Technical Paper

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Selecting servobrakes correctly and monitoring them intelligently

Servo systems are the standard nowadays in a large number of drives. Safety brakes for holding a specific position and for emergency stop situations play an important role here. In addition to the correct dimensioning, the monitoring of servo brakes is a sensitive issue, especially if the brakes are integrated into the systems or are very small. Up to now, they have been considered unmonitorable in these cases - a real challenge in times of Industry 4.0 and a growing need for data from the machine. With a combination of technically leading brake technology and innovative monitoring solutions, the hurdles can be overcome, servo systems optimally secured and valuable data obtained from the brakes.

Whether in industrial robots, vertical axes in machine tools or in servo axes in medical engineering - these days servo brakes can be found in many different applications. The usual design of servo systems includes safety brakes, which safely hold the position of the drive at standstill and bring it safely to a standstill in an emergency, such as a power failure. The correct selection of safety brakes as well as their proper integration into the overall system are decisive for reliable function. Safety brakes according to the fail-safe principle are the first choice here, as these brakes are closed in de-energised condition. They provide the required braking torque even in the event of an emergency stop, a power failure or in case of an interruption in the power supply caused by cable breakage, for example. To ensure that the safety brakes also provide sufficient friction work in emergency stop situations and brake movements with a defined braking torque, a friction lining developed for this purpose with a corresponding steel counter friction surface is required.

Servo brakes not always integrated

In the industry, systems are common in which the brake is already integrated, i.e. installed together with the other components in one housing. Users can choose between classic servo brakes in the motor, with hub and toothed rotor or so-called pad solutions with large inner diameter. This installation situation involves specific challenges. Firstly, the temperature: In a servo motor, the temperature

can reach up to 120° C. In order to function safely and reliably even in this high temperature range, all brake components must be designed for such temperatures. In the motor, servo brakes are preferably installed into the A-bearing shield, because the fixed bearing is located here and temperature expansions cannot influence the brake severely. However, brakes from renowned manufacturers can also be integrated into the B-bearing side of the motor without restriction, as here temperature expansions and bearing backlash do not influence the function and reliability of the brakes negatively. Alternatively, users can also make use of mounted brakes, which are attached to the motor in a modular fashion. High-quality servo brakes are also characterized by compact dimensions. Not only are they very lightweight, but also extremely fast when it comes to magnetic actuation. At the same time they display high performance density and wear resistance. Furthermore, the brakes impress users with their high permitted friction work during dynamic braking actions: For servo drives, normally load mass ratios (load/motor) of 3:1 or smaller are selected for the benefit of good control characteristics and high dynamics. On the brakes of renowned manufacturers, high permitted friction work and friction power values mean that load mass ratios of 30:1 and more are possible.
With these externally mounted brakes, condition monitoring via micro- or proximity switches is usually also possible, as has been customary up to now.

Integrated servo brakes - are they really unmonitorable?

The situation is different with integrated brakes. Previously, they were considered unmonitorable, as it was not possible to use switches or sensors due to the installation situation, the operating temperatures and the extremely small air gaps. This is a concern in view of the increasing networking of machines - keyword Industry 4.0. Of course, the control and regulation electronics of the servo system provide data that also allow conclusions to be drawn regarding the state of the overall system. But the safety brake itself remains silent. Even though in closed systems data from the brake would also be very helpful and would enable, for example, predictive maintenance. If, for instance, the friction lining reaches the end of its service lifetime, intelligent monitoring could provide timely warning. The maintenance date could then be scheduled long-term for a time window that is favorable in terms of the overall operating process. Monitoring is therefore also very useful for these safety brakes integrated in servo drives.

Sensorless monitoring: Safe and reliable

mayr® power transmission offers exactly these possibilities with its intelligent ROBA®-brake-checker module. It works without sensors. Instead, it detects the movement of the armature disk by analysing current and voltage, and knows what condition the brake is in. From the control cabinet! In addition to the switching condition, temperature and wear, it also monitors the pull-in distance or tensile force reserve, i.e. whether the magnet is still able to release the brake. On reaching the tensile force reserve, the ROBA®-brake-checker emits a warning signal early enough so that a certain operating time for the brake is still possible. During this time, maintenance is possible in a targeted manner, aligned to the working process. This in turn ensures higher system availability. In a further expansion stage, the module can also be integrated into a remote maintenance system via a suitable interface. This further reduces service times and costs.
If damage should occur nevertheless, the ROBA®-brake-checker provides users with significantly better analysis options. With previous solutions, such as contactless release monitoring, users are only able to see the failure and the destruction pattern. They do not know, however, why the error occurred. However, using the ROBA®-brake-checker, progressions are made visible and error analysis can be used and even transferred onto other user systems. All this data from malfunctions and normal operation thus supply valuable input for future improvements and optimizations.

Conclusion

Selecting the right brake for servo systems depends on several factors. Ideally, the brake concept takes all the factors, which are decisive for safety and reliability, into account. These factors include first of all reliable mechanics which function independently of temperatures and external influences. Secondly, the selection of the friction lining material plays an important role in ensuring a consistently high braking torque throughout the entire service lifetime, even in emergency stop situations. New, intelligent monitoring technology completes the concept and makes even integrated or very small servo brakes fit for the networked machine of the future. This is brake technology 4.0

Company portrait
The family-run company Mayr power transmission, which was founded in 1897, is a leading manufacturer of safety brakes, torque limiters and shaft couplings. These products

are primarily designed for application in electrically driven machines and systems. They can be found, amongst other things, in filling plants, machine tools, packaging and printing machines as well as in elevators, wind power plants and in the stage technology. The company is active in over 60 branches worldwide. Currently, approximately 700 employees work at the headquarters in Mauerstetten, in the Allgäu region. Worldwide, Mayr power transmission has more than 1200 employees. With production plants in Poland and China, sales subsidiaries in the USA, in France, Great Britain, Italy, Singapore and in Switzerland as well as 40 additional foreign representatives, the company is active around the globe.