---

## **/vessels/<RegExp>/steering/autopilot/portLock**

**Units:** rad (Radian)

**Description:** Position of servo on port lock

---

## **/vessels/<RegExp>/steering/autopilot/starboardLock**

**Units:** rad (Radian)

**Description:** Position of servo on starboard lock

---

## **/vessels/<RegExp>/tanks**

**Title:** tanks

**Description:** Tank data, each tank indentified by a unique name i.e. FreshWater\_2

---

## **/vessels/<RegExp>/tanks/freshWater**

**Description:** [missing]

---

## **/vessels/<RegExp>/tanks/wasteWater**

**Description:** [missing]

---

## **/vessels/<RegExp>/tanks/blackWater**

**Description:** [missing]

---

## **/vessels/<RegExp>/tanks/fuelWater**

**Description:** [missing]

---

---

## **/vessels/<RegExp>/tanks/fuel**

**Description:** [missing]

---

## **/vessels/<RegExp>/tanks/lubrication**

**Description:** [missing]

---

## **/vessels/<RegExp>/tanks/liveWell**

**Description:** [missing]

---

## **/vessels/<RegExp>/design**

**Title:** design

**Description:** Design/dimensional data of this vessel

---

## **/vessels/<RegExp>/design/displacement**

**Units:** kg (Kilogram)

**Description:** The displacement of the vessel

---

## **/vessels/<RegExp>/design/draft**

**Title:** draft

**Description:** The draft of the vessel

---

## **/vessels/<RegExp>/design/draft/minimum**

---



**Units:** m (Meter)

**Description:** The minimum draft of the vessel

---

## **/vessels/<RegExp>/design/draft/maximum**

**Units:** m (Meter)

**Description:** The maximum draft of the vessel

---

## **/vessels/<RegExp>/design/draft/canoe**

**Units:** m (Meter)

**Description:** The draft of the vessel without protrusions such as keel, centerboard, rudder

---

## **/vessels/<RegExp>/design/length**

**Title:** length

**Description:** The various lengths of the vessel

---

## **/vessels/<RegExp>/design/length/overall**

**Units:** m (Meter)

**Description:** Length overall

---

## **/vessels/<RegExp>/design/length/hull**

**Units:** m (Meter)

**Description:** Length of hull

---

## **/vessels/<RegExp>/design/length/waterline**

**Units:** m (Meter)

**Description:** Length at waterline

---

## **/vessels/<RegExp>/design/keel**

**Title:** keel

**Description:** Information about the vessel's keel

---

## **/vessels/<RegExp>/design/keel/type**

**Description:** The type of keel.

**Enum values:**

- long
  - fin
  - flare
  - bulb
  - wing
  - centerboard
  - kanting
  - lifting
  - daggerboard
- 

## **/vessels/<RegExp>/design/keel/angle**

**Units:** rad (Radian)

**Description:** A number indicating at which angle the keel currently is (in case of a canting keel), negative to port.

---

## **/vessels/<RegExp>/design/keel/lift**

---

**Units:** ratio (Ratio)

**Description:** In the case of a lifting keel, centreboard or daggerboard, the part of the keel which is extended. 0 is 'all the way up' and 1 is 'all the way down'. 0.8 would be 80% down.

---

## **/vessels/<RegExp>/design/beam**

**Units:** m (Meter)

**Description:** Beam length

---

## **/vessels/<RegExp>/design/airHeight**

**Units:** m (Meter)

**Description:** Total height of the vessel

---

## **/vessels/<RegExp>/design/rigging**

**Title:** rigging

**Description:** Information about the vessel's rigging

---

## **/vessels/<RegExp>/design/rigging/configuration**

**Description:** The configuration of the rigging

---

## **/vessels/<RegExp>/design/rigging/masts**

**Description:** The number of masts on the vessel.

---

## **/vessels/<RegExp>/sails**

---

**Title:** sails

**Description:** Sails data

---

**/vessels/<RegExp>/sails/inventory**

**Description:** An object containing a description of each sail available to the vessel crew

---

**/vessels/<RegExp>/sails/inventory/<RegExp>**

**Description:** 'sail' data type.

---

**/vessels/<RegExp>/sails/inventory/<RegExp>/name**

**Description:** An unique identifier by which the crew identifies a sail

---

**/vessels/<RegExp>/sails/inventory/<RegExp>/type**

**Description:** The type of sail

---

**/vessels/<RegExp>/sails/inventory/<RegExp>/material**

**Description:** The material the sail is made from (optional)

---

**/vessels/<RegExp>/sails/inventory/<RegExp>/brand**

**Description:** The brand of the sail (optional)

---

**/vessels/<RegExp>/sails/inventory/<RegExp>/active**

**Description:** Indicates wether this sail is currently in use or not

---

---

## **/vessels/<RegExp>/sails/inventory/<RegExp>/area**

**Units:** m2 (Square meter)

**Description:** The total area of this sail in square meters

---

## **/vessels/<RegExp>/sails/inventory/<RegExp>/minimumWind**

**Units:** m/s (Meters per second)

**Description:** The minimum wind speed this sail can be used with

---

## **/vessels/<RegExp>/sails/inventory/<RegExp>/maximumWind**

**Units:** m/s (Meters per second)

**Description:** The maximum wind speed this sail can be used with

---

## **/vessels/<RegExp>/sails/area**

**Description:** An object containing information about the vessels' sails.

---

## **/vessels/<RegExp>/sails/area/total**

**Units:** m2 (Square meter)

**Description:** The total area of all sails on the vessel

---

## **/vessels/<RegExp>/sails/area/active**

**Units:** m2 (Square meter)

---

**Description:** The total area of the sails currently in use on the vessel

---

## **/vessels/<RegExp>/sensors**

**Title:** sensors

**Description:** Sensors, their state, and data.

---

## **/vessels/<RegExp>/sensors/<RegExp>**

**Title:** sensor

**Description:** An object describing an individual sensor. It should be an object in vessel, named using a unique name or UUID

---

## **/vessels/<RegExp>/sensors/<RegExp>/name**

**Description:** The common name of the sensor

---

## **/vessels/<RegExp>/sensors/<RegExp>/sensorType**

**Description:** The datamodel definition of the sensor data. FIXME - need to create a definitions lib of sensor datamodel types

---

## **/vessels/<RegExp>/sensors/<RegExp>/sensorData**

**Description:** The data of the sensor data. FIXME - need to ref the definitions of sensor types

---

## **/vessels/<RegExp>/sensors/<RegExp>/fromBow**

**Description:** The distance from the bow to the sensor location

---

## **/vessels/<RegExp>/sensors/<RegExp>/fromCenter**

**Description:** The distance from the centerline to the sensor location, -ve to starboard, +ve to port

---

## **/vessels/<RegExp>/performance**

**Title:** performance

**Description:** Performance Sailing data including VMG, Polar Speed, tack angle, etc.

---

## **/vessels/<RegExp>/performance/polarSpeed**

**Units:** m/s (Meters per second)

**Description:** The current polar speed based on current polar diagram, trueWindSpeed and truewindAngle.

---

## **/vessels/<RegExp>/performance/polarSpeedRatio**

**Units:** ratio (Ratio)

**Description:** The ratio of current speed through water to the polar speed.

---

## **/vessels/<RegExp>/performance/velocityMadeGood**

**Units:** m/s (Meters per second)

**Description:** The current velocity made good derived from the speed through water and appearant wind angle. A positive value is heading to upwind, negative to downwind.

---

## **/vessels/<RegExp>/performance/velocityMadeGoodToWapoint**

**Units:** m/s (Meters per second)

**Description:** The current velocity made good to the next waypoint derived from the speedOverGround, courseOverGround.

---

## **/vessels/<RegExp>/performance/beatAngle**

**Units:** rad (Radian)

**Description:** The true wind beat angle for the best velocity made good based on current current polar diagram and trueWindSpeed.

---

## **/vessels/<RegExp>/performance/beatAngleVelocityMadeGood**

**Units:** m/s (Meters per second)

**Description:** The velocity made good for the beat angle.

---

## **/vessels/<RegExp>/performance/beatAngleTargetSpeed**

**Units:** m/s (Meters per second)

**Description:** The target speed for the beat angle.

---

## **/vessels/<RegExp>/performance/gybeAngle**

**Units:** rad (Radian)

**Description:** The true wind gybe angle for the best velocity made good downwind based on current polar diagram and trueWindSpeed.

---

## **/vessels/<RegExp>/performance/gybeAngleVelocityMadeGood**



**Units:** m/s (Meters per second)

**Description:** The velocity made good for the gybe angle

---

## **/vessels/<RegExp>/performance/gybeAngleTargetSpeed**

**Units:** m/s (Meters per second)

**Description:** The target speed for the gybe angle.

---

## **/vessels/<RegExp>/performance/targetAngle**

**Units:** rad (Radian)

**Description:** The true wind gybe or beat angle for the best velocity made good downwind or upwind based on current polar diagram and trueWindSpeed.

---

## **/vessels/<RegExp>/performance/targetSpeed**

**Units:** m/s (Meters per second)

**Description:** The target speed for the beat angle or gybe angle, which ever is applicable.

---

## **/vessels/<RegExp>/performance/leeway**

**Units:** rad (Radian)

**Description:** Current leeway

---

## **/vessels/<RegExp>/performance/tackMagnetic**

**Units:** rad (Radian)

**Description:** Magnetic heading on opposite tack.

---

## **/vessels/<RegExp>/performance/tackTrue**

**Units:** rad (Radian)

**Description:** True heading on opposite tack.

---

## **/resources**

**Title:** resources

**Description:** Resources to aid in navigation and operation of the vessel including waypoints, routes, notes, etc.

---

## **/resources/charts**

**Title:** chart

**Description:** A holder for charts, each named with their chart code

---

## **/resources/charts/<RegExp>**

**Description:** A chart

---

## **/resources/charts/<RegExp>/name**

**Description:** Chart common name

---

## **/resources/charts/<RegExp>/identifier**

**Description:** Chart number

---

## **/resources/charts/<RegExp>/description**

---

**Description:** A description of the chart

---

## **/resources/charts/<RegExp>/tilemapUrl**

**Description:** A url to the tilemap of the chart for use in TMS chartplotting apps

---

## **/resources/charts/<RegExp>/region**

**Description:** Region related to note. A pointer to a region UUID. Alternative to geohash

---

## **/resources/charts/<RegExp>/geohash**

**Description:** Position related to chart. Alternative to region

---

## **/resources/charts/<RegExp>/chartUrl**

**Description:** A url to the chart file's storage location

---

## **/resources/charts/<RegExp>/scale**

**Description:** The scale of the chart, the larger number from 1:200000

---

## **/resources/charts/<RegExp>/chartFormat**

**Description:** The format of the chart

**Enum values:**

- gif
  - geotiff
  - kap
  - png
  - jpg
-

- kml
  - wkt
  - topojson
  - geojson
  - gpx
  - tms
  - S-57
  - S-63
  - svg
  - other
- 

## **/resources/routes**

**Title:** route

**Description:** A holder for routes, each named with a UUID

---

## **/resources/routes/<RegExp>**

**Description:** A route, named with a UUID

---

## **/resources/routes/<RegExp>/name**

**Description:** Route's common name

---

## **/resources/routes/<RegExp>/description**

**Description:** A description of the route

---

## **/resources/routes/<RegExp>/distance**

**Units:** m (Meter)

**Description:** Total distance from start to end

---

## **/resources/routes/<RegExp>/start**

**Description:** The waypoint UUID at the start of the route

---

## **/resources/routes/<RegExp>/end**

**Description:** The waypoint UUID at the end of the route

---

## **/resources/routes/<RegExp>/feature**

**Title:** Feature

**Description:** A Geo JSON feature object which describes the route between the waypoints

---

## **/resources/routes/<RegExp>/feature/type**

**Description:** [missing]

**Enum values:**

## **\* Feature**

## **/resources/routes/<RegExp>/feature/geometry**

**Title:** LineString

**Description:** [missing]

---

## **/resources/routes/<RegExp>/feature/geometry/type**

**Description:** [missing]

**Enum values:**

---

## \* **LineString**

**/resources/routes/<RegExp>/feature/geometry/coordinates**

**Description:** [missing]

---

**/resources/routes/<RegExp>/feature/properties**

**Description:** Additional data of any type

---

**/resources/routes/<RegExp>/feature/id**

**Description:** [missing]

---

**/resources/notes**

**Title:** notes

**Description:** A holder for notes about regions, each named with a UUID. Notes might include navigation or cruising info, images, or anything

---

**/resources/notes/<RegExp>**

**Description:** A note about a region, named with a UUID. Notes might include navigation or cruising info, images, or anything

---

**/resources/notes/<RegExp>/title**

**Description:** Note's common name

---

## **/resources/notes/<RegExp>/description**

**Description:** A textual description of the note

---

## **/resources/notes/<RegExp>/region**

**Description:** Region related to note. A pointer to a region UUID. Alternative to position or geohash

---

## **/resources/notes/<RegExp>/position**

**Title:** position

**Description:** Position related to note. Alternative to region or geohash

---

## **/resources/notes/<RegExp>/geohash**

**Description:** Position related to note. Alternative to region or position

---

## **/resources/notes/<RegExp>/mimeType**

**Description:** MIME type of the note

---

## **/resources/notes/<RegExp>/url**

**Description:** Location of the note

---

## **/resources/regions**

**Title:** region

**Description:** A holder for regions, each named with UUID

---

## **/resources/regions/<RegExp>**

**Description:** A region of interest, each named with a UUID

---

## **/resources/regions/<RegExp>/geohash**

**Description:** geohash of the approximate boundary of this region

---

## **/resources/regions/<RegExp>/feature**

**Title:** Feature

**Description:** A Geo JSON feature object which describes the regions boundary

---

## **/resources/regions/<RegExp>/feature/type**

**Description:** [missing]

**Enum values:**

## **\* Feature**

## **/resources/regions/<RegExp>/feature/geometry**

**Description:** [missing]

---

## **/resources/regions/<RegExp>/feature/properties**

**Description:** Additional data of any type

---

## **/resources/regions/<RegExp>/feature/id**

**Description:** [missing]

---



## **/resources/waypoints**

**Title:** waypoints

**Description:** A holder for waypoints, each named with a UUID

---

## **/resources/waypoints/<RegExp>**

**Description:** A waypoint, an object with a signal k position object, and GeoJSON Feature object (see [geojson.org](http://geojson.org), and <https://github.com/fge/sample-json-schemas/tree/master/geojson>)

---

## **/resources/waypoints/<RegExp>/position**

**Title:** position

**Description:** The position in 3 dimensions

---

## **/resources/waypoints/<RegExp>/feature**

**Title:** Feature

**Description:** A Geo JSON feature object

---

## **/resources/waypoints/<RegExp>/feature/type**

**Description:** [missing]

**Enum values:**

## **\* Feature**

## **/resources/waypoints/<RegExp>/feature/geometry**

---

**Title:** Point

**Description:** [missing]

---

**/resources/waypoints/<RegExp>/feature/geometry/type**

**Description:** [missing]

**Enum values:**

## **\* Point**

**/resources/waypoints/<RegExp>/feature/geometry/coordinates**

**Description:** A single position, in x,y order (Lon, Lat)

---

**/resources/waypoints/<RegExp>/feature/properties**

**Description:** Additional data of any type

---

**/resources/waypoints/<RegExp>/feature/id**

**Description:** [missing]

---

**/version**

**Description:** Version of the schema and APIs that this data is using in Canonical format i.e. V1.0.0.

---