Customizing drives with selected properties

Making the most of EC drive output

The trend in automation has thus far been toward components with maximum flexibility that can be assembled from a set for quick customization. Now miniaturization of the electronics makes it possible to go a step further by “replacing” some hardware functionality with software. Electric drives are an example of this trend: Now a developer no longer needs a number of different electric motors but can use integrated electronics to program modern EC drives for an application’s drive profile, e.g. torque-controlled for a thread winder or speed-controlled for pump applications.

Automation increasingly calls for the ability to electronically regulate motors for variable speed or torque or limited output as needed. ebm-papst has been observing this trend for some time and has meanwhile integrated the entire control system and power electronics in the drive unit’s K4 module (Fig. 1), expanding the range of uses for modern, electronically commutated drives. Whereas conventional DC drives needed to be mechanically designed for certain torque or speed ranges, EC motors are intrinsically able to cover much more extensive ranges. Now an integrated control system makes it possible to fully exploit this potential without compromising on reliability. In addition, programmable drives can be more easily integrated into applications and reduce cabling effort and installation time.

Configurable drives

Modern EC drives excel thanks to their rugged construction; their magnetic circuits can easily withstand even the most extreme mechanical and electromagnetic stresses. The result is an enormous potential output at maximum efficiency, though to date the full output range has seldom really been utilized. That will change radically with the new control electronics, designated “K4,” which monitor the drives and enable 100% motor output exploitation with the specified parameters for optimum utilization of drive benefits such as full motor torque from zero speed with high short-term overload capacity for applications such as rapid acceleration of heavy loads. With reconfigured parameters, the same motor can also wind even the finest thread at variable speed, or it can be operated like a stepper motor to automatically move to specific positions on command.

Benefits of an integrated control system

A flexible control system makes it possible to tailor a drive to an application’s requirements. Three operating modes are possible, with the motor working in speed, positioning or torque mode to reduce the burden on external control systems. The fully integrated control electronics provide several analog and digital inputs and outputs, which can be configured

via an RS485 interface. The drive's functionality during operation can also be controlled by monitoring numerous quantities such as voltage, current, speed, temperature, etc., so that users can concentrate on their core expertise – development – and drives operate with optimum values in the permitted range of performance data. In addition, the number of drive variants needed by users with broad requirements profiles is reduced substantially, and subsequent adjustments during operation are also possible. The control and power electronics make these modern drives suitable for a wide variety of uses and can be configured quickly using the powerful "Kickstart" PC configuration tool (Fig. 2). An endless variety of applications is conceivable with the concept described here; two practical examples are described below.

Use as a steering motor

Precise and reproducible positioning is needed for an active rear axle in transport vehicles, an example of the use of the ECI 63.20-K4 as a steering motor. The vehicle's control system supplies a target angle to the motor, which works in stepper motor mode. The drive then converts this input into a corresponding steering angle automatically. Since the integrated control system preprocesses the steering angle inputs for the motor and passes them on to the power unit, the user need not be concerned with motor control and can concentrate on the core task of correct positioning. In addition, depending on input, the current, voltage, position, speed and other parameters are constantly monitored with a diagnostic tool and alarms are issued when necessary. A configuration tool helps with familiarization, significantly reducing the time needed for development and testing. Only a few mouse clicks are needed to quickly assemble entire functional sequences, which can be activated through two digital inputs. Thanks to the drive's small size and its overload capacity, the steering unit can be built small and light.

Drives for intralogistics

With their compact designs and high overload capacity, the drives in the ECI and VDC series lend themselves to applications characterized by confined spaces and dynamic requirements. A good example is a diverter unit used in conveyor systems. In this case, a drive based on the VDC-3-49.15-K4 motor is used. Only 120 mm long and 63 mm in diameter, it contains the motor, the planetary gear and the associated K4 electronics. "Here the customer benefits from both the compact design and the fast configuration of the drives (Fig. 3)," says Dominik Häßler, a developer at ebm-papst. "Via the electronics, every motor can be configured to its specific drive task along the conveyor line, which optimizes the system while also lowering costs for spare part inventory. This drastically reduces the number of different drive units."

In spite of their compactness, the drives transport packages weighing up to 50 kg at a speed of about 1 m/s. The acceleration needed for distributing or diverting the packages is approximately 2.5 m/s2. The drive benefits here from the high efficiency of the EC motors and their pronounced overload capacity. Low dissipation and compact motor design keep the thermal effects of high transient load peaks manageable.

Modular system plus software

Since the electronics can only work within the power range dictated by the motor design, this motor series is also designed as a modular system, with a variety of components such as gearboxes, brakes or electronics modules being combined around a compatible EC drive to match the application. The application bandwidth of a drive configured in this fashion is further expanded by the K4 electronics, which provide especially precise control to unfold the entire capability of each EC motor. Output ranges up to 400 watts for the ECI series of internal rotor motors and 120 watts for the electronically commutated VARIODRIVE Compact external rotor motors.

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Figure. 1: Cross-section of drive with K4 electronics module and EtaCrown® angular gear .

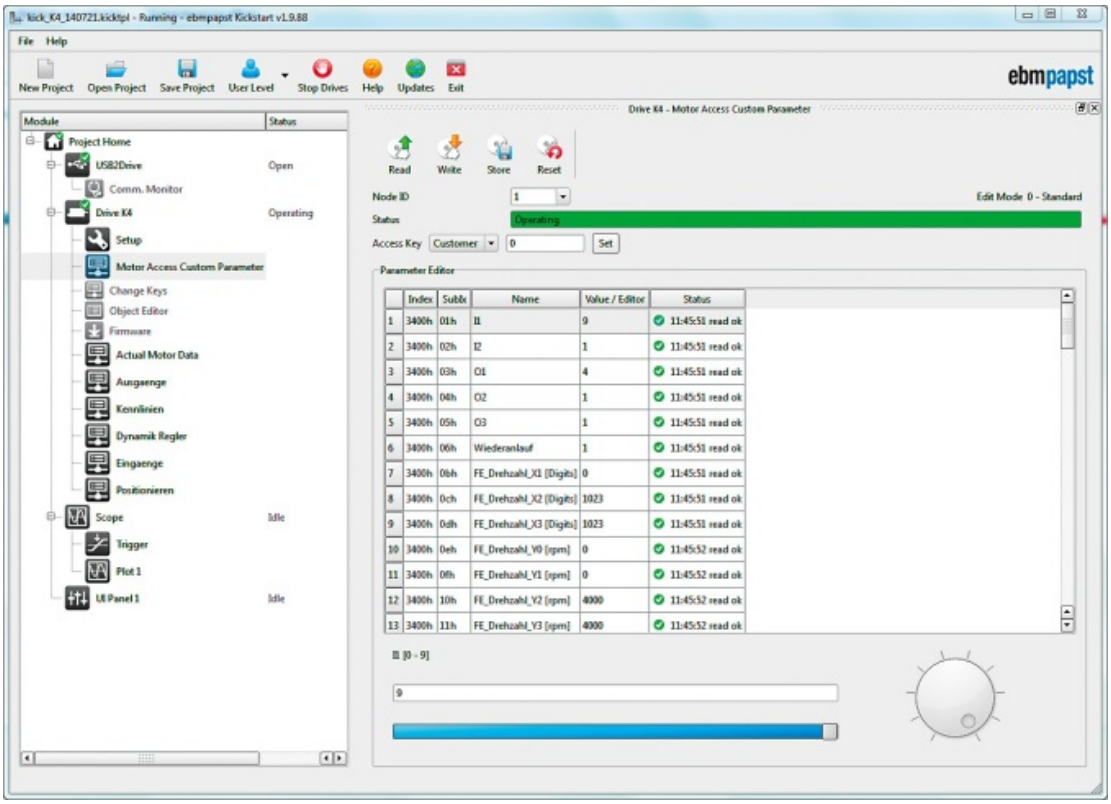

Figure. 2: Screenshot of Kickstart tool: the menu enables fast configuration of parameters with the mouse (ebm-papst)

Figure. 3: ECI series VDC series (ebm-papst)