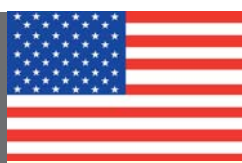


CANopen

Protocol Stacks
 Software Tools
 Interface Boards
 Development Services
 Training



CANopen is an open and flexible higher layer protocol that is used in an ever-increasing range of applications. Based on the CAN bus, it combines low cost with high performance and represents an attractive distributed control solution for industrial automation, medical equipment, public transportation, elevators, maritime electronics, and many others.

CANopen Products

IXXAT provides a complete range of products including protocol stacks, CANopen libraries for Microsoft Windows, communication interfaces, configuration and development tools, and development services.

CANopen Protocol Software

Based on more than ten years of experience with CANopen communication systems, IXXAT offers highly optimized and flexible protocol stacks that are used in numerous applications world-wide.

Covering the most recent versions of the CiA specifications, the standard **CANopen Slave or Master/Slave Protocol Software** includes a comprehensive range of functions that are used to implement CANopen Slave or simple Master devices. It features a modular structure that can be optimally scaled to particular

requirements of device applications, enabling IXXAT customers to offer highly efficient and resource-saving device implementations.

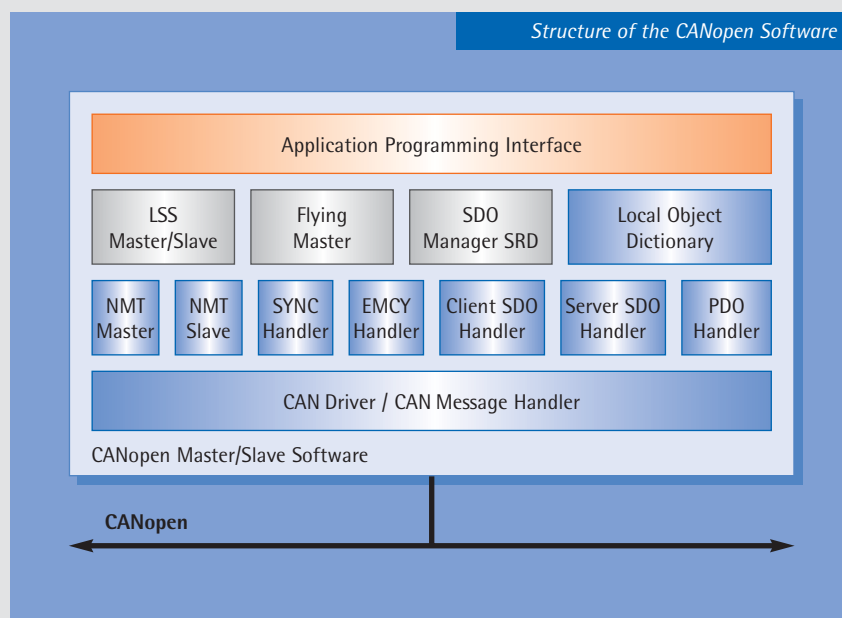
The core functionality of the CANopen Protocol Software is independent of particular processor architectures and can be easily port-

ed to different target controllers. Typically, only a driver for the specific CAN controller has to be implemented when migrating from one to another target processor.

For simulation of the dynamic behavior of individual CANopen devices or entire networks on a single Microsoft Windows based PC, IXXAT offers its CANopen Protocol Software in a version that employs the versatile CAN VCI driver (Virtual CAN Interface) shipped with each IXXAT hardware CAN interface module. Using this software package, engineers are able to implement realistic simulations of a device's functionality without the need of having the final target hardware already available.

With the availability of **CANopenRT**, a version which has been specifically optimized for the integration with real-time operating systems, the CANopen Protocol Software is able to be applied in an extremely wide range of applications from the smallest sensor to the most demanding CANopen devices such as found in medical applications.

For more complex CANopen Master implementations, as typically found in PLCs or intelligent controllers,



IXXAT offers the **CANopen Manager Software**. Built on the core elements of the CANopen Protocol Software, the CANopen Manager Software has been significantly enhanced to fully support the network startup procedure as standardized in *CiA302 Additional Application Layer Functions*. This software enables users to implement powerful CANopen Master devices that can be flexibly configured according to the given network topology. The software is particularly well 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.

High-availability, redundant and CANopen Maritime Software

With close to ten years of experience in the field of maritime applications and significant contributions to the *CiA307 CANopen Framework for Maritime Electronics* specification, IXXAT is the supplier of choice when looking for protocol software for high-availability, redundant CANopen solutions. IXXAT provides its customers with an extensively tested, fully functional, and high-performance CANopen Maritime solution that enables the device manufacturer to cut time-to-market and reduce development risks. The high-availability and redundancy concepts developed for maritime control systems are equally applicable in other application areas where single point of failure tolerance represents an important system requirement. While particularly developed with maritime applications in mind, the IXXAT CANopen Maritime Software may be used in other safety sensitive areas like railway control systems and public transportation networks.



Mature and reliable Solutions

Based on a long history of involvement in development and specification of the CANopen family of communication and device profiles, IXXAT provides its customers with mature and reliable protocol software that is constantly validated against the currently available version of the official CANopen Conformance Test as provided by CiA. IXXAT protocol software is deployed in numerous applications worldwide and is the solution of choice for CANopen device implementations.

CANopen API Software for Microsoft Windows

CANopen API software is the preferred solution when a Microsoft Windows based PC application has to provide CANopen Master functionality within a CANopen network. Applications range from relatively simple device test applications to embedded machine control, or very complex control systems that require sophisticated support for automatic configuration or plug-and-play functionality.

For static network topologies typically found in device test or machine control, the CANopen Master API enables customers to implement all required control functionality with very little effort. Due to its easy-to-use application programming interface and the support for all popular development environments, the CANopen Master API shortens the lead time required for training of engineers and significantly reduces time-to-market.

For the implementation of complex and fully configurable PC-based CANopen control applications the CANopen Manager API represents the perfect starting point. Powerful and flexible, the CANopen Manager API offers an optional auto-configuration mode in which connected CANopen devices are scanned for application objects and a corresponding process image is automatically generated on the host PC. As all complex CANopen services, such as the standardized network startup procedure, are fully encapsulated within the firmware of the CANopen Manager API, engineers can concentrate development effort on their application task and avoid implementing specific CANopen mechanisms. Due to the processing of the CANopen protocol mechanisms on local micro controller of the CAN interface module, the PC processing capacity is fully available to the user application.

By providing a CiA405 compliant process image, the CANopen Manager API is also suitable for integration with IEC 61131-3 runtime environments based on Microsoft Windows PC platforms.

Tools for Developers and System Integrators

CANopen implementation and integration tasks may be considerable without dedicated development and configuration tools. IXXAT offers a graphical editor tool for CANopen device description files compliant to CiA306 as well as optimized test, service, and configuration tools. When developing a CANopen device, the availability of flexible test tools is particularly advantageous. IXXAT's **CANopen Device Manager** not only is a compelling tool that provides all required mechanism to exercise CANopen protocols and services, including a fully featured scripting engine required for device testing,

but can also be the basis for an optimized service tool specifically targeted at the requirements of field service staff. Due to its highly flexible plug-in interface, CANopen Device Manager can be enhanced by add-on modules either implementing functionality of standardized CANopen device profiles, or by using proprietary vendor-specific modules to service specific CANopen devices.

CANopen Configuration Tool

Contrary to other configuration tools, the IXXAT CANopen Configuration Studio takes a highly intuitive approach by allowing the system integrator to view the complete network as a collection of input and output channels. This unique presentation of the process in form of a matrix, as pioneered by IXXAT, is particularly designed for larger networks in contrast to conventional configuration approaches that limit the user by only displaying network connections between two devices at any point in time. With the IXXAT CANopen Configuration Studio, PDO connections are established by simple drag-and-drop

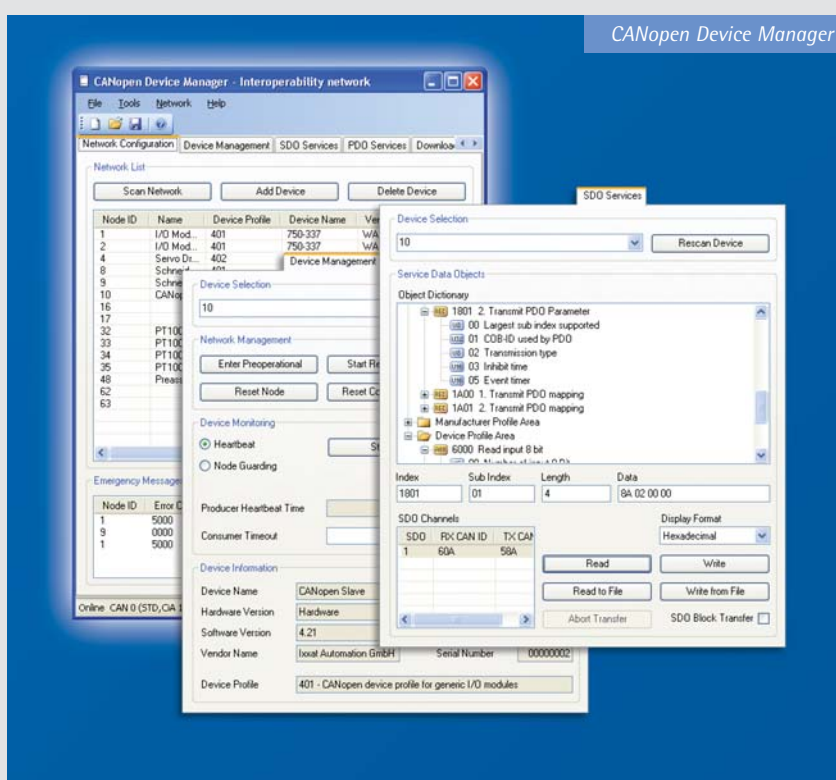
operations that considerably accelerate the overall configuration process.

OEM Platform

Due to a straight-forward integration with IEC 61131-3 development environments, the CANopen Configuration Studio also represents an attractive solution for PLC vendors who require CANopen configuration functionality but do not want to invest in the considerable effort required for the development of a CANopen configuration tool. Internal software components of the CANopen Configuration Studio are also made available as building blocks without user interface to PLC vendors who require full CANopen configuration functionality and who need to retain a common look-and-feel when integrating a CANopen configuration tool with their development environment.

About "CAN in Automation" (CiA)

CiA is the international users' and manufacturers' organization that develops and supports CAN-based higher-layer protocols. All activities are based on CiA members' interest, participation and initiative. CiA representatives actively support international standardization of CAN protocols and represent the members' interest in national and international standardization committees, such as ISO and IEC. CiA members initiate and develop specifications that are then published as CiA standards. These specifications cover physical layer definitions as well as application layer and device profile descriptions.





The CANopen family of higher layer protocols provides an ideal solution for distributed industrial communication. Based on the CAN bus, CANopen was developed within the CAN in Automation (see green box) international users and manufacturers organization and is standardized in CiA301, *CANopen Application Layer and Communication Profile* and CENELEC EN 50325-4, Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces - Part 4: CANopen. Originally developed for industrial automation systems, CANopen is now used in all application fields requiring a highly reliable, flexible and cost effective solution for both internal and external communication interfaces. The continued success of CANopen is demonstrated by the fact that even now, more than ten years after its initial specification, CANopen is applied in an ever-increasing number of application areas.



CANopen Device and Application Profiles

CANopen Device Model

Very early in the design and specification process it was understood that a clear separation between communication and application functionality would provide users with the ability to apply CANopen in applications not previously accessible to industrial communication protocols. Following these design guidelines, a CANopen device is logically sub-divided into a functional module implementing the application process, a communication interface providing for the CANopen protocol mechanisms, and, as the connecting link between these two modules, an Object Dictionary that

represents a logical addressing scheme to access both communication and application parameters of a CANopen device.

Device and Application Profiles

This clear separation allowed for the specification of dedicated device profiles now covering the most common device types used in industrial automation systems. Device profile specifications have for example been made available for generic I/O modules with CiA401, drives and motion control with CiA402, closed loop controllers and measuring devices with CiA404, IEC 61131-3 programmable devices with CiA405, and encoders with CiA406.

The inherent flexibility of CANopen furthermore allowed users to develop and publish device profile documents for many other industrial and non-industrial application areas and, more recently, application profiles describing entire systems including specific communication relations between individual devices.

CANopen Master and Slave Devices

CANopen networks typically consist of one Master device, such as a PLC or industrial computer, and up to 126 Slave devices, such as generic I/O modules, drives, encoders, sensors, etc. Both CANopen Master and

Slave devices can be implemented at different levels of complexity, resulting in economical yet flexible solutions that can be configured to meet the most demanding system requirements.

Network Management and System Services

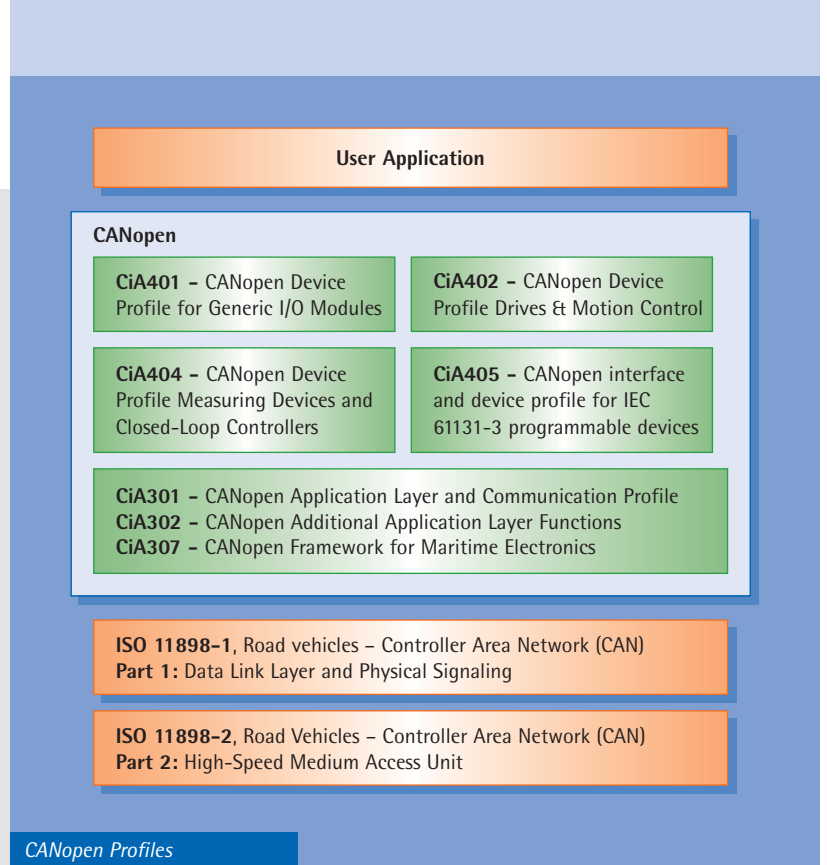
CANopen Master devices are primarily assigned the tasks of system configuration and start-up. The specified mechanisms optionally allow detailed consistency checks, preventing system operation if pre-configured network criteria are not met. The support for unattended and automatic device configuration result in low system maintenance costs and enables the implementation of plug-and-play systems. The network management concept of CANopen also includes various mechanisms for monitoring correct device operation and configurable reaction to device failures. For safety critical applications, like maritime control systems, CANopen even allows for hot-standby Master devices that immediately take over system control in case of a loss of the default Master device.

As additional system services, the transmission of emergency messages, time stamp distribution and the synchronization of process data exchange are standardized by the CANopen Application Layer and Communication Profile.

Process and Service Data

One of the main features that makes CANopen unique with respect to other field bus systems is the process data exchange based on a producer-consumer model. Using Process Data Objects, this enables a direct data exchange between any CANopen devices in the network.

Process Data Objects enable highly efficient synchronous or asynchronous broadcast of application data



CANopen Profiles

to any CANopen device in the network without additional protocol overhead, thus fully utilizing the available CAN bandwidth.

As the second basic communication mechanism, Service Data Objects are primarily used for system configuration, transfer of larger data blocks or to update device firmware using a point-to-point protocol between two CANopen devices.

Combining the efficiency of the CANopen services with the short message latency of the CAN protocol makes CANopen an attractive solution for networks where short response times are a priority of the communication system.

Services

Customer Specific Development

In addition to the standard product line, IXXAT offers customer-specific development of software and hardware components for CANopen, as well as consultation services and seminars.

CANopen Know-How

IXXAT supports its customers over the full lifetime of their products. From the initial specification and design phase to development and testing, IXXAT engineers have an extensive knowledge of CANopen, based on long experience and an active participation within the CAN in Automation working groups.

Training

To provide a quick start with CANopen and the associated protocols, IXXAT offers a two day in-depth technical training course conducted by experienced instructors. The seminar is targeted both at system integrators or device developers in charge of CANopen implementations and decision makers that need the background information required to assess the technology. The training course is held in German language at a regular schedule at the IXXAT main offices in Weingarten, Germany, or on request as in-house seminar in German or English language.