

# CANopen-based Distributed Intelligent Systems

Making installation and service much easier



Since the deployment of the first CANopen devices and systems in 1995/1996, CANopen has become an established solution in more and more application areas as a communications standard for exchanging process-related data and parameters between controllers and peripherals. Approval of version 4.01 of the CANopen specification and submission of the standard at European level (prEN 50325-4) demonstrates that CANopen is now on equal footing with established competing field bus standards.

Heating and power generation with a fully automatic cooling plant

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The architectures of today's control systems are still primarily designed as systems with centralized control, despite the fact that systems based on decentralized control (so-called distributed systems) could offer some significant advantages. Where systems and machines are divided into separate operational and organizational units, it would seem to make sense to control the various tasks



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(sub-processes) on their own independently of each other. Among other things, this allows computing power to be tailored to the exact requirements of a given sub-process. Availability, reliability and flexibility in a distributed system are significantly higher than in centralized systems. If one component fails, other parts of the system can continue to operate. If the functionality of a system needs to be upgraded or modified, it is often possible to accomplish this during ongoing operation. Processing speeds are also significantly higher in a distributed system, and sub-processes can place higher timing demands on the as-

sociated controllers because the data are processed directly at the location where they are generated or required. As a result, latency in these systems is significantly reduced, and bus loading decreases.

One of the reasons why, for the most part, only centralized systems have been deployed, is undoubtedly the fact that most existing field bus systems do not offer communications mechanisms that are logical and easy to use in distributed system applications. Furthermore, specific tools and mechanisms are required to enable or simply project planning, installation and maintenance. Because of its simple and flexible communica-

tions mechanisms and the ability for each device to communicate directly with any other device, CANopen offers an ideal communications basis for distributed intelligent systems. Using the additional mechanisms defined in the supplemental CiA DS-302 „Framework for Programmable Devices“ specification and provided by the standardized boot-up procedure and the Configuration Manager, distributed systems can be implemented quasi as plug & play systems. This makes installation and service considerably more straightforward and less error prone.

Figure1 shows the system structure of a fully automatic coal

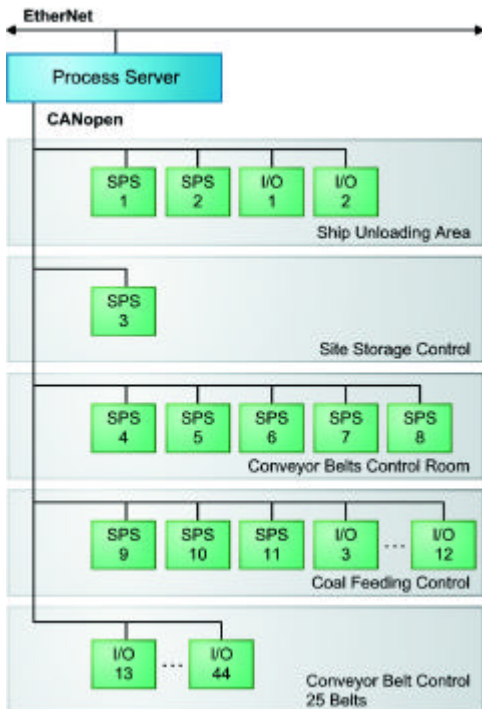


Fig. 1: System structure of the fully automatic coaling plant based on CANopen at a heat and power generation facility

stockpile at a heating and power generation plant. A CANopen-based distributed system was deployed, in which eleven IEC 61131-programmable small devices control the various elements of a coaling plant. A single CANopen network enables the devices to exchange data with each other as well as 44 other I/O devices. All of the PLC programs contain 159 KByte of code and data. There are 1,140 data points and 280 network variables that are mapped to 509 PDO links.

Because freely-programmable devices such as PLCs or operator devices (HMIs) perform the control tasks in distributed systems and thus can be used both as CANopen masters or CANopen slaves, they must provide the required CANopen functions. You can implement an uncomplicated, easy-to-use CANopen controller based on Ixxat Automation's CANopen Master Kernel. In addition to the standard functions and mechanisms that a standard CANopen master/slave software library normally provides, this product offers a wide range of additional functions. These functions

include a freely configurable, standardized boot-up procedure to control network boot-up and to manage all devices on the system, a Configuration Manager to maintain configuration data for all devices on a system, and an interface to provide simple access to the process data of the application (the loaded program) via the object directory. In the past, a device manufacturer had to write his own programs for all of these functions and address many more



Fig. 3: Module to automatically link input/output data. The Visual Object Linker of CANopen ConfigurationStudio

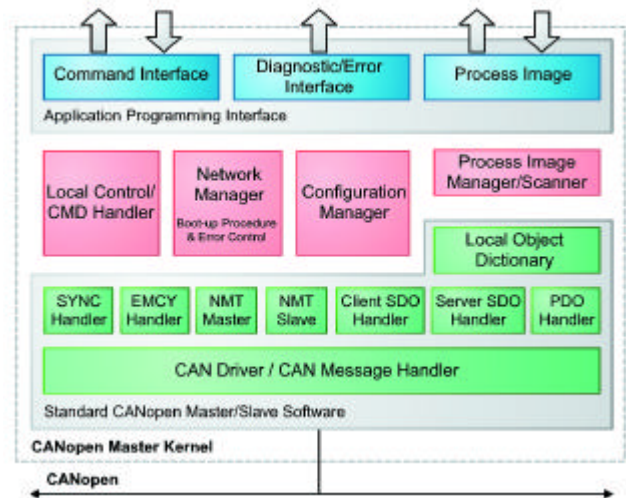


Fig. 2: Software architecture of the CANopen Master Kernel

CANopen details instead of concentration on his actual device.

Figure 2 shows the basic functions of a CANopen master/slave software product plus the additional functional units of the CANopen Master Kernel. Implementation of the controllers at the heat and power generation plant presented was based on the CANopen Master Kernel by IXXAT together with the CoDeSys runtime system from 3S.

Users in particular have been reluctant to use distributed intelligent systems in the past, because project planning, programming and maintenance require a good knowledge of the communications system used. Suitable tools can overcome this hurdle. Tools for distributed systems should support project planning, programming and configuration of the communications system in a way that hides the communications system from the user, who then only needs to be concerned with project planning and programming for his own processes. Ixxat's CANopen Configuration Studio allows that user to create the required communications links needed in his system directly.

Figure 3 shows the object linker, which enables the user to link together in a matrix the data required for his application. The pro-

gramming environment for the controller can be started directly from the object linker. Thanks to a database-oriented design and open programming interface, manufacturer-specific modules for setting parameters or including diagnostic functions can easily be added to this configuration tool. CANopen today provides a mature communications system, which allows the simple implementation of distributed systems. During project planning, the user no longer needs to address details of the communications system. He can instead concentrate on his processes. This will significantly enhance the acceptance level and spread of distributed systems.

### A wide range of services

CANopen software packages and tools, which have been used worldwide for years, Ixxat Automation offers a wide range of services relating to CANopen. These include training and workshops, consultancy on system design and implementation issues as well as the development of hardware, software and complete system solutions. As a result, Ixxat has participated intensively in the development of the CANopen Conformance Test, contributing experience in the testing of devices and systems as a service.