CANopen lifts people

By Holger Zeltwanger (CiA)

Doors are closing. The synthetic voice in the lift becomes silent. The electronic devices controlling the lift start to communicate inaudibly for human beings before the lift moves the passenger to the requested floors. In the past, the embedded lift control system used proprietary networks and device interfaces. This lead either to high efforts in system integration or the lift manufacturer had to buy all electronic devices from one single manufacturer.

In the near future, lift control systems may be based on the CANopen Lift application profile. It was officially introduced at the Interlift exhibition in Augsburg (Germany) on the joint booth of the non-profit CAN in Automation (CiA) international users' and manufacturers' group. CiA's CANopen Special Interest Group (SIG) Lift has developed the specification, which describes the communication in multiple lift control system. It is the first time that different vendors have jointly developed an embedded lift communication system.

The exhibiting companies showed prototypes of panels, drives, doors, controllers, etc. compliant to the CANopen Lift standard. Besides the prototype lift control system at the CiA booth, several CiA member companies exhibited CANopen Lift products at their own booths. Boehnke & Partner (www.bp-online.de) exhibited another CANopen multi-vendor lift application based on their lift controller and a CANopen-compatible drive by Control Techniques. The demonstrated bp306 lift controller with two CANopen interfaces is configurable via the CANwizard tool that can also be used for any other CANopen Lift-compliant device. Additional interfaces included ISDN, modem and Ethernet. The company also presented the CAP-01 board to be used in external and internal panels, and the CLK-01 cabin controller.

Weber Lifttechnik (weber-lifttechnik.de) introduced the weCAN lift control controller featuring 60 landings and group control capability (up to lifts). The controller is compliant to the CANopen Lift application profile. The company also offered plain text menu-driven displays.

The CANopen Lift specification (DSP 417) is available at the CiA office in Germany (www.can-cia.org). The specification describes the default communication of a control system for up to eight lifts with up to 254 floors each. The default communication can be changed by means of configuration. The CANopen Lift specification does not standardize physical devices. The specification defines "virtual devices". They are, in a manner of speaking, the atomic granularity of functions to be implemented in the same physical device. A virtual device must not be distributed to several physical devices. However, it is possible to combine several virtual devices in one physical device.

This concept supports the description of transparent gateways. This means the design of the network topology is not predicted. The lift system designer is not restricted by the specification regarding the layout of networks.

CAN-based lift controllers and devices

Wittur (www.wittur.com) has developed the CAN-based WLC-4000 lift control system consisting of the control cabinet, frequency inverter cabinet, car installation cabinet with inspection unit, and hand-terminals. The CAN communication protocol is proprietary but can be integrated into CANopen Lift applications via gateways.

The CAN-based Liftronic 3000 controller from Findili (www.liftronic.ch) supports up to 32 landings and up to three car doors. The group control option provides RS-485 communication up to eight other lift controllers. The CAN network links cabin, storey, display, and controller. The S3 lift control system designed by P. Dahl Elektronik & Data (www.pdahl.com) consists of controller (based on MC 68HC812), contactors for motor, safety and 24-V power supply. All contactors and motor circuit breakers in the cabinet are by Telemechanique. There are two CAN networks for connecting panels and displays.

Crouzet, Selectron, and Telemechanique, daughter companies of Schneider Electric (www.schneider-electric.de), offer a broad range of components and devices for lift control applications. Among them there are CAN and CANopen connectable devices, e.g. decentralized car controllers and floor controllers with I/O functionality. The Spanish company Micelect offers load weighing sensors and controllers for lift applications with CAN connectivity. The ILC3 wire rope sensor can be linked via CAN to the LM3D or LM6D programmable control unit.

Panels, displays, and encoders

A lift control system is made of very different parts including electronic devices that measure, control and actuate. The communication between the electronic control devices is done silently and invisible for passengers. They only see some displays indicating in which floor the lift is at the very moment or push buttons to call the lift car. The CANopen lift profile defines control devices (call controller car door controller, car drive controller, etc.), as well as virtual devices, such as output and input panel, car door unit, car position unit, car drive unit, load measuring unit, etc.

WS Schaefer (www.ws-schaefer.de) has developed a broad range of CAN-connectable tableaus. Via the CiA DSP 417-compliant gateway the tableau subsystem can easily be integrated in a CANopen-based lift control system. Kronenberg (www.kronenberg-gmbh.de) has launched lift-operating panels for landing stations as well as for lift cars. They are compliant to CiA DSP 417. The first car position devices compliant to the CANopen lift profile based on standard encoders were introduced by Fraba (www.posital.com) and IVO (www.ivo.de). Schmersal (www.schmersal.com) has chosen a different technology: The USP elevator positioning system is a non-contact sensor for positioning measurements of up to 130 m. The DSP-based sensor supports the CANopen Lift profile. At the Interlift exhibition, several companies launched car drive units (frequency converters) compliant to CiA DSP 417. The frequency inverters are functionally compatible to standard CANopen drives, optionally they may support additional functions such as jerk control. The Micovert 2000 frequency converter from Micotrol (www.micotrol.com)

supports open- and closed-loop control functions as well as six driving speeds. The 5-Star (DSV 5445 Lift) frequency converter from Dietz Electronic features a maximum of 132-kW lifting power. The car drive unit provides speed, position, and torque control in all quadrants. Siemens (www.siemens.de/edm) has developed a CANopen DSP 417 gateway for its lift car door unit. The AT-series drives doors up to 400 kg. The AT 25 lift door unit and the corresponding CANopen gateway can easily be connected to any CANopen DSP 417 door controller. These modules were used in the CiA prototype application. The lift builder benefits from standardized device-interfaces. System design needs much less effort when using standardized communication networks. In addition, the lift builder can integrate more easily devices from third parties. Another benefit is the availability of off-the-shelf configuration and maintenance tools. Device manufacturers benefit from the reduction of variants they have to provide in order to supply several lift builders. The lift car decelerates unnoticeably. The soft voice says: “Doors are opening”. In order to educate interested lift builders as well as device manufacturers, CiA is going to organize a seminar dedicated on the CANopen Lift application profile in Spring 2004. In order to make developers’ work as easy as possible, Boehnke & Partner has introduced the CANopen starter kit for developers of CANopen lift devices.

CANopen Lift encoders for elevator engineering

Precise positioning of the lift cabin is a vital precondition for optimized travel of the elevator. The formerly applied magnet switches, which required rather large efforts in installation are more and more replaced by encoder systems nowadays. Encoders for monitoring position and speed allow any required curve of way and time. Whereas incremental encoders are perfect for measuring speed, absolute encoders are designed to fit positioning applications. The position values remain available even after power loss and make the reference run superfluous. New, “intelligent” solutions do not only allow comfortable installation and setup but reduce operational costs by enabling selective maintenance work. Thus, for example, service intervals can be adapted to individual requirements. The CANopen protocol (EN 50325-4) is experiencing a breakthrough now also in elevator engineering as flexible serial communication system for electronic component network. The corresponding application profile (CiA DSP 417) is clearly defined but still allows utmost individuality. To the elevator manufacturer the new, OEM-independent (Original Equipment Manufacturer) standard above all means devices with better price/performance ratio and a considerable relief in system integration. IVO (www.ivo.de), has contributed their experience in bus systems to CiA’s CANopen SIG (Special Interest Group) Lift by designing an encoder corresponding to the application profile and capable of direct connection to CANopen. This opens up advantages of bus technology to the user, starting with comfortable set-up and ending with comprehensive diagnostic options. The company’s compact multiturn absolute encoder operates without any mechanical gears, but the number of turns is captured without any wear and tear by the patented „touchless encoder principle“. Even tempera-

tures from - 20 ˚C to +80 ˚C have no impact on the encoder's reliability. The encoder is shock-protected up to 2 m/s2. The encoder resolution is 29 bit, whereas 13 bit are for the angular information and 16 bit for the number of turns.

Control tasks in elevator technology often imply a combination of two encoder types: During traveling up and downwards the signals of an incremental encoder are being evaluated for controlling the speed of the cabin drive. The incremental encoder supplies a speed-irrelevant clock pulse that can be changed rather easily by a frequency/voltage transformer into a speed-relevant voltage. Precise travel to the individual floors however calls for the absolute position signals of a multi-turn encoder. For this and similar applications, for example swing forklift trucks in high multi-store shelves now one device and consequently the occurring costs can be saved. An electronic multi-turn encoder of the company's Multivo product series features two additional incremental track signals shifted by 90 degrees. The integrated ASIC processes both absolute and incremental signals and makes them available to the control unit for speed and position regulation via standardized interfaces. The incremental signals for example are for regulating travel profiles whereas the absolute signals are for capturing the stop positions. The device provides processing speeds of more than 10 kHz. The basic encoder fits all current bus systems by plugging on the desired bus cover. Separate connectors for the incremental signals enable simple installation.

Besides speed control, the encoder's incremental signals shifted by 90 degrees open up further possibilities and applications, for example in monitoring slippage tolerances at belt drives or steel cables. Slippage means the difference between the path covered by the cable and the drive roll respectively motor. Slippage tolerances are needed to avoid extreme loads on reels, fan belts or steel cables but certain limit values must not be exceeded. It takes two encoders to capture the slippage tolerance, one for the cable and one for the drive line. The measured values supplied may be used for example by the elevator's control unit for permanent slippage monitoring. Preventive maintenance service for controlling the slippage tolerances are thus becoming superfluous.

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Drive for CANopen lift

Control Techniques (www.controltechniques.com) has introduced the Unidrive SP that can be stopped in a controlled, damage-free way – and given them the means, for example, to bring lifts safely to the nearest floor for the evacuation of their occupants. This is due to the drive's power supply input. This feature is relevant for any equipment that needs UPS back-up – e.g. fairground rides and machine tools, so that it can be shutdown safely. With pending European elevator regulations, the key application for this feature is likely to be lifts.

Public safety is of key concern for building owners and lift contractors – one issue being the ability to get lift passengers rescued during a catastrophic power failure, such as those recently experienced on the eastern seaboard of the USA and in London. In the vast majority of instances a full uninterruptible power supply back-up with a generator that kicks in to take over critical supplies is too costly. An alternative solution could be the fitting of the company's drives as lift drives. Built into every Unidrive SP is a 48-V DC back-up power supply connection. In the event of a power-loss, connection of a simple 48-V battery-operated UPS allows full load operation of the lift motor albeit at a slower speed.

The drive is designed for both geared and gearless lifts and supports open-loop vector, closed-loop vector, brushless synchronous motor modes. Multiple feedback types are supported as standard, including Sin/Cos feedback. Additional control and communications option modules such as CANopen (CiA DSP 402 and CiA DSP 417) are available. The drive includes features such as brake control, excellent speed and torque control designed specifically to provide smooth, high-performance lift operation and control.

For lifts

The ARTDrive L from SIEI America (www.amicondrive.com) is powered by a Vecon micro-processor coupled with a proven IGBT power section design. The CANopen-connectable device provides multiple control modes for AC induction (asynchronous) motors including V/F, sensor-less flux vector, and closed-loop flux vector.

For the AC drive enthusiast, the motion controller provides AC brushless control for synchronous motors. This allows covering all elevator applications from the residential to the high rise, geared or gearless, to speeds exceeding 5 m/s.