

Sensing the load and adapting the phase current

The Loadsense drives by Sonceboz comprises power electronics and an integrated controller. The products featuring brushless motors provide CANopen connectivity and are suitable also for “outdoor” applications.

At the device level the Loadsense drive technology represents a first step towards decentralized control, whereby existing modules – in the field of actuation these are a motor, a transmitter, and the drive electronics – are equipped with a CANopen interface. In order for decentralized actuators and sensors to satisfy requirements regarding reliability, working life, and often unfavorable environmental conditions, it is advisable that such systems are designed as integrated mechatronic units. The family of Loadsense drives from Sonceboz, is an example of such an approach. The motor adapts permanently the phase current to meet the torque load. This reduces the energy consumption.

A brushless multi-pole motor is the drive technology used in conjunction with Loadsense. Such motors have already proved themselves in tough environments for many years, for example, in actuators for hydraulic systems on John Deere and Agco Fendt tractors. A robust magnetic sensor has been specially developed to detect the actual value for the position control loop. It offers high resolution, which permits evaluation of the load angle of the motor and thus creates an actual value equivalent to the motor load. This gives its name to the Loadsense drive family. The information on the load controls the motor current and thus ensures energy-efficient operation combined with low heat generation and smooth running. In addition, the motor can be controlled without restrictions right down to speeds of zero rotations per minute.

Suitable for outdoor applications

When installed in a housing of protection class IP67 and an extended temperature range of $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$, new fields of application open up, for example in outdoor areas or in applications that are greatly exposed to dust or moisture. Many industrial solutions are unsuitable due to a lack of impermeability or temperature stability. The high level of integration of motor, transmitter, driver, and control electronics enable Sonceboz to reduce the number of components and internal interfaces, and permit a very compact physical design. With a power supply of just 24 V_{DC} to 48 V_{DC} , the drive can also be powered directly from batteries without requiring inverters. Furthermore, the drives can be integrated into complete systems by means of the CiA 402 CANopen device profile for drives and motion control, which is a standard for many client applications, such as tooling machines or solar plants.



Figure 1: The Loadsense drives come in Nema 34 format (Photo: Sonceboz)

It is precisely such decentralized systems that demand mechatronic drive units, which can be easily combined and pre-tested, which encapsulate the complexity and thus contribute to the clarity of the concept. The integrated electronics of the drive family provide analog and digital inputs and outputs that can be used for specific control tasks directly in the motor environment. Integration into an overall system is achieved by means of standardized communications interfaces such as CANopen. Due to the CANopen integration, the driver offers complete versatility to the user: SDO configuration to tackle most application's needs; and PDO mapping for tailored, fast and dedicated data exchanges.

Multiple modes of control such as position, speed, etc., enable one solution for multiple purposes. Moreover, it was an easy integration for Sonceboz, as an efficient stack of the CiA 301 application-layer was bought and quickly set up in the micro-controller. Not only can manufacturers take advantage of the CANopen integration, it is also the client that goes from a complex centralized clock and direction control system, to a simple CANopen communication and Loadsense motor. In the end, a smarter and simpler solution with better performances is achieved.

For specific functions, there exists the option of creating application-specific software and transferring them to the drive for local execution. Many applications not only demand the shortest possible downtime for maintenance purposes but also flexible adaptation to suit new applications. Downloading software functions via the network provides an appealing basis for such adaptations. The inbuilt diagnostic functions also contribute to minimizing downtimes. They facilitate access for remote maintenance and thus contribute to the high availability of the plant.

Many applications for industrial positioning drives and intermittent drives (S5 mode) demand torques in the Nm range at low to medium speeds of 1 000 rotations per minute. Geared motors are often used for such applications. However depending on the loadings, the gearboxes may ▷

quickly come up against the limits of their working life. The only wearing parts are the two sets of ball bearings on the motor. This means that the actuator can even withstand continual switching between high acceleration and braking torques without any problems, so that well over 40 000 operating hours are reliably achievable at torques up to 8 Nm directly at the motor shaft. A direct drive eliminates the mechanical play on the gearbox. In conjunction with high-resolution sensors with a resolution of 0,06° per increment this enables them to be used even for high-precision applications.

The smooth running, low generation of heat, and long working life, mean that the drives are used in medical devices for blood pumps, for example. The compact physical design, the programmable control functions, and the direct drive eliminating the gearbox for high availability allow it to satisfy the requirements of manufacturers of intra-logistics systems such as roller conveyors. Their overall efficiency and their power supply of 24 V_{DC} to 48 V_{DC} make them a suitable drive module for mobile machines, since they do not require a complex power system with inverters. Applications for direct drives outdoors, where dust-tight and watertight characteristics coupled with freedom from maintenance for decades of operation are required, for instance, heliostat drives in CSP solar panel installations.

Sonceboz specializes in developing innovative solutions for demanding drive problems in industrial, medical, and automotive applications, and undertakes large series production of industrialized drives, always with the aspiration of achieving 0 parts per million. The challenges of a hostile environment such as high levels of vibration, extreme temperatures, high IP protection ratings, long working life, flexible integration within tight spaces and miniaturization of the control electronics with network communications and sensors do not present a problem for Sonceboz mechatronic drive systems. This is, because, for the Loadsense drive family, as with all other Sonceboz products, the customer benefits from the expertise of the Swiss company, built up through decades of experience and fundamental research in the various fields, and serving as the basis for new solutions. With its product range designed on the modular principle, the company offers the customer maximum flexibility with solutions to satisfy the customer's individual requirements. ◀

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