Qseven can CANopen

Wolfgang Eisenbarth

Author
Wolfgang Eisenbarth
MSC GmbH
VP Marketing Embedded
Computer Technology
Tel.: +49-8165-906-154
boards@msc-ge.com

Links
www.msc-ge.com
www.ixxat.de

Introduction
Fast and flexible CANopen-based systems for industrial automation, transportation applications and modern energy facilities may be implemented on the basis of compact Qseven embedded modules with integrated CAN controller. MSC (Germany), in cooperation with Ixxat (Germany), offer in-house developed processor modules as well as complete CANopen solutions.

MSC entered into a partnership with Ixxat Automation in order to offer the CAN-connectivity while software and hardware integration in industrial applications. In addition to embedded modules, the scope of delivery includes the device driver and the CANopen protocol support so that customers are able to implement systems at a higher application layer. According to Wolfgang Eisenbarth, CANopen support on a Qseven processor module with industry-standard CAN components is finally realized thanks to the intensive cooperation of the two companies.

The fields of application for CANopen-based systems range from industrial automation, laboratory automation and healthcare technology to transportation applications (rail vehicle technology and vehicle equipment such as for the police, fire department and construction machines) and elevator systems, to name just a few examples for which Qseven modules are suitable. A number of promising applications in modern energy facilities such as solar and wind technology, in building automation and in smart grid solutions are also conceivable. First projects are underway.

Originally developed as an in-vehicle network, CAN established itself as a standard embedded network for various control systems. In addition to the reliable communication system, the flexible configuration options and interoperability of the individual devices are the main focuses for developers of embedded networks. Hence,

the CAN-based higher-layer protocol CANopen as well as a large number of CANopen specifications were developed by the CAN in Automation (CiA) organization. The goal is to open up CANopen networks also to small and medium-sized users. In addition to the CANopen application layer and communication profile (as defined in CiA 301), the CANopen specifications include a framework for programmable CANopen devices (CiA 302), CANopen cabling and connector pin assignment and CANopen representation of SI units and prefixes (CiA 303 series). CANopen device and application profiles (CiA 4xx documents) are dedicated for according devices or areas of applications. Up to now, CiA has allocated almost thousand of CANopen Vendor-IDs. Numerous companies already offer a wide range of standard products, tools and protocol stacks.

Embedded modules

The provision for CANopen support on a compact embedded module in the Qseven form factor was created with the expanded and revised Qseven specification revision 1.2. One of the updated features is the support for CAN and UART functionality and the ▷
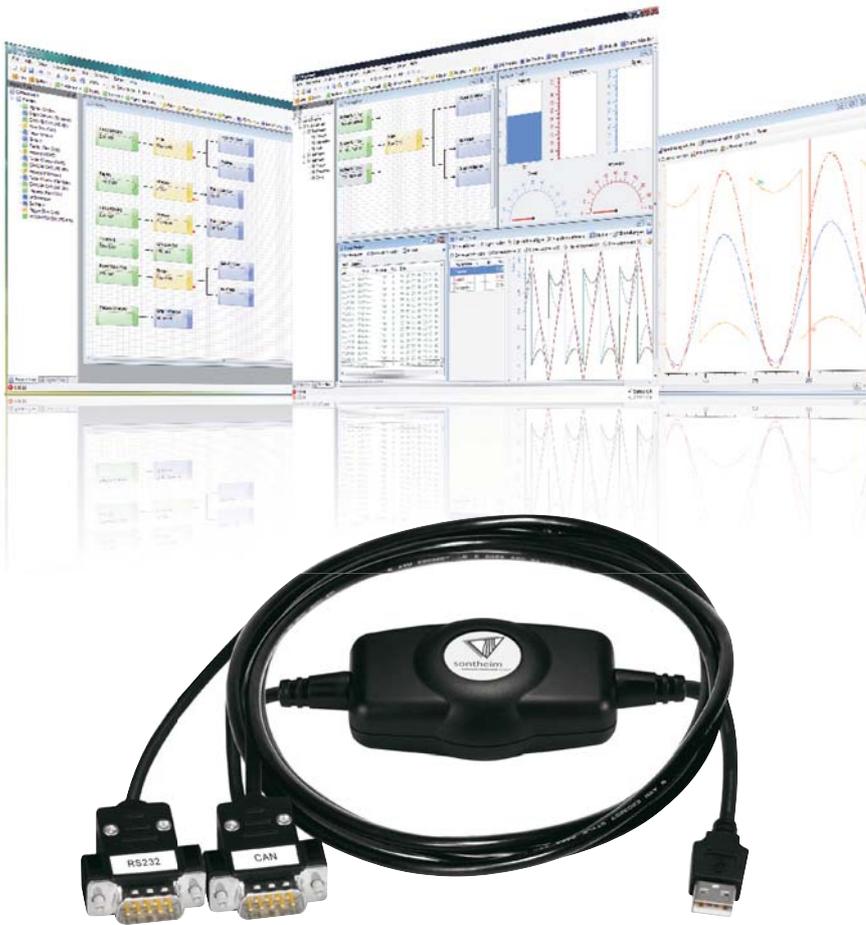

Figure 1: The Q7-TCTC-FD platform (MSC)

Figure 2: The Q7-MB-EP3 baseboard (MSC)

support for x86 und ARM/ RISC processors on the same carrier board. The MSC Q7-TCTC-FD platform is company's first x86-Qseven module with the CAN controller already integrated in the chipset. The module comes with an Intel Atom E6xx processor series that supports hyper-threading and Intel's virtualization technology in some options. The module family is offered in four different computing performance variations. The entry-level model integrates the 600-MHz Intel Atom E620 CPU and has a TDP (thermal design power) of 2,7 W. Alternatively, computer-on-modules are available based on the 1,9-GHz E640 CPU, the 1,3-GHz E660 CPU or the 1,6-GHz E680 CPU with a TDP of 3,9 W. The modules providing extended temperature range of -40 °C to +85 °C are offered as well.

In addition to a 32-bit single-channel memory controller, an Intel GMA (graphics media accelerator) 600 is also integrated in the processor. The 2D/3D-capable graphics engine runs at 400 MHz and uses a video memory with a capacity of up to 384 MiB. The GMA supports acceleration of video playback with HD resolution by hardware Mpeg2 and Mpeg4 decoding as well as encoding of videos. The Intel EG20 platform controller hub (PCH) is connected directly to the processor via one of the four PCI Express lanes. The board contains a 1-GiB DDR2-533 SDRAM. The module contains an ACPI 3.0 power management with suspend-to-RAM support and integrated functions for battery management, watchdog and system monitoring. In addition to CAN, the Qseven platform offers six USB host and one USB client ports, three PCI Express lanes for customer-specific extensions, LPC (low pin count bus), audio interface and a 10/100/1000 Base-TX Ethernet. SD
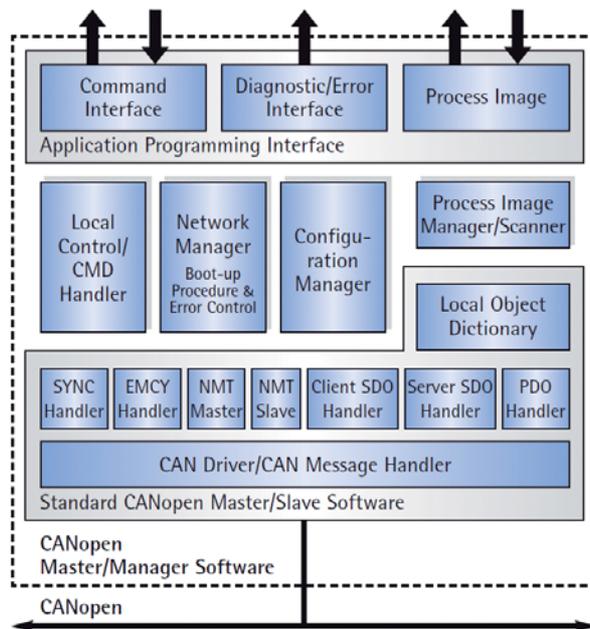

Figure 3: The modular CANopen Manager software (Ixxat)

cards may be connected via the SDIO interface. The system may be enhanced with a 4-GiB or 8-GiB flash memory connected via the Sata II interface. An LVDS (18-bit/24-bit; up to 1280 x 768 pixels) interface and a SVDO interface (up to 1920 x 1080 pixels) are provided for connecting a display. In the dual mode two displays may be driven simultaneously.

The MSC Q7-MB-EP3 baseboard is dedicated for implementation of embedded systems based on the Q7-TCTC-FD Qseven module family. It is provided with assembly options for the commercial and for the extended temperature range. The module is mounted onto the baseboard through an MXM connector. Wolfgang Eisenbarth explains: "The flexible baseboard saves extensive in-house development costs for customers. In order to optimize their system, customers can, of course, develop their own baseboard with the desired functionality and required interfaces. In our demonstration kit, we have used a H1-A compact DIN rail-mounted PC from DSM Computer, which integrates our Qseven processor module. In our demo set-up, the CAN bus is routed from the industrial PC to an off-the-

shelf industrial terminal (for example, from Beckhoff) and to a CAN gateway from Ixxat, which offers analog and digital interfaces for the process connection. Thus, numerous CAN devices and CAN modules such as sensors and actuators can be connected."

CAN gateway

The CANio 500 I/O gateway from Ixxat enables connection of analog and digital signals to the CAN or CANopen network. The respectively four configurable analog inputs and outputs offer a resolution of 12 bits. The analog inputs are available in different voltage ranges with differential input circuits or current inputs. Four digital inputs and outputs are available as well. The voltage range of the short-circuit-protected outputs is selectable. The switching threshold of the inputs automatically adjusts to the selected voltage range. In order to ensure operability in both CANopen and CAN systems, the device is designed as a self-starting CANopen NMT slave, in which all important parameters, such as node-ID or sampling rates of the analog inputs, are stored as default values. This enables the device to start its oper-

ation directly after startup, also without making any further settings. The individual configuration of the gateway for different applications may be done either by loading configuration data by a CANopen NMT master or by sending configuration messages in a CAN network. It also may be done offline via the configuration tool for the gateway.

CANopen software

The CANopen Manager software by Ixxat acts as a network manager and as a configuration tool for CANopen networks. Built on the core elements of the CANopen protocol, the manager software supports the network startup procedure as defined in CiA 302 additional application layer functions specification for CANopen. The software enables the implementation of a CANopen controller-based device configurable according to the given network topology. It is suited for the integration with IEC 61131-3 run-time environments by providing a built-in process image manager for the data exchange with a host system. The software is also usable for Ethernet-to-CANopen gateways, in which the device acts as an I/O device or a slave within the Ethernet network and as an NMT master in the CANopen network. Other fields of application are HMI systems, which operate either as CANopen NMT slave or as NMT master. The CANopen Manager supports no further CANopen device and application profiles. ◄