

# Torductor<sup>®</sup>-S

Torque measurement with Pressductor<sup>®</sup> Technology



Real feedback control at all times

# Torductor<sup>®</sup>-S

## The technology that makes champions

The ABB Torductor<sup>®</sup>-S represents unbeatable transducer performance, thanks to its unique combination of accuracy, overload capacity and ability to withstand harsh environments.

For a number of leading racing teams around the world the ABB Torductor<sup>®</sup>-S is the obvious choice when it comes to accurate and reliable torque measurement in a demanding environment.

With a record of several years in the toughest racing series the ABB Torductor<sup>®</sup>-S has proven that a measurement quality close to laboratory standard can be achieved in an environment that is a nightmare for any measurement equipment.

With Torductor<sup>®</sup>-S, reliable measurement data is achieved without interruption, lap after lap, race after race.

The true non-contact measurement of the sensor guarantees a reliable measurement even in the presence of oil, dirt and other contaminants. The compact design of the sensor makes it possible to integrate directly in the gearbox or transmission.

ABB works together with several leading racing teams in a number of different demanding racing disciplines and has a record as a multiple champion together with these teams.

A major feature of Torductor<sup>®</sup>-S is the ability to operate in hostile environments with long-term stability and a high degree of accuracy due to the robust design and high output signal.

# Rac

### On-track dyno

Torductor<sup>®</sup>-S is an excellent tool to use for calibration and supervision of the entire powertrain of the vehicle. In effect a Torductor-S<sup>®</sup> in the powertrain gives the vehicle an on-board dynamometer.

An effective use of the sensor makes it an invaluable tool during all phases of racing.

### Designed for racing conditions

The robust and durable design of the Torductor<sup>®</sup>-S ensures reliable and continuous real-time torque measurement at all times. It withstands the temperatures and vibration levels that exist in a racing car. It is also resistant to surface scratches and magnetic crack testing without any detrimental effect on the sensor. Finally, the sensor is calibrated at the factory. No recalibration or break-in is required.

A torque sensor that can act  
as an on-track dyno





- Robust and durable
- True non-contact measurement
- Compact design
- Developed for volume production

No recalibration  
or break-in  
is needed

### Engine calibration

With Torductor®-S in the powertrain the engine can be tuned before the race to its optimum performance in the vehicle. This makes it possible to bridge the differences between the test rig to those in the actual vehicle on the track. During the race the sensor provides an invaluable tool to monitor the wear and degradation of the engine. Any undesired and unpredicted changes can be detected before they are noted by the driver. With Torductor®-S it is possible to obtain and maintain an actual map of the engine at all times.

### Condition based maintenance

A desired situation for any machinery is to have a CBM (Condition Based Maintenance) that is related to the actual wear and loading of the machine parts. With Torductor®-S actual measured load data is provided instead of load data estimated with various means.

With actual torque data, wear on powertrain parts can be monitored with much better precision and lifetime calculations can be performed.



Torductor®-S is the ideal choice for torque measurement in areas where cost and reliability used to make this impossible.



### Improved gearshifts

In the transmission Torductor®-S can be used to monitor and control transients and oscillations that occur due to backlash, wheelslip, or from the road surface.

During gearshift it can be used to measure the speed and performance of every single gearshift in order to optimize speed and efficiency. This is particularly important in order to synchronize the engine and gearshift during the engagement of geardogs.

Another effective use of the torque sensor is as an overload protection, eliminating the need for overdesign of transmission components.



Torductor®-S is the ideal choice for the highly stressed gearbox input shaft in Formula 1, with rotational speeds of 19,000 rpm and temperatures in excess of 200°C.

### ...and more

In combination with the above a Torductor®-S in the race car can be used for a lot more. For instance it can be used as an instrument to monitor track conditions. It can also be used in KERS (Kinetic Energy Recovery Systems) to measure energy take-up or release.

# Automotive

## Real-time torque measurement

With Torductor<sup>®</sup>-S the engine control system has access to direct instantaneous information about the actual mechanical output from the engine. This information is available for every single combustion and can be used throughout the lifetime of the engine. This opens up unique possibilities to control and maintain correct combustion control at all times. For new combustion schemes this kind of feedback can be the key for a stable and reliable control of the engine.

Torductor<sup>®</sup>-S enables real feedback control of the engine output at all times.

## Engine performance

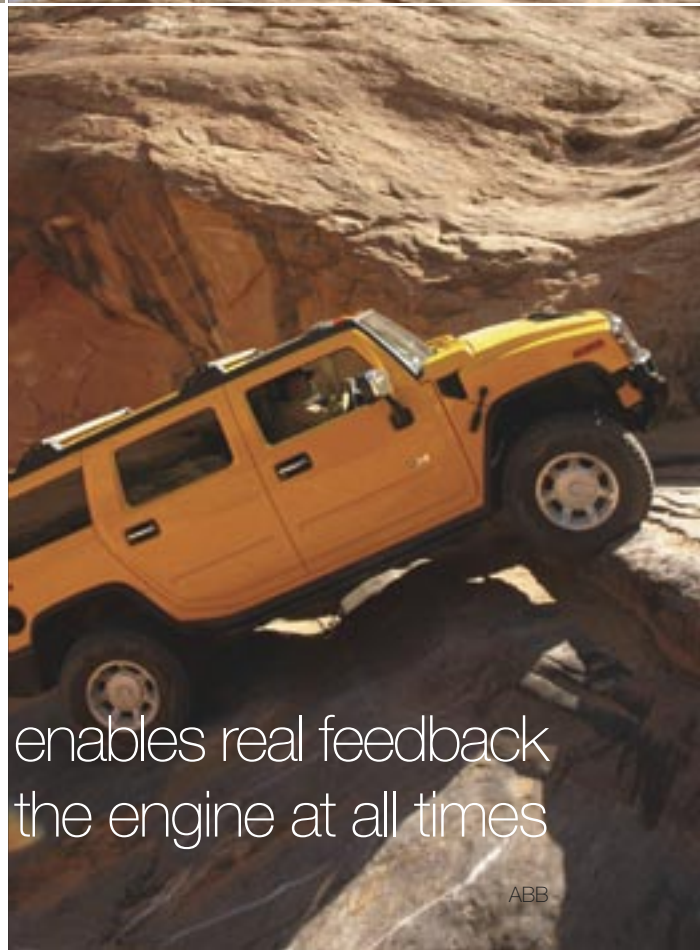
The ABB Torductor<sup>®</sup>-S not only measures the overall torque, but also subtle changes in torque during individual combustions. This makes it capable of engine diagnostics such as misfire detection and control of cylinder balance. The sensor provides a true measure of the actual mechanical output of the engine and can be used to continuously improve and maintain aspects such as driveability, tip-in/tip-out and startability. For a torque based EMS (Engine Management System) it provides an ideal reference signal that allows the engine to continuously adapt for best performance.

Using the Torductor<sup>®</sup>-S to monitor gearshifts will provide critical information that will improve both comfort levels and shift speed.



## Alternative combustion concepts

New combustion concepts such as LTC (Low Temperature Combustion), PPC (Partially Pre-mixed Combustion) or HCCI (Homogeneous Charge Compression Ignition) are pressing the need for real feedback control. This is especially important in combination with alternative fuels. For those concepts Torductor<sup>®</sup>-S can provide a key component to reach their full potential under changing circumstances. With Torductor<sup>®</sup>-S the control system can keep the combustion in balance within each operation mode, manage mode shifts between different combustion modes and keep a close control of the combustion at each combustion cycle under both steady state and transient operation.



Torductor<sup>®</sup>-S enables real feedback control of the engine at all times



## Hybrids

In hybrid vehicles Torductor®-S can be used to control the intricate balance between electric motors and combustion engine. Since the sensor gives a true signal of the total output of the system it can be used to monitor the shift quality between different drive modes and to control the performance during normal drive. With Torductor®-S the hybrid drive can be used as an active damper of the powertrain. With its strong immunity to magnetic fields Torductor®-S is well suited to be used in combination with electric machines.



## Power steering

The feeling and performance of an electric or semi-electric power steering system is highly dependent on the characteristics of the torque sensor. Torductor®-S exhibits features such as high overload capacity and non-compliance, which are essential for a distinct and quick response of the system.

# otive

## Transmission management

In the transmission Torductor®-S can be used to reveal detailed information about all transients and oscillations that can occur during normal driving, take-off, gearshifts, rough road and other transient operations. This can be used to continuously monitor and control the performance of the transmission.

In combination with automatic or semiautomatic transmissions such as AMTs, DCTs or CVTs Torductor®-S provides a perfect tool to optimize the speed and efficiency of gearshifts and to continuously adapt the system to compensate for wear, temperature and other changing conditions. It can also be used as an overload protection, eliminating the need for overdesign of transmission components.

## Proven technology

Torductor®-S can be applied in production cars and trucks and also provide the cutting edge over the competition in motorsport. Torductor®-S has been proven in close cooperation with many of the major car manufacturers.



# Other applications

Several industrial processes use torque on rotating shafts as a primary means of operation. Although torque is the desired quantity, only indirect means are usually available to measure the torque, such as motor current, air pressure, or reaction force. The compact dimensions of Torductor®-S allow installation directly in the powertrain of the machinery, without need for major modifications.

## Bicycles

For bicycles, where torque sensors have not been used due to size or cost, Torductor®-S is the ideal choice.

With the compact design of the sensor it can be installed inside the bottom bracket of a standard bicycle, where it continuously measures the effort of the cyclist on the road. In power assisted bicycles the torque signal can be used for a true correlation of the pedaling effort of the cyclist to the power output of the motor.



Torductor®-S fits easily inside the bottom bracket of a standard bicycle.



## Aerospace

The aerospace industry, with high demands on performance and reliability, makes Torductor®-S well suited for torque measuring applications in this area. The temperature durability of the sensor makes it possible to integrate in close vicinity to the combustion chamber. With actual torque data, wear on engine parts can be monitored and lifetime calculations can be performed.



## Nutrunners

In handheld tools such as pulse nutrunners, Torductor®-S can be installed on the output shaft, thereby directly measuring the actual tightening torque. The compact and flexible design of the sensor allows for an integration appropriate to endure the vibrations within the tool. The fast response of the sensor ensures an accurate measure of the short torque pulses.

## Rotating shafts

In any area requiring the monitoring or control of a rotating shaft Torductor®-S opens up completely new possibilities. Torductor®-S operates equally well on static shafts and rotation up to over 20,000 rpm.



# Technology

The design of Torductor®-S gives a true non-contact and rugged torque sensor without any moving parts. Since the sensor is part of the load-carrying shaft, the measured torque is the true transmitted torque. This enables Torductor®-S to combine high accuracy with high overload capacity and fast response at all times. A high output signal ensures integrity against electrical or magnetic interference from the surroundings.

Torductor®-S is designed to work in harsh environments where other sensors have poor reliability. The typical environment found within an engine powertrain in terms of vibrations, temperature, lubricants or magnetic components is no problem for the sensor.

Even if the sensor is based on magnetic fields for its operation it is virtually completely immune

to magnetic fields in the surroundings. The surface of the sensor is resistant to scratches and the sensor shaft can also withstand magnetic crack testing that is widely used within racing.

Torductor®-S is the ideal choice for measurement under demanding and hostile conditions.



The measuring principle of Torductor®-S is based on the magnetoelastic property of ferromagnetic materials. In the ABB Torductor®-S torque sensor this leads to changes in the magnetic flux depending on the actual torque in the shaft. The flux change is converted into a high output signal proportional to the torque. This gives a rugged sensor without moving parts.



ABB Force Measurement places a high value on research into sensor design, materials and applications.

## R&D

ABB Force Measurement places a high value on research into sensor design, materials and applications. With a team of highly qualified engineers and scientists, we have developed some of the most advanced sensors of their kind. We have a strong commitment to constantly improve our technology and intend to continue keeping our products at the leading edge.

With our assistance you will achieve a competitive advantage using up-to-date torque measuring technology developed by ABB.

Together with ABB Force Measurement you will create a competitive advantage using up-to-date torque measuring technology.

# Technology



ABB ([www.abb.com](http://www.abb.com)) is a leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 111,000 people.

ABB Automation Technologies is the global market leader in automation technology. We provide products, software and services for the automation and optimization of discrete, process and batch manufacturing operations. Key technologies include measurement and control, instrumentation, process analysis, drives and motors, power electronics, robots and low-voltage products, all geared toward one common Industrial IT architecture for real-time automation and information solutions throughout a business.

ABB Force Measurement is a business unit within ABB Automation Technologies. It provides equipment for accurate, reliable measurement and control in a broad range of applications in the metal, paper, marine and automotive industries.



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