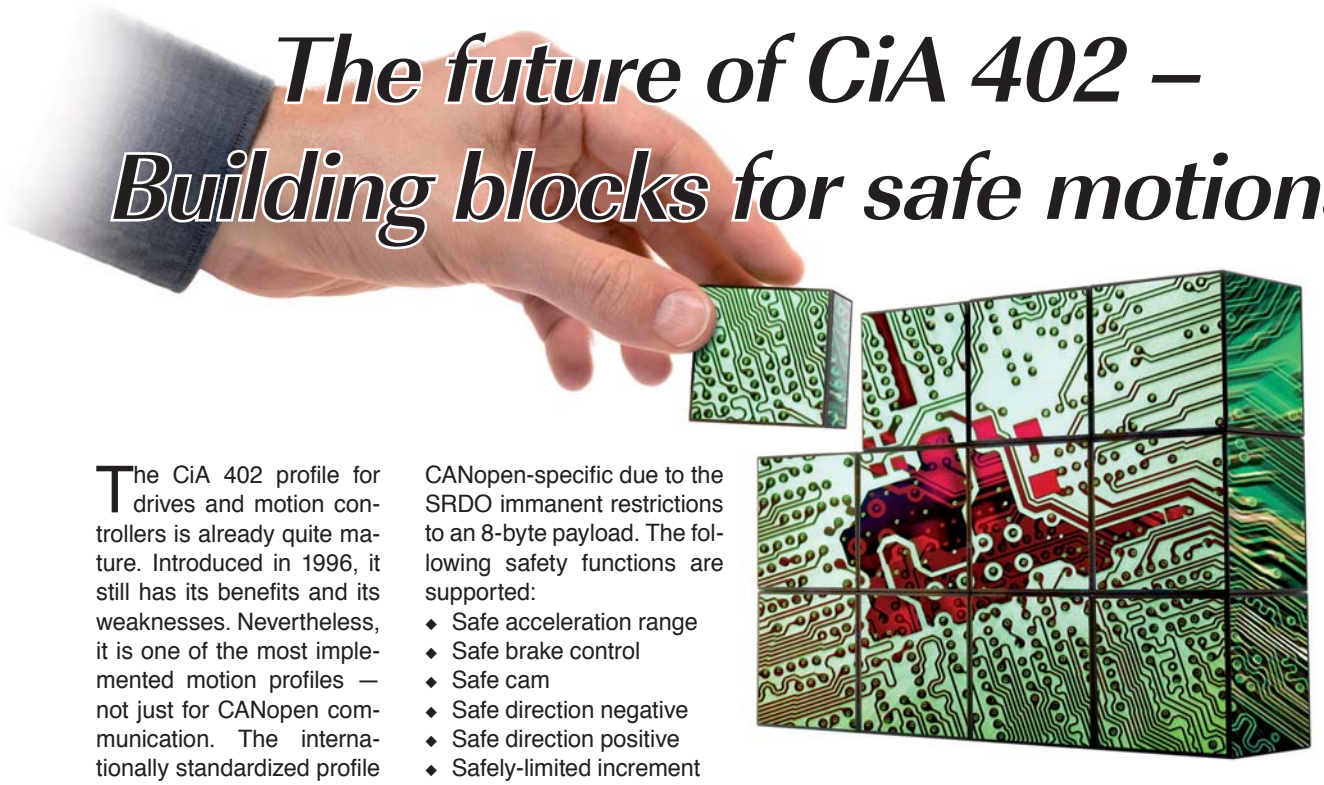
The future of CiA 402 – Building blocks for safe motions



Additional building blocks for the CiA 402 CANopen motion profile are under development: Safe motion function (CiA 402-4) and PDO mapping for devices controlling asynchronous and synchronous motors (CiA 402-5)

Abstract

The CiA 402 CANopen profile for drives and motion controllers will be enhanced in the direction of drives. Additionally, there is a new PDO mapping under development for devices that can handle asynchronous and synchronous motors using the same motion controller.

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The CiA 402 profile for drives and motion controllers is already quite mature. Introduced in 1996, it still has its benefits and its weaknesses. Nevertheless, it is one of the most implemented motion profiles — not just for CANopen communication. The internationally standardized profile (IEC 61800-7-201) has also been mapped to Ethercat and Powerlink (IEC 61800-7-301). In the next revision of this international standard, mappings to CC-Link IE and EPA will be launched as well. Of course, IEC 61800-7-301 also contains CANopen mapping. CiA will withdraw part 1 to part 3 of the CiA 402 specification, in order to avoid double-specifications and the risk of inconsistent descriptions. Nevertheless, the CANopen SIG motion control will continue to enhance the profile. New building blocks will be specified in additional parts of the CiA 402 specifications. The modular approach enables motion control manufacturers to implement optimized functionality in their products.

One of the most important extensions is the support of safety functions. The SIG will adopt the motion safety profile originally developed by the ETG (Ethercat Technology Group). The mapping to CANopen will be similar as to Ethercat in respect to the object dictionary (index and sub-indexes will be the same). However, the mapping to SRDOs is CANopen-specific due to the SRDO immanent restrictions to an 8-byte payload. The following safety functions are supported:

- Safe acceleration range
- Safe brake control
- Safe cam
- Safe direction negative
- Safe direction positive
- Safely-limited increment
- Safely-limited position
- Safely-limited speed
- Safely-limited torque
- Safe maximum acceleration
- Safe maximum speed
- Safe operating stop
- Safe stop 1
- Safe stop 2
- Safe speed monitor
- Safe speed range
- Safe torque-off

The safety functions comply with the corresponding IEC standards. The safety control-words and safety status-words are highly device-specific depending on the supported safety functions. Therefore, the profile provides a mapping function for command bits and status bits. Also, SRDO mapping is highly device-specific. The CiA 402-4 specification predefines merely the mapping of the safety control-word and the safety status-word into SRDOs. Additional safety target values and safety actual values may be mapped by the system-designer.

Special PDO mapping

Besides safety, there is a trend to control asynchronous and synchronous motors with the very same device. This requires additional PDO mapping. Generic PDO mapping is not suitable, because the system designer needs to assign COB-IDs to the PDOs. Only the first four have pre-defined COB-IDs. Type specific PDO mappings for servos and stepper motors, respectively for frequency inverters overcome this problem, but do not support both kinds of motors simultaneously. The proposed additional PDO mapping will be specified in CiA 402-5, another building block of the CiA 402 series of specifications. It is intended that three TPDOs and three RPDOs will be pre-defined. The fourths will be used manufacturer-specific. The standardized PDOs contain the status word, respectively the control word. Additionally, they contain the values for vl velocity (first instance), position (second instance), and velocity (third instance). “With this mapping we use the very same EDS for power derive systems irrespective of if they control asynchronous or synchronous motors,” said Günther Wenzel from Schneider Electric. *Holger Zeltwanger*