

INTERVIEW

Customer testimony: Agco Fendt

Where is the smart actuator located in the tractor, and what role does it perform?

The Smart Actuator is assembled on the outer part of the transmission housing and is therefore exposed to all kinds of difficult environmental conditions. The purpose of the actuator is to transform the electronic commands coming from the control cab and the automatic control algorithms into regulating movements in the transmission. It is the interface between the transmission's electronic control unit (ECU) and the mechanical drive unit of the continuously variable hydrostatic transmission with torque derivation (Vario Drive) that delivers the power needed for propulsion.

The smart actuator combines monitoring electronics located beside the electric motor with CAN-Bus interfaces and position probes. What was your reason for deciding on an integrated unit instead of distributed functions?

We decided on an integrated function to facilitate maintenance of the whole system, and in order to obtain a clean interface between the electronic control and the mechanical driving of the transmission. This results in a clear division of the responsibilities and functions of the product. Stringent specifications in the areas of vibration, seal, mechanical loads, temperature and electromagnetic compatibility require a robust unit with simple interfaces to ensure reliable operation of the system.

The design of the stageless transmission with smart actuator gives AGCO a unique position in the market. What benefits do the end users get from it?

The VarioDrive transmissions combined with the smart actuator are the key element of the innovative continuously variable transmission technology offered by Fendt. The high quality of the regulation of the transmission ratio of the main transmission is a clear benefit for the end user: the user benefits from high precision regulation (over the full regulating interval), quick adjustment (just 2.5 s between the maximum transmission ratios in both directions of motion) as well as the security and reliability of the setting (signals are read from two sensors). In case of failure, an accelerated analytic function is available for



Rainer Hofmann,
R&D, Technical Manager



Robert Heisler,
R&D, Product Manager

the mechanical and electronic parts. Also, the possibility of quick replacement with a minimum downtime is significant for the end user. In the event of failure, operation is guaranteed by a backup actuator system.

What future do you see for this technology in your range of

applications?

Deployment of the system in all Fendt Vario product lines and extension of its use to other applications in the tractors.

SONCEBOZ was not an Agco-Fendt supplier before this project. What criteria played in our favor in this strategic decision?

The decisive factors for us were the existing comprehensive expertise in the areas of electronics, drives, and mechanics, from development to industrialization; with internal component production and assembly. The range of products, the industrial references, the appearance of Sonceboz's production lines and the company's performance in audits also played an important role cost competitiveness is always important and a cost analysis was a deciding factor as well.

What technical challenges had to be resolved during development?

Demanding specifications with respect to precision of position and repeatability under all conditions of use, taking into account all factors that affect the use of a tractor.

How did co-development with our team work out?

Concrete and practical proposals from a very motivated team. Communicative, open and pleasant relationship at a personal level. In summary, a high level of cooperation on both sides with demanding requirements.

Now that the smart actuator has been in production for two years, can you give us your impressions so far?

We are happy that we have had very high levels of on-time delivery and product reliability.

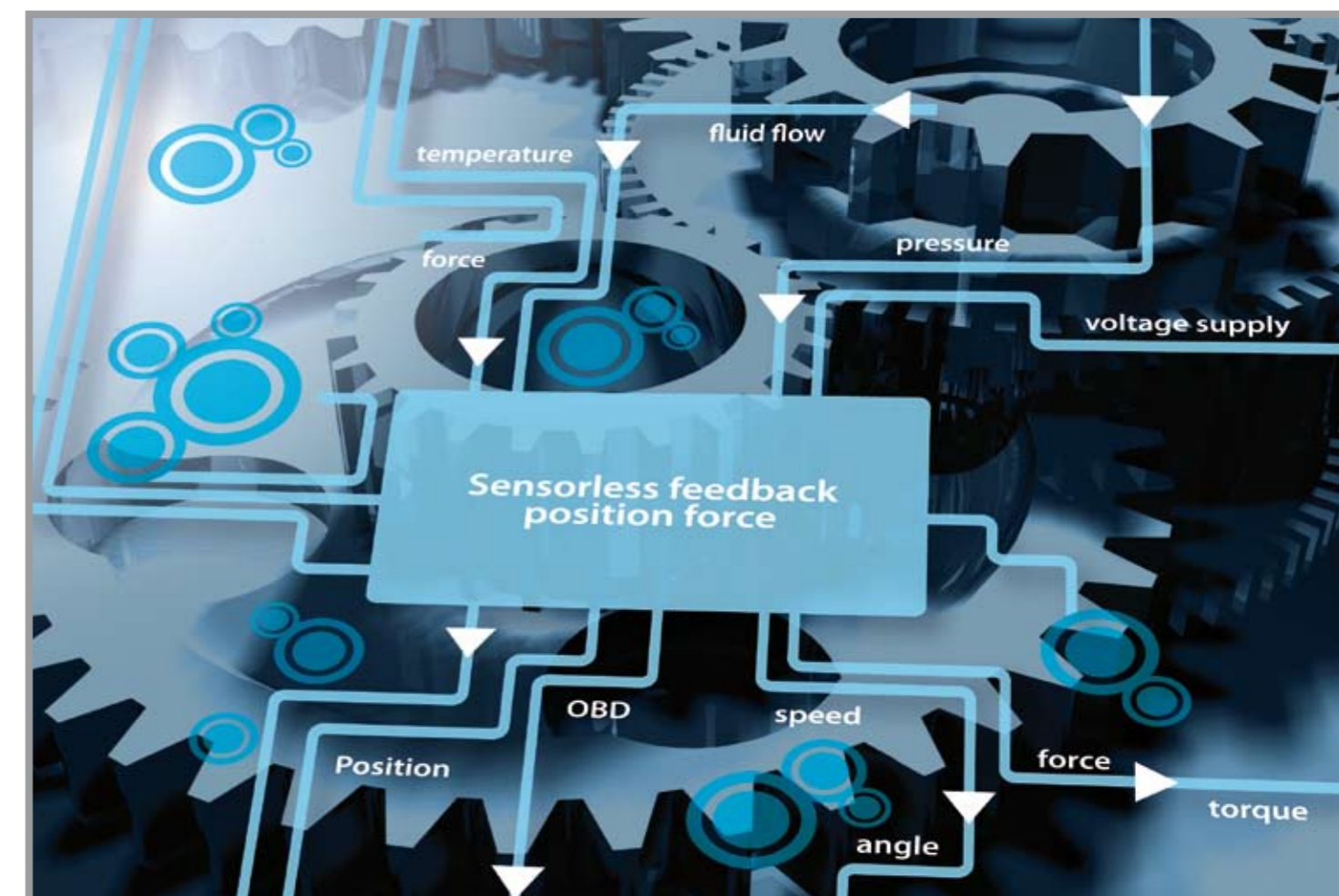


Divide et impera

Divide and rule! This strategy from Roman politics is also applicable to developing solutions for complex problems. The increasing complexity of system subassemblies in vehicles, machines and appliances are actually better controlled by splitting them into self-contained components. Probes and intelligent actuators arranged in a network and exchanging data over a BUS system via sequenced commands are becoming the basis for the efficiency, safety and comfort of modern technical systems. SONCEBOZ has a long history in the development and production of motors and actuators, in both the fields of mechanics and electronics. This experience, combined with our ability to create reliable solutions for difficult environmental conditions, is still the foundation for our successful cooperation with customers in many industry sectors. This edition of "Move" will give you a glimpse of this cooperation.

H. Trummer

Director Mechatronic Division



Intelligence and performance

Robustness, precision, reliability, and safety are the characteristics expected from a "smart actuator". These characteristics along with diagnostic functionality provide a complete solution in modern applications. In addition to its mechanical performance, the integrated electronics of the actuator need to be robust so that it can efficiently control and monitor the motor.

These days, motors can no longer just respond to simple commands, they need to include an analytic and information processing loop. This iterative cycle must be established between each peripheral system to be able to communicate with the central processing unit, and in turn, allow them to control their own operation. The miniaturization of electronic components and the drop in the cost of silicon allow this functional integration to become widespread. Greater computing power is available, but the challenge is to maintain a highly compact size. Software

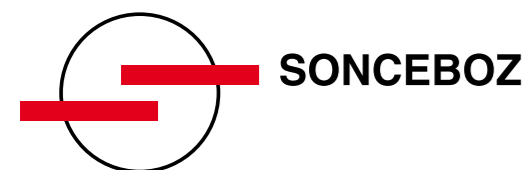
expertise therefore goes hand in hand with mastery of mechanics in devising the best possible physical and functional integration. Smart actuators are also able to provide information on the environment in which the client application operates, such as temperature, supply voltage, current consumption, etc. Using redundant monitoring systems, the smart actuator detects, diagnoses and reports on potential malfunctions. It can then enter a reduced functionality mode, where its priority is to make sure

the whole system remains safe until a repair is performed. The recorded monitoring information simplifies the maintenance operation, thereby reducing the risk of unnecessary replacement of functional components.

As a result of the benefits it provides, the smart actuator will end up being used in numerous industrial applications where intelligence, precision and reliability are required. This performance is fully utilized when environmental constraints and technical specifications are high.

SONCEBOZ SA

CH-2605 Sonceboz
Tél. : +41 (0) 32 488 11 11
Fax : +41 (0) 32 488 11 00
info@sonceboz.com
www.sonceboz.com



Case study

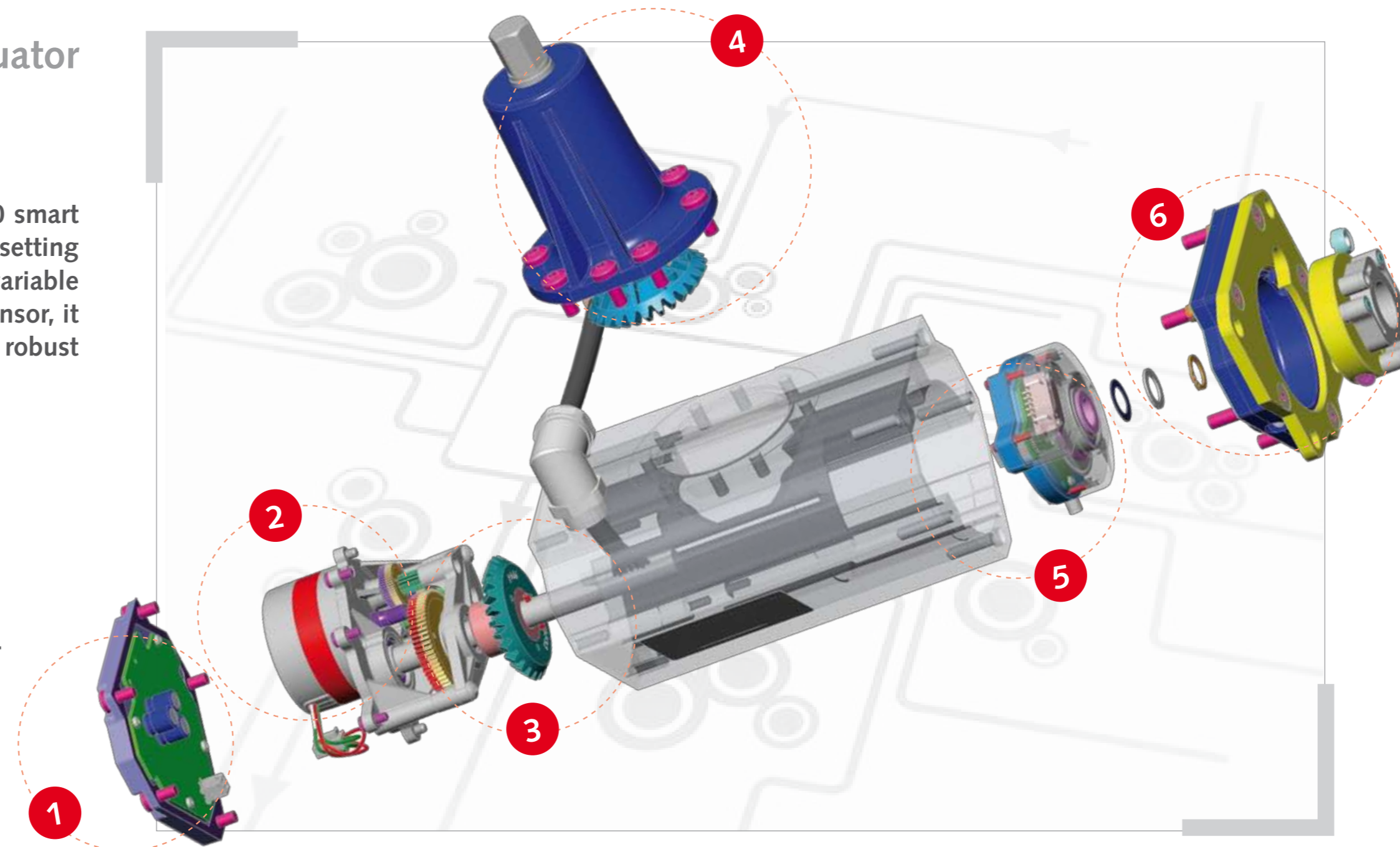
An intelligent transmission in extreme conditions

A close-up look at an 8960 series smart actuator working in a tractor transmission.

Used on an agricultural vehicle, the purpose of the 8960 smart actuator is to provide a precise, high-resolution angular setting that determines the reduction ratio of a continuously variable transmission (CVT). Used together with a redundant sensor, it is part of a safety circuit in the vehicle. The application requires a robust actuator that can withstand the following conditions:

- Severe Vibrations
- Operate in Extreme Temperatures
- Waterproof
- Dustproof (IP 6K9K)
- Withstand Electromagnetic Interference
- Perform to an Expected Lifetime of 20,000 hours.

Operating in such an environment, the 8960 system must respond quickly and precisely to a position signal, while at the same time guaranteeing that it can overcome a dynamic torque of 2.5 Nm. ▶▶



- 1 Electronics**
CAN interface
2.5 A motor control
- 2 Motor**
Based on a 1.5' - 200 steps/t
hybrid stepper
- 3 Reducer with no backlash**
3 stages, reduction ratios from 1 to 40
- 4 Safety system**
Allows manual control of the output shaft
in case of problems
- 5 Optical/magnetic sensors**
Resolution of 8,000 increments/revolution
with magnetic redundant system
- 6 Client interface**
Via flexible coupling

Markets



▶▶ Even in disabled mode, it has to guarantee that a torque of less than 1Nm from the transmission will not move the output shaft and ensure that the position of the shaft will be maintained. The 8960 system is controlled via a joystick located in the vehicle's cabin, which sends angular positioning messages to the unit via a CAN communications bus. A precision sensor monitors the position of the output shaft. If communications fail, supply power is lost or the output shaft becomes locked, the "On Board Diagnostic" function allows information to be sent to the central processing unit. The smart logic in the actuator will then decide to adjust speed or torque in the system.