AN5678

Application note

Teseo-VIC3D and Teseo-VIC3DA - installation and calibration

Introduction

The Teseo-VIC3x module is an easy to use Dead-Reckoning Global Navigation Satellite System (GNSS) stand-alone module, embedding TeseoIII single die stand-alone positioning receiver IC working on multiple constellations (GPS/Galileo/Glonass/BeiDou/QZSS) and ST 3D IMU sensors to support Teseo Dead Reckoning Automotive Way (Teseo-DRAW).

The module is designed for top performance in a minimal space and it has been optimized for cost sensitive applications without quality compromise. It allows, at competitive costs, an easy integration and migration from existing designs of products.

Within its 16x12.2 mm compact size, Teseo-VIC3x is offering superior accuracy, a reduced Time To First Fix (TTFF) and Dead-Reckoning capability. The device is offered with a complete Dead Reckoning GNSS firmware which performs all GNSS operations including acquisition, tracking, sensors fusion and navigation and data output with no need of external memories.

Table 1. ST GNSS Teseo-VIC3x supported devices

Device Type	Device grade
Teseo-VIC3DA	Automotive grade
Teseo-VIC3D	Industrial grade

1 Installation

Teseo-VIC3x can be installed on your board and in the final platform in whatever position; Teseo-VIC3x detects the its-own position and auto-tune the internal 3 gyro and accelerometer axis bias.

Take care that the board, which hosts the Teseo-VIC3x, and the final platform must be perfectly united, **there must be NO relative movement**.

2 Calibration

Once the system installed and running on the target vehicle the following steps should be executed in order to fine tune accurately the calibration.

1. Turn on vehicle and Teseo-VIC3DA system.
2. Wait about a minute with the vehicle stopped and turned on. In this way the yaw rate offset is automatically initialized with a reliable value.
3. Drive in straight road sections (speed > 30 km/h) for at least 5 minutes. In this way odometer scale calibrates accurately and yaw rate offset fine tunes.
4. Drive in areas rich of curves (speed > 30 km/h). This process is needed to calibrate the yaw rate gain. It is important to underline that tight turns (with narrow radius of curvature) are required. Examples of turns that allow this step to be performed properly are roundabouts, corners, and in general sections in which road direction changes of 90 degrees or more in few seconds. Large turns (e.g. highway ones, lane changes, etc.) do not have any use for calibrating. Note also that the success of this operation does not depend on its duration, but on the number of valid turns that the system is subjected. E.g. in order to have a fine tuned yaw rate gain ST suggests including in first-boot calibration route at least 10 examples of the tight curves described above. This procedure may be fulfilled also repeating the same curve more time (e.g. crossing more times the same roundabout).

It is of the utmost importance that all these operations are fulfilled under benign GNSS signal conditions. This means that the antenna must have maximum sky visibility. In order to fulfil this condition the field test should be performed driving in open areas, i.e. avoiding urban scenarios, forests, tunnels and any form of signal blockage or reflection.

It is important to remark that the hybrid GNSS/DR navigation mode will not be entered until a valid calibration becomes available (through either of the methods outlined above). Prior to that point, only GNSS-standalone navigation will be provided.

2.1 Expected duration

Typical duration of calibration process assuming drive conditions reported above are fulfilled, is around **15 minutes**. This time may become larger if guidelines are not fulfilled (e.g. slow motion induced by traffic). To reduce the duration of calibration phase it is recommended performing it where unrestricted maneuvering is possible, such as a large, empty paved areas or roads, where the clearest view of the sky is possible. All calibration maneuvers must happen in benign GNSS signal conditions, i.e. avoiding urban, forests, tunnels and other forms of signal blockage or reflection. In general, it must be kept in mind that success of the operation does not depend on its duration, but on how much the driving style and sky condition fits with present recommendations.

2.2 Status check

NMEA output contains data that allow to understand if calibration phase is over and system is ready. ST proprietary message $PSTMDRCAL provides at 1 Hz useful information about readiness status. “DR Calibrated” flag, depicted in green, allows user to understand easily if the odometer-based navigation system is calibrated and operational.

```
$PSTMDRCAL,<DR_calibrated>,<odo_is_calib>,<gyro_sensitivity_is_calib>,
<gyro_bias_is_calib>,<imu_flag>,<gyro_integrity_flag>,<acc_integrity>,
<dr_calib_status>*<checksum><cr><lf>
```

ST proprietary message $PSTMDR2 provides at 1 Hz useful information about readiness status. System Ready flag, depicted in green, allows user to understand easily if the system is ready or not to work in DR mode.

```
$PSTMDR2,<IMU_cal>,<AS_cal>,<motion_status>,<err_code>,<System_Ready>,
<cross_track_error>,<along_track_error>,<sa>,<vro_ws>,<vro_st>*<checksum><cr><lf>
```

The system is fully operational when DR calibrated, and System Ready flags are both set.

Revision history

Table 2. **Document revision history**

Date	Revision	Changes
19-May-2021	1	Initial release.

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