Till now modern navigation and positioning systems have been using rather general output signals for rudder control operation while manoeuvring, because the force generated at specific rudder angles is not available to the navigation system, resulting in less efficient manoeuvring. The new Becker Intelligent Monitoring System (BIMS) is now able to directly measure rudder forces and to interface them with the ship’s navigation systems as well as visualise rudder lift on the bridge, thus improving manoeuvrability and allowing energy-saving autopilot operation and more efficient dynamic positioning.

- Determination of rudder lift, drag and torque
- Serial and network interfaces to navigation systems such as autopilot (AP) and dynamic positioning (DP) systems
- Fewer rudder motions during AP and DP operation
- Energy savings and emission reduction through improved efficiency
- Showing rudder force on the bridge and wings makes manoeuvring safer
- Reduced wear and costs of maintaining steering gear and rudder
- GL Type Approval
Measuring rudder force

The rudder force measurement arrangement is designed for full spade rudders, because, unlike semi spade rudders, they provide a mechanically-explicit, statically-determined system. Using strain gauges, the BIMS measures the bending of the rudder stock and from this calculates rudder lift, drag and torque in relation to the ship’s coordinate system. The Becker Intelligent Monitoring System is certified and type approved by Germanischer Lloyd (GL).

Fast and easy BIMS installation

The Becker Intelligent Monitoring System consists of strain gauges mounted on the rudder stock, including cabling, a processing unit and optional bridge displays. The BIMS can be installed and optionally extended in three different ways, allowing it to flexibly meet customer needs:

- Preparation of rudder stock with strain gauges to be ready for later installation of the complete system
- Installation of the BIMS processing unit for measurements and interfacing rudder force data with navigation systems
- Installation of BIMS bridge displays to show rudder force on bridge and wings

Preparation of the rudder stock should be done at an early stage of new building, while installation of the processing unit and bridge display may take place at any suitable time, including during ship operations, provided that cable connections from the steering gear deck to the bridge are available.

BIMS processing unit and bridge display

The BIMS processing unit mounted in the steering gear room calculates and interfaces rudder forces. Rudder force information can be sent via serial (NMEA) and network interfaces to any navigation control system connected to it. Additionally, current rudder force can be visualised on the BIMS bridge display, which provides a variety of display modes showing rudder response, rudder lift and force history.
**BIMS for safer manoeuvring**

By displaying rudder force to the Officer of the Watch, the BIMS ensures optimal rudder performance for safely manoeuvring even in shallow, coastal or restricted waterways. It can detect low rudder forces, indicating where poor rudder response or even rudder stall can be expected under current conditions. This enables the Officer of the Watch to take appropriate countermeasures in advance, by applying the optimum rudder angle to achieve maximum rudder force and manoeuvrability in emergency situations such as a last-minute manoeuvres or during a banking effect.

**BIMS for energy-saving autopilot operation**

Travelling at a speed of 14 knots on autopilot, the rudder of a 100,000 dwt tanker moves continuously within a range of +/- 5 degrees, leading to a significant increase in fuel consumption. Due to direct force feedback made available by measuring rudder force, interfacing the BIMS to the ship’s autopilot navigation system results in fewer rudder movements in AP mode. Decreasing control of rudder operation along with increasing manoeuvrability in autopilot mode thus results in energy savings with a corresponding reduction in emissions of CO₂, NOₓ, and SO₂. Furthermore, the use of the BIMS for autopilot operation is in accordance with Article 5 of the Ship Energy Efficiency Management Plan (SEEMP), which gives guidance on best practices for fuel-efficient operation of ships by optimum use of rudder and heading control systems.

**BIMS for efficient dynamic positioning**

The use of conventional rudder-propeller arrangements for dynamic positioning on offshore vessels has many advantages over azimuth thrusters. They include there being no limit on installed power, good response times and high course-keeping performance. BIMS provides the perfect solution for supporting and improving the DP system in this case. Precise measurement of rudder force lead to better station-keeping performance as the DP model is better updated, resulting in more reliable and safe dynamic positioning/manoeuvring operations. Additionally, the energy savings resulting from fewer rudder movements in DP mode are substantial due to its operating characteristics. Considering that offshore vessels will in future be operating in “Emission Controlled Areas” (ECA), requiring the use of expensive desulfurised fuel, savings will be increasing even further. A subsequent reduction in wear on the bearings will also result in an extension of maintenance intervals, increasing overall vessel availability to such an extent that a shorter return on investment can be achieved.

www.becker-marine-systems.com
First orders: from prototype to 13,000 TEU giants

The first prototype of Becker’s innovative BIMS was installed and approved on Wallenius’ car carrier Titania at the end of 2011. Following over a year of extensive data recording, analysis and development work spent further improving the rudder force measurement arrangement in the end lead to the successful market-launch of the Becker Intelligent Monitoring System, the world’s first and only system capable measuring and processing the forces generated by a ship’s rudder. At the end of 2012 the first BIMS system ordered was already installed and brought into operation on Volstads’ new OCV Grand Canyon. On board the Grand Canyon rudder force data measured by BIMS is utilised by the Kongsberg Maritime DP System to improve DP performance. For the new 13,200 TEU Hamburg Express series of Hapag-Lloyd the rudder stocks are being prepared and equipped with measurement sensors to allow a later installation of the BIMS at any time even when the ship is in operation. At the beginning of 2013 the first ship of this series, the New York Express, was equipped with the complete BIMS system, including a processing unit in the steering gear room, a rudder force display on the bridge and an interface to the ship’s autopilot.