Technical Note

Use of the Compass in an EdgeTech Side Scan Sonar

This Technical Note is designed to address some of the questions that typically arise with regard to the compasses fitted to EdgeTech Scan Sonars, and their use.

The first part of this Note covers the compasses in 4125 and 4200 towfish, and the second part the improved compasses fitted to 4205 towfish.

Compasses in 4125 and 4200 towfish

Historically the compass units fitted to EdgeTech side scan sonar towfish (e.g. 4125 and 4200) have been magnetic field measurement devices that provide a heading relative to magnetic north.

When these were originally specified, it was not intended that the compass data be used in the processing of the side scan data. It was the intention that, along with the pitch and roll, this heading information would give the operator an indication of how the towfish was towing (e.g. to help in confirming that it is the fish motion affecting the data quality).

Heading sensors that rely purely on Magnetic field measurements suffer from a number of issues that makes them less than ideal for use in processing side scan data:

➢ The raw data is noisy, and whilst in principle it could be averaged out over a longer period to give a more stable heading, this is rarely done in practice, and applying the raw data to build a mosaic creates a very uneven image that is difficult to interpret and not of much real use.

➢ Whilst hard iron and soft iron compensations are applied once the sensor is installed in the towfish, to account for the effects of the towfish itself, the sensor can still be affected by rest of system. Towcable type, proximity to vessel etc all have a big impact. In theory a vessel / operation specific compensation routine could be undertaken to account for these, however, as the hard iron and soft iron compensations often require 3D motion of the towfish, running in field compensation routines is not practical.

➢ The sensor can also be affected by large metallic objects on the seabed, such as wrecks, pipelines, and seabed structures. These are the very objects that the user is often trying to identify and position.

➢ Plus of course there is the local magnetic declination to factor in, and the potential for ambiguity about whether, and where, this has been applied.

Hence why we have always recommended that course made good be used in the processing / mosaicing of the side scan sonar data, or for target positioning.

Verification procedures for these compasses

For these magnetic field measurement devices, the factory acceptance and verification tests include running hard iron and soft iron compensations at a magnetically quiet site once the sensor is installed in the towfish, and again at a magnetically quiet site, a verification to check the output relative to magnetic north.

Upgraded compass in 4205 towfish

The introduction of the 4205, has given us an opportunity to improve the performance of the heading sensor, by fitting a MEMS-based inertial motion sensor unit that combines data from built-in gyroscope, accelerometer, and magnetic field sensors. The data inputs are combined in a Kalman filter, so whilst it still uses the magnetic field sensors to determine magnetic north, the use of the rate gyro inputs means that the resultant output does not suffer from the noise issues of a purely magnetic sensor system.

So whilst the absolute heading is still reliant on magnetic field measurement, and as such subject to some of the limitations outlined above, the incorporation of other sensor data means that the relative heading is much more stable, and overall the sensor provides a more reliable output that is less susceptible to short term magnetic field variations.

Care still needs to be taken if using the compass data for mosaicing or target positioning, as there may be external magnetic fields that are not being adequately allowed for, and in particular care must be taken to ensure with the application of the local magnetic declination.

Verification procedures for the upgraded 4205 compasses

Once again, the factory acceptance and verification tests for this sensor are run at a magnetically quiet site and include running hard iron and soft iron compensations once the sensor is installed in the towfish, followed by a verification to check the accuracy of the output relative to true north.

In order to accommodate these tests, a fixture is used that in conjunction with the stable sensor output allows any misalignments between the mounted sensor and the tow fish longitudinal axis to be measured. The resultant offset is applied as a correction in the sensor software as part of the compass verification procedure.

Each towfish is accompanied by a compass verification certificate which confirms that the towfish compass meets specifications.

Options for applying magnetic declination

The sensor unit that provides heading has the ability to take a local latitude and longitude and apply a local magnetic declination adjustment to the heading measurements thus providing true north measurements as outputs.

A. By default, a latitude and longitude that lie on one of the agonic lines (zero magnetic declination) will be entered prior to shipping the system. This means that effectively no magnetic declination will be applied to the raw heading data, such that any magnetic declination corrections can be applied in post processing.

B. Alternatively, the user can enter local latitude, longitude and date, for the area in which they are operating and apply magnetic declination prior to outputting heading data from the sensor. However, this requires that the user run an application on the tow fish to enter and save the settings for each new site. If the user incorrectly applies the settings, or simply forgets to do this and leaves the settings from a previous site, the heading measurements will be incorrect.

For this reason, we recommend Option A, not applying the correction in the sensor and instead applying the magnetic declination in post processing. If you do want to use the method outlined in Option B, then please contact EdgeTech Customer Service.