Survey Grade INS
DVL – Doppler Velocity Log

Operating Handbook

SBG SYSTEMS

This operating handbook aims to guide SBG users for DVL sensor installation and configuration in marine environments.

Use this document in complement of the Operating Handbook "Use in Marine Applications"

DVL installation

Mechanical Installation

DVL must be rigidly fixed to the vessel structure. It is typically recommended to align the DVL forward mark toward the vessel bow. In that case, the nominal alignment angle to enter in the inertial system configuration is +45°. You can mount the DVL in any orientation by entering appropriate misalignment angles.

Note that the native DVL instrument frame (displayed DVL_X and DVL_Y on the diagram) is a left handed frame whereas the SBG Systems products operate in a right handed coordinate system. Therefore we internally invert the DVL X and Z velocity before applying user alignment angles. Following diagram shows DVL instrument frame as well as the inverted DVL X (pink arrow) axis that is used for DVL to vessel misalignment determination.

The lever arm from the IMU to the DVL must also be measured accurately.
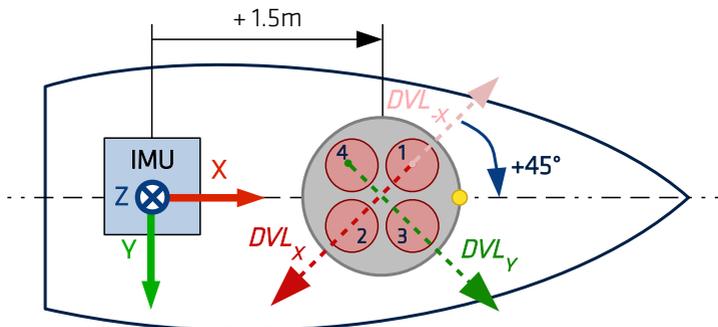

*Figure 1: Typical DVL installation: alignment with IMU is set to +45°
View from above.*

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Electrical connections

When using an external DVL sensor, the following electrical connections must be performed:

- RS-232 or RS-422 **DVL data output** has to be connected on a dedicated "Rx" port.
- **DVL synchronization** with the device must be performed either:
  - Driven by the navigation sensor, by triggering the DVL pings by a Sync Out pin signal.
  - Driven externally, by connecting the external trigger signal to a Sync In pin, and to the DVL synchronization input.

Here is an example of a typical DVL wiring in RS-422:

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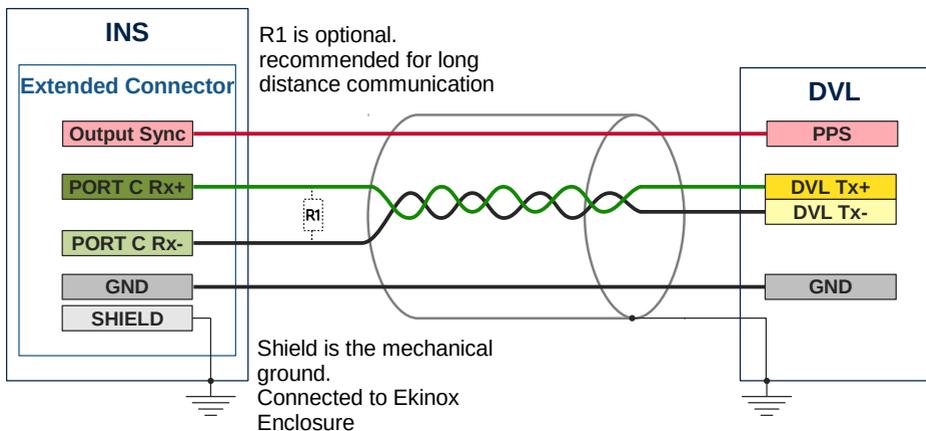
Software configuration

All the standard configuration steps are already detailed in the Operating Handbook "Use in Marine Application". Here we only focus on the DVL part.

Aiding Assignment

Select the DVL on the **input port** of your choice (COM or Eth port) and the synchronization.

Aiding Settings

1. Select the **communication protocol**: Teledyne for PD0 or Generic PD6 message format.
2. Then select the **orientation** and **lever arm**.
3. Set up the **rejection** on Automatic

Input / Output

COM Ports

Configure the baudrate of the serial port you chose in Aiding Assignment section.

Logic IO

Configure the synchronisation chosen in Aiding Assignment section.

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Data Output

For data check, make sure you output the **DVL Bottom Track** and **DVL Water Layer** on **"New Data"**:

This is not mandatory for DVL use, but will allow to check the data received from the DVL on the sbgCenter.

This is also strongly recommended to use the "Support" output preset in the Data Logger section, and let is activated for the test run. This way logs can be replayed and data checked later on sbgCenter or on text file export.

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Installation Check

The whole configuration can easily be checked in the Setup Overview section. It features a 3D display that can be modified by simply clicking on an item, then changing the orientation or lever arm values. Any change will be directly visible.
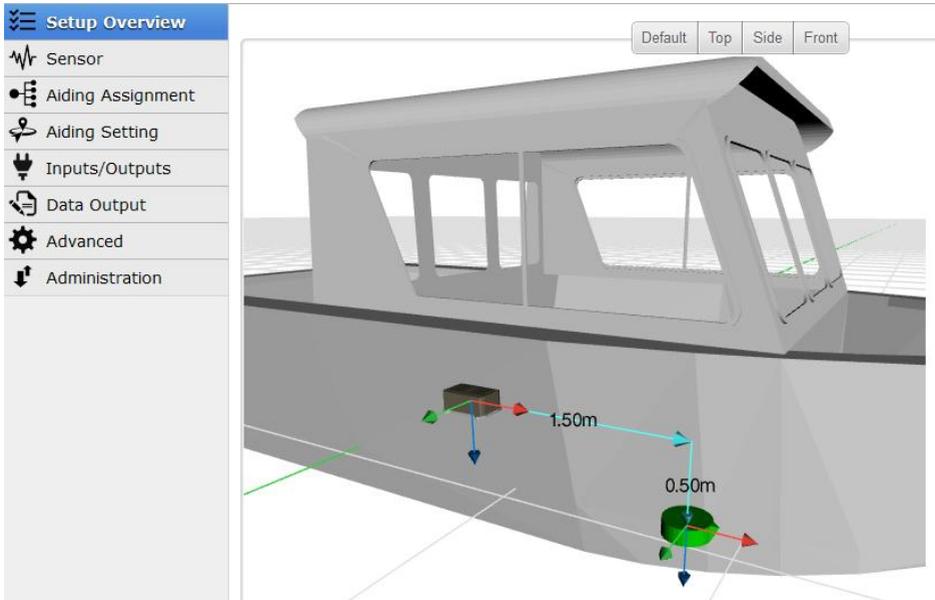
Operation

DVL Calibration

At each start, the DVL will be automatically calibrated by the INS. This requires:

- **Good GPS reception:** To Initialize and warm-up the INS and be used as a reference for DVL bias and gain estimations.
- **Bottom Tracking available:** shallow water may be necessary, depending on DVL range.
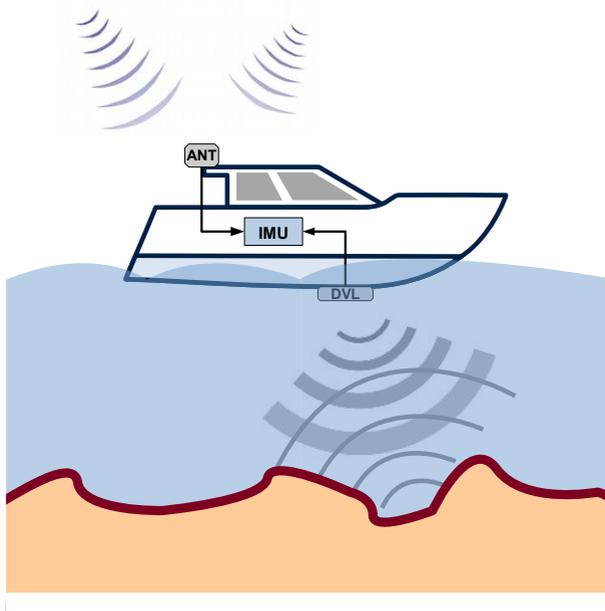
In case the GNSS reception or the bottom tracking is missing, the DVL can not be calibrated, **both are required during initialization.**

As in standard Marine Application there is no mandatory pattern to perform for the DVL calibration: A typical alignment pattern is shown in the next picture:
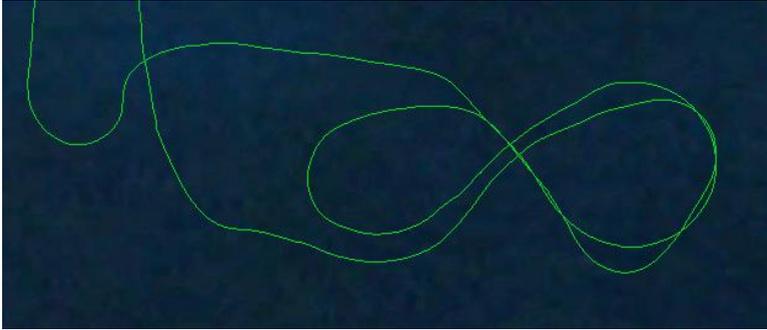
A few "eight" figures are sufficient most of the time, and the reported status flags will help you to validate that the alignment phase has ended.

Status check

The web page provides advanced status feedback to make sure the system is working properly.

The Alignment Status is switched to green when internal filter parameters have converged and the system can achieve optimum accuracy. Other quality indicators focus on the accuracy of individual outputs (orientation, position, velocity).

Once these status flags are green, you can start your survey!

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Data check

You can also check the DVL data directly on sbgCenter:
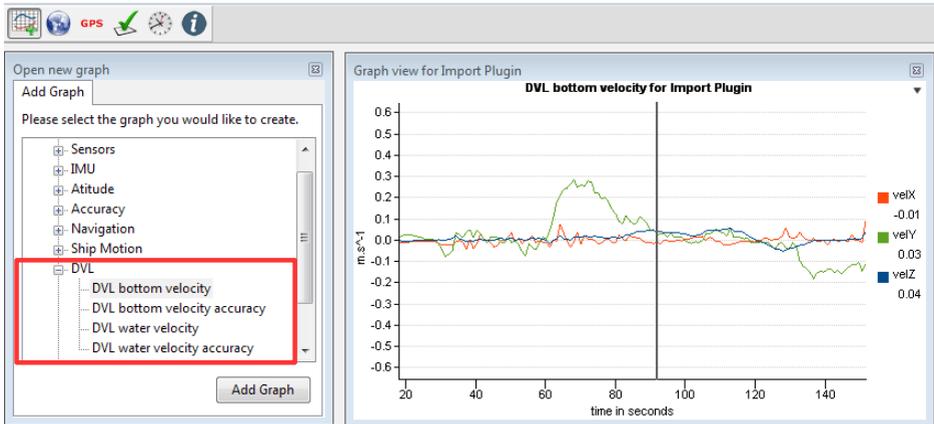
The requires that you output the DVL Bottom Track and DVL Water Layer in the Data Output section.

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