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CiA 402 is the dominating drive profile

Many drives and motion controller suppliers support the CiA 402 profile. It is the state-of-art profile not only used by CANopen, but also by other network technologies.

Although many companies did not promote visibly their CANopen interfaces at the SPS tradeshow, many of them sell a lot of them (Source: SEW)

Developed mid of the 90ties, the CiA 402 has become the dominating profile for drives and motion controllers. One of the early promoters, KEB joining CAN in Automation (CiA) already in 1992, is still providing in all of its actuators CANopen interfaces supporting CiA 402 functionality. On the fairground of the SPS in Nuremberg, the company has been honored for its 30 years' CiA membership. The company celebrates itself its 50th years' anniversary this year.

The recently introduced C6 compact 3 control unit was presented by KEB at the SPS 2022 in Nuremberg. Its control concept is based on the Linux operating system. The product using multi-core technology and real-time motion control is programmable in IEC 61131-3 languages. Of course, the device comes with CANopen connectivity as most of the company's drives and motions controllers. It features optionally NMT manager functionality. KEB provides also inverters for lift control applications compliant with CiA 417 profile using a subset of the CiA 402 profile plus some addition lift-specific add-ons.

Currently, the CiA 402 specification series is under review and some revised parts will be submitted for the next edition of the IEC 61800-7 series. Improvements include among others the support of 64-bit parameters. The new PDO mapping for CANopen FD is not part of the IEC standard.

CiA 402 applications

CiA 402 compliant drives and motion controllers are used in very different applications. The companies at the SPS tradeshow exhibited CiA 402 products ranged from high-power inverters to tiny stepper motors and servo controllers. CANopen drives and motion controller vendors, who offer also other communication interfaces, estimated that about 70 percent of the sold products use the CANopen interface.

The Italian company Ever Elettronica offers since more than 20 years CANopen stepper motor controllers featuring CiA 402 functionality. The products are used in packaging and labelling machinery as well as marble and glass processing. According to the company, the stepper motors are applied also to blister packaging machines. Other medical applications include collimators, laboratory equipment, and peristaltic pumps. Another CANopen drives manufacturer, Georgii Kobold, has applied its CiA 402 products also to different medical devices as well as to food and beverage production machinery. There are also still some motion controllers on the market using proprietary CAN-based profiles due to historical reasons. One example is the Hamatic linear actuator by Hanning integrated in dentist chairs. For other applications the company offers CiA 402 compatible products.

There are also vendors just starting to develop CANopen interfaces for their products. GMT Global (Taiwan) announced at the SPS tradeshow to support CANopen in the near future.

When space is limited, tiny drives are needed. CANopen-based control units can be integrated together with electrical motor and gears in 22-mm diameter housings. Faulhaber and Maxon offer such tiny products. Such devices are available since more than 10 years. They also can emulate stepper motors and applied in 3D printers. A typical example is the CAN Multi BX4 servo by Faulhaber integrating a brushless DC motor. It supports also the cyclic synchronous position mode as specified in the CiA 402 profile specification.

Functional safe behavior is increasingly demanded

There is a trend to support (STO) safe torque-off functionality. Several CANopen servo controllers feature this: Micontrol's E- and F-series of servo controllers are just examples. Additionally, they can be equipped with encoders. EZ-Wheel, a French company, offers CiA-402-based wheel drives with CANopen Safety functionality. These products are used by mobile robots, AGVs (automated guided vehicles), and AMRs (autonomous mobile robots). The French company cooperates with the Japanese IDEC enterprise developing AGVs and AMRs.

Especially, when battery-powered, these mobile systems use embedded CANopen networks, because of the low-power consumption and the low-weight requirements. Such CANopen networks links also the needed sensors, for example, those from Sick and Pilz.

The ACD Group offers CANopen drive control units featuring CiA 402 functions. These products are used for example in food and beverage processing as well as in grinding machines. Optionally, the come with an STO function compliant with the 2006/42/EC Machine Directive.

Copley Controls presented at the SPS fair its Nano series of servo drives. They are capable delivering up to 70 A, and weighs 22 g. The size is 30 mm by 35 mm, which make them suitable for AGV and AMR applications. Of course, they feature an STO capability.

Application-specific drives and motion controllers

In some applications, you need highly-optimized drives and motion controllers. Therefore, many of the suppliers develop and manufacture customized products. Heidrive, for example, has made CiA 402 products for laboratory equipment, aircrafts, and sun-tracking photovoltaic panels.

Intec's CiA 402 servo motors are used in soldering machines, circuit board handling systems, solder pasting equipment, and in wood processing machines form SCM. The majority of products are delivered with CANopen interfaces.

CANopen actuators are also used in stairlifts and wheel hub gears for AGVs. CiA 402 products by Dunkermotoren, part of the Ametek group, are implemented in such applications, for example. In Nuremberg, the company presented its portfolio of CANopen-connectable servos. "When comparing different motor concepts, not only the rated power but also the high overload capacity of DC motors should be considered," explained Tobias Pfendler from Dunkermotoren. "In many applications with cyclic operating modes, it is not the continuous output power that is relevant, but the power that can be achieved for a short time." Both the brushed and brushless DC motors can be loaded with several times the rated torque. "This is a feature that is not available with many other motor designs (e.g. asynchronous motors, stepper motors)," stated Pfendler. The company offers also alternative product measurements for improved comparison of specifications. The BGE 5510 dPro external controller can be applied even to third-party motors.

Fullmo also supplies customer-specific stepper motors with CANopen interfaces. The products support several CiA 402 operating modes. The MC349/MC634 families can be customized by means of a Phython command interpreter. The products come with different Movingcap control units integrating the CANopen interface available at M12 connectors.

CiA 402 used by other network technologies

The CiA 402 profile has been adapted by other communication technologies, especially by Ethercat and Powerlink. The benefit for the drive and motion controller vendors is obvious: Independent of the desired network technology, the application programming interface is the same. It is the CANopen object dictionary implementing the CiA 402 process data, configuration parameter, and diagnostic information. A typical example is the Movitrac Eurodrive inverter by SEW. It is available with CANopen, Ethercat, and Powerlink interfaces supporting CiA 402. The inverters can control and monitor both synchronous and asynchronous AC motors with or without encoders, as well as asynchronous motors with LSPM (line start permanent magnet) technology or synchronous and asynchronous linear motors. They feature a power range from 0,25 to 315 kW and an overload capacity of 150 %. The products offer optionally functional safety by means of an integrated STO (safety torque-off) function STO or higher-level safety functions via the network. They are designed for conveying and motion applications such as conveyor belts, hoists or, palletizers.

CANopen interfaces for Simatic host controllers

When Simatic programmable logic controllers (PLC) users like to apply the broad range of CiA 402 products, they need appropriate CANopen interfaces. Therefore, Siemens has adapted the Hilscher CANopen interfaces for its Simatic IPCs. Since some years, Siemens promoted the CANopen gateways by HMS, which can be obtained by the Swedish supplier. These interface modules are available for operating the Simatic S7-1200 on CANopen networks.

Just before the SPS tradeshow, Siemens announced to integrate the cifX PC card technology from Hilscher into the Simatic IPCs. The Simatic Box and Panel PC come with PC cards in the M.2 format. Hilscher's PC card family supports CANopen as well as Devicenet and other non-CAN network technologies. Switching to the required protocol can be carried out via Hilscher's loadable firmware, which is included in the scope of delivery. The M.2 bundles for ready-to-use integration, e. g. into the Simatic IPC227G and IPC BX-39A, are available directly from Hilscher.

Hilscher supplies for the Simatic PC network interfaces including those for CANopen and Devicenet (Source: Siemens)

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