

Exploring All Motor Options

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Siemens expanded line of 1FK7 servomotors allows for a 10 percent higher power output (courtesy of Siemens).



Harald Poesch

In 2010, Harald Poesch, product marketing manager, servomotors for Siemens Drive Technologies Division, published a technical paper on permanent-magnet, synchronous torque motors (*Ed's note: See PTE August 2010 for full article*). PTE recently caught up with Poesch to discuss the current and

future state of the servomotor industry as well as some insight into the latest servomotor offerings from Siemens.

Briefly discuss the current state of the servomotor industry, specifically after emerging from the recent economic crisis? Our servomotor is coupled with the machine builder business. After the global economic crisis, this market is recovering well. Regions such as China were not as strongly affected as others. Europe, and especially Germany, is recovering very quickly.

Looking forward, I see the servomotor business growing at a constant pace.

What industries will be the key to Siemens' continued success in motors—now and in the future? In addition to our presence in market segments like plastics, printing, machine tools, packaging, textiles, metalforming and others, we are active in cross segments such as converting, materials handling and safety-integrated drives. General motion control is also one of our focus segments. New markets such

as renewable energy or energy efficiency are part of our overall strategy—having already shown success in these areas. To be successful in the future means we have to be active in all different market segments. This means being the trusted partner in areas in which we are already active, along with developing new solutions in upcoming segments.

What are the most important factors in today's manufacturing environment that designers have to consider before selecting a motor? Besides the conventional approach—like motor type, speed, torque, accuracy and pricing, a machine builder, today, must consider additional aspects such as the machine's lifecycle—it's more important now than ever before. For example, energy savings and maintenance are two areas to consider. Highly efficient servomotors and maintenance-friendly motors with field-replaceable encoders, along with easy connection systems, are extremely important.

You wrote a technical article last year on the advantages of permanent magnet synchronous torque motors. Make a quick case for them once again. One reason to use a direct drive torque motor —when it comes to small windmills, a low-speed solution is necessary because the rotor is running at relatively low speeds. One solution for such windmills is using a reduction gearbox and a standard generator. By using a 1FW3 torque motor, the gearbox can be eliminated during the construction phase which gives you the advantage in the overall efficiency, product costs and maintenance costs. Another example using the advantage of the stiffness of a direct motor solution is a cast roll in film lines where very low speed ripple is required. By using a direct drive torque motor instead of a motor/gearbox combination, the overall ripple could be reduced.

Explain the significant differences (advantages/disadvantages) between a standard servomotor and a torque motor? The main difference between



The 1FK7 series offers two new connector systems, the Speed Connect System and the Drive-CLiQ.

a standard servomotor and a torque motor is the amount of pole-pairs. A torque motor has a greater number of pole pairs and; therefore, runs at a lower speed. This is because power is comparable and the torque motors have a high output torque.

In a conventional solution, a gearbox is used to reduce the motor's speed and increase torque.

The advantages for using a direct drive solution include:

- Highest stiffness, no backlash— inertia-ratio up to 1:1,000 is possible
- Low torque ripple compared to the motor-gearbox combination
- Higher total efficiencies are possible
- The hollow shaft can be used for additional benefits such as cooling
- Cost advantages to a technically comparable motor-gearbox solution

Very maintenance-friendly

Disadvantages include:

- Increased effort needed for the integration of a direct drive solution into the machine than using a motor/gearbox solution
- Mechatronics expertise is necessary, especially for built-in motors
- More expensive than a low-cost

standard motor-standard gear-box combination

What is the key role that mechatronics now play in the direct drives market? Basic mechatronics knowledge is necessary when using direct drive technology. The reason being—it's no longer possible to separate the electrical part from the mechanical part of a machine. Direct drive motors are rigidly connected to the mechanical part of the machine. Additional considerations about the bearings, the machine and the motor are necessary. Increased expertise in mechatronics is needed when using built-in motors where the motor is deeply integrated in the machine—or in other words, the machine is actually the motor. In such cases, the machine builder kind of becomes a motor builder, so every bit of knowledge about encoder systems, bearings and cooling is required.

Siemens recently expanded its 1FK7 servomotor family. What are the main features/key capabilities of the new high-inertia style of servomotors? Siemens now has the second generation of the 1FK7 servomotor family, which is an innovation from the first generation. The advantages from the first-generation 1FK7 still exist and

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the mechanical connection is the same as before, which makes it easy to change over. The full range of the first generation 1FK7 servomotor is still available.

A major advantage for the second generation, however, is the mechanical and thermal decoupled encoder, which can easily be exchanged during maintenance without having to exchange the entire motor. Since the encoder is always the weakest part of a motor, it extends the motor's lifecycle. The encoder system is also decoupled from the shaft, which makes it more resistant to vibration. Another advantage of such a decoupled system is the thermal isolation of the encoder. It allows a 10 percent higher power output for some types of the 1FK7-series as compared with the first generation.

Other advantages include new encoder types with up to 24-bit resolution/turn, a Speed Connect system for the power connector and the Drive-CLiQ connector for the encoder itself. These two connector systems allow the quick and easy connection to the motor.

What does this motor line provide that a potential customer might not find from the competition? The 1FK7 servomotor is a very compact permanent-magnet servomotor. It is available for 230 V and 400 V, speeds up to 6,000 rpm, 0.08 up to 37 Nm torque and is available in three different variations—compact, high dynamic and high inertia. Together with the decoupled encoder, the speed connector for the power cable and the Drive-CLiQ encoder system with integrated electronic nameplate recognition for easy commissioning with our SINAMICS drive system make the 1FK7 an ideal motor for a variety of machines.

Describe the advantages from the customer's perspective on working with a company that offers an entire package of products and services for production machinery and machine tools? The biggest advantage is the system-tested interfaces. From the top level of an automation system, the process control systems to the control-

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lers and HMIs—down to the drives and actuators, all of the interfaces are system-tested and defined—and they are still highly configurable. Our customers can also take advantage of our system-tested standard for a variety of applications. This will result in reduced development time, commissioning time, machine downtime and allows for easy maintenance.


What sort of emphasis does Siemens put on service and support for its motor products? Service and support is a very high priority in our company. In fact, Siemens can support its customers in every stage of a machine's lifecycle. From the planning and selection of components, to programming, commissioning and, of course, service. Customers have the entire Siemens global service network at their disposal. In fact, excellent service and support is not an option for Siemens, it is something that our customers can count on.

What has the response been like regarding Siemens' Sizer toolbox and 3-D CAD model-generating CAD-Creator package? Are there any other tools being implemented to assist customers with motor selection? The response has been phenomenal—especially for access to our CAD Creator. In the past, it was inconvenient for our customers to ask for the drawings. Today, everyone can easily access the database to get the 2-D-drawings or 3-D CAD model immediately. Sizer also has a great reputation in the marketplace. It makes it easy for customers to select the right products based upon simple specifications or even complicated mechanical constructions. It helps in the selection of the right motor, cables, drives, controllers and also the 24 V power supply. The output of Sizer is the entire project documentation with lists of order numbers, load curves, motor curves, motor data, wiring examples and even a sample cabinet. Instead of developing new tools for other tasks, we are extending the functionality of Sizer. For example, in the latest version, Siemens included an efficiency calculator. This

calculator gives you an insight to all of the losses within the cabinet and at the motor for the selected operating point. This is a huge benefit to our customers optimizing their machines when it comes to the topic of energy efficiency.

What new or upcoming projects is Siemens working on or developing in the motor division?

The motion control business of Siemens is working on completing its existing motor range. Two major projects are in development that we can talk about today: The 1PH8 motor series will be extended to shaft heights of 180 and 225. The 1PH8 is our newest main spindle motor. This motor type can be selected as servo or induction, water-cooled or forced-ventilated and can run up to 20,000 rpm for smaller shaft heights. The 1FW3 torque motor's series will be extended to a shafted version. The integration of a shafted torque motor in an existing machine design will be simplified with this design.

Where do you see the direction of the motors industry as a whole in the future? What will the emphasis be on regarding design and development? We can see several different trends, actually. One trend uses more-and-more direct drive technologies to increase the accuracy and the productivity in high-end production machines. We see this trend in different market segments all around the globe. Another trend is the development of electrical servomotors without permanent magnets. Because of the shortage of raw materials, the costs for high-density permanent magnets will increase in the future. Additionally, the demand for servomotors in hybrid vehicles and EV will rise. Several manufacturers are still using permanent magnets in their hybrid cars. Further investigations into servomotors without magnets or high-performance induction with similar characteristics as servomotors might be necessary. 

(See page 16 for Siemens contact info.)



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