

October 2013

# CAN Newsletter

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- ▶ *Lifts for public means of transport with CANopen*
- ▶ *CANopen-Lift: The open specification for elevators*
- ▶ *Magnetic encoders conquer safety-relevant applications*

*CANopen-Lift special*

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# CANopen-Lift: The open specification for elevators

Jörg Hellmich

A lot of electronic assemblies are needed to realize the desired functionality, the ride quality and the current safety requirements called for in modern lift systems. These electronic assemblies are networked via modern network systems and use these systems to exchange status information or commands. In order to achieve this, it is necessary to have all assemblies involved in the communication “speak and understand” the same network protocol. This is only possible when all assemblies use an open, standardized protocol or a proprietary protocol produced by only one manufacturer. An example of an open standardized protocol is the application profile CiA 417 Lift Control CANopen-Lift, which is based on CANopen. In this application profile, all parameters and commands of a modern lift system are standardized, e.g. the parameters of the frequency converter in the drive unit, or the door controls and commands such as “Open door A”, “Cab call floor 8” or “Position 23,263 m; Speed 0,8 m/s; Acceleration 0,5 m/s<sup>2</sup>”. In this article the most important milestones of the development of CANopen-Lift and the latest functions are presented.

On the occasion of the Interlift 2001, 20 small to medium-sized lift component manufacturers agreed to participate in producing an open standard for the communication of the CAN network for the first time. At the beginning of 2002, these manufacturers agreed to use the

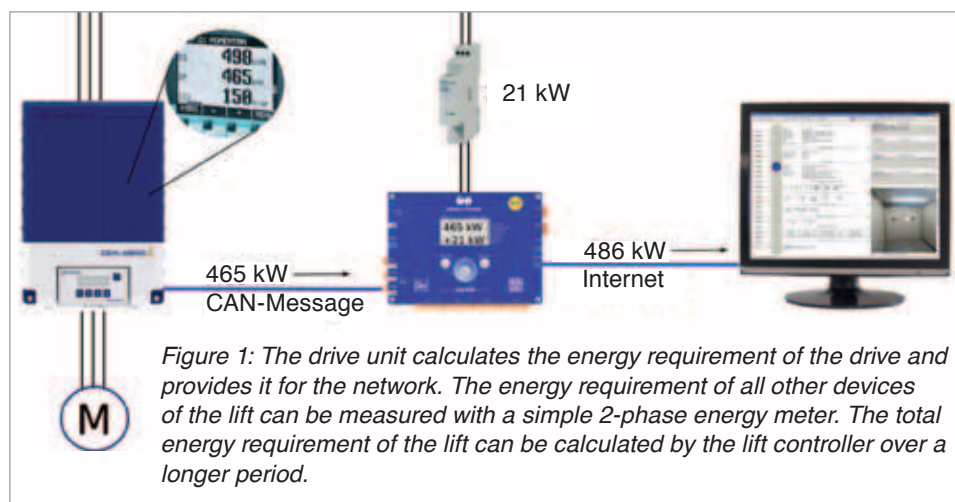


Figure 1: The drive unit calculates the energy requirement of the drive and provides it for the network. The energy requirement of all other devices of the lift can be measured with a simple 2-phase energy meter. The total energy requirement of the lift can be calculated by the lift controller over a longer period.

CANopen standard as a development basis, which had already been widely used in automation technology for years, and to extend it by the functions needed for lifts. Within CAN in Automation, the Special Interest Group (SIG) “Lift” was founded. This SIG was expected to check existing profiles to see if they were suitable for lift engineering purposes and extend or redefine functions that were needed. The result of this review was the application profile CiA 417 Lift Control (CANopen-Lift) published in June 2003. This profile determined many “virtual units” of a lift system, objects and messages of these virtual units, as well as technical marginal conditions (bit-rates, services, pin assignments of

connectors, etc.). At the Interlift 2003, several manufacturers exhibited the first prototypes of components at a common stand developed by the Special Marketing Group Lift, which had been founded for this particular purpose. In the following months the manufacturers integrated the functions step by step into their components and as early as 2005 the first 1000 lifts were supplied with CANopen-Lift components and put into operation. In the years between 2003 and 2009 an increasing number of units were equipped with a CANopen interface and mostly those functions were integrated into the standard, which had already been realized conventionally and/or with other interfaces, such

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Figure 2: Virtual console

as the serial communication between converter and control system with the DCP protocol. The full functionality is available since version 2.0 of CiA 417, which was passed in 2010, and has been freely available since 2011 as Draft Standard. In order to illustrate the functionality, the Special Marketing Group Lift developed the CANopen-Lift-Demonstrator, which was presented in March 2009 for the first time, on the occasion of the Heilbronner Aufzugstage. To allow interoperability to be checked, so-called Plug Fests were introduced, which have taken place on a regular basis since the beginning of 2009. During the Plug Fests, check lists are used to successively test the functionality of individual units with units by other manufacturers. The developers have the opportunity to directly remedy smaller shortcomings cropping up during the tests. Tests were also carried out

during these Plug Fests to check the physical boundaries of the CANopen specification. The stability of the connections with different lengths of network connections up to a length of 230 m was checked and the units were subjected to a network stress test, in which the network load was gradually increased with high and low prioritized messages up to 100%, while the behavior of the units was tested.

Since 2009 new functions have constantly been integrated into the standard and into the units of the manufacturers, which would not have been possible in this way without an open standard. Up to now the measurement of the energy had to be done manually during a defined test drive. With the integration of the protocols of an automatic, continuous measurement in the CANopen-Lift Standard, the total energy requirement can be calculated over a longer period.

In addition to the existing modes (such as "drive", "ready", "standby" or "off"), the power saving mode reduces the demand during the business hours, without compromising the operational readiness of the lift. The resulting savings are much greater than the previously used full shutdown during limited hours.

This process not only allows a software update to be carried out in an assembly but also the parameter sets of all assemblies to be read out and secured following commissioning. This allows system manipulations that were effected after the final inspection to be detected. The process is not only of interest to the servicing company and operator of a lift system, but also to the monitoring authority or the fire brigade in case of damage.

Any unit can place virtual display content on the network and any other unit with a display and keys can be used for representation and

configuration. One could for example use an LCD display in the cab and the keys of the cab panel to display the control menu in the cab during maintenance and access the parameters or information on malfunctions. At the moment a method to allow the transfer of the graphical displays' contents is under development.

The CANopen-Lift standard is full of life and under constant development. The essential novelties are still coming from Germany, but CANopen-Lift is also increasingly gaining in international importance. In the future, CANopen-Lift will be the basis for the remote diagnosis of all components over the Internet and for the safety-related data transmission in lifts.

More and more companies are taking part in the development of CANopen-Lift and introducing new ideas into the standard, which are available to all participants. The future remains exciting. ◀

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# Model driven integration of CANopen components

Prof. Dr.-Ing. Ansgar Meroth

The histories of elevators and vehicles share several noteworthy commonalities. Cars started at the end of the 19<sup>th</sup> and the beginning of the 20<sup>th</sup> century as mechanical systems with electromechanical components – mainly ignition. Steam-driven lifts started to be employed in 1850, and were driven by electrical engines by 1880. In the 1970s, electronic components entered both worlds, first replacing single electromechanical parts, and in the 1990s, networking started to spread out so that complex and expensive wiring could be replaced. The next development step, however – model-driven development and automated integration and testing - is rather further developed in the automotive industry, driven by cost and safety requirements.

## Integration of lift components

In 2002, CiA 417 for lift control systems was specified in order to interconnect lift components with a common open interface. Many virtual devices have been created that add up to a complete lift system, such as an input panel unit, an output panel unit, a call controller, a car door unit, a car door controller, a light barrier unit, a car drive unit, a car drive controller, a car position unit, a load measuring unit, and a sensor unit. As a consequence, system specifications, system integration and maintenance can be performed by independent suppliers (Hellmich &

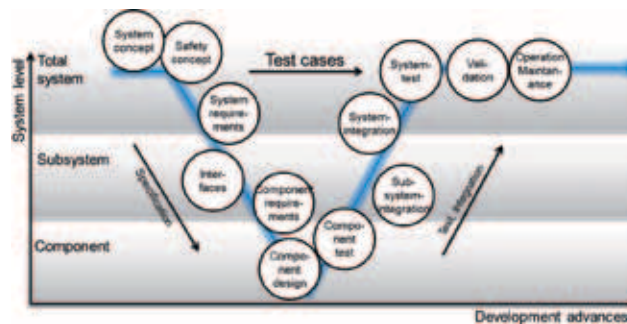


Figure 1: V-Model for the system design in the light of functional safety (Gutmann, 2010)

others). The common open interface helps to reduce development life cycles and time to market, especially in light of the challenging requirements of IEC 61508, the basic functional safety standard (International Electrotechnical Commission (IEC), 1998). These requirements have implications on the developing process, which challenge the integration of lift components in several ways. (Gutmann, 2010). The development of safety critical systems usually follows the V-model as shown in Figure 1. This approach would

theoretically require a long development time since all the specifications are made with a top-down-approach, in which the test cases for integration and verification are also elaborated. Consequently, system integration and verification is performed in a bottom-up-process. Using well known common interface specifications on subsystem and component level can reduce the development efforts considerably by taking advantage of off-the-shelf components and a parallel integration process on the subsystem level as shown in Figure 2.

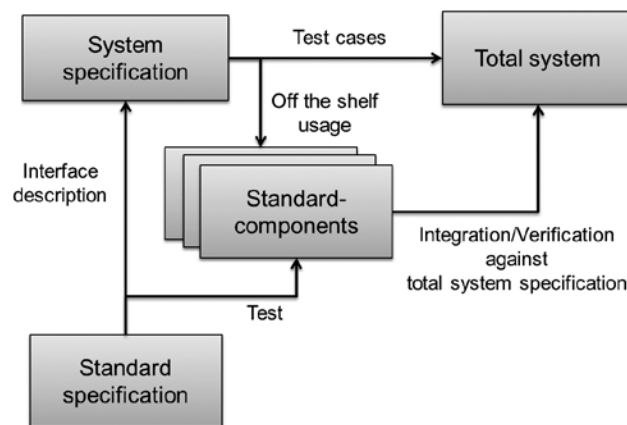


Figure 2: System development using standard components

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## Introduction

CANopen for Lifts, specified in CiA 417, has reached a maturity that allows fast development cycles, short integration times and easy maintenance. This article shows the usage of model-based development methods and hardware-in-the-loop (HIL) testing for lifts, following well-known schemes from automotive engineering and transforming them for lifts. This work is based upon the modeling of a lift system by Matlab/Simulink, which later will be used as a HIL test bench. The paper discusses how conformity tests and integration tests can be conducted in the proposed environment. Furthermore, a demonstrator lift is presented that takes advantage of the proposed ideas.

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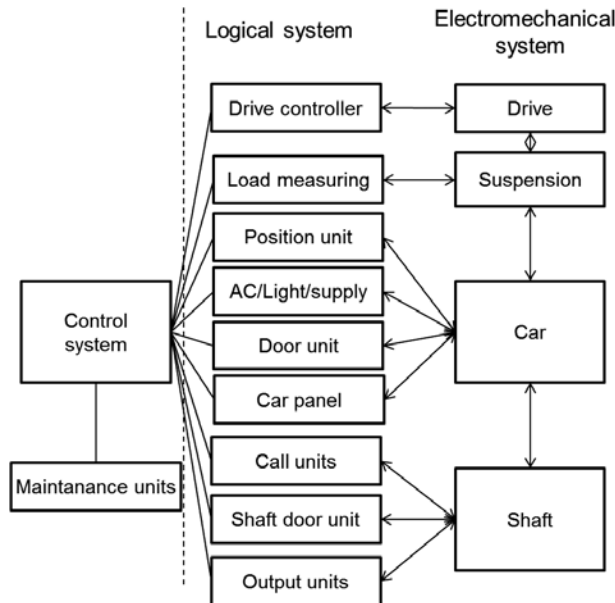


Figure 3: Logical system architecture

Each new component can be tested for the CiA 417 specification and integrated into a system that follows the standard and uses CANopen messages as interface. There is, however, a practical drawback, which is the fact that lifts need to be highly customized and individual. In other words, integrating and testing a new component would require the presence of the entire remaining lift system.

**Hardware in the loop**

The problem is well known and well solved in the automotive industry (Schäuffele

& Zurawka, 2010). From the beginning of their functional specification, new components undergo a test and integration process against a simulated total system. The future system is specified by taking advantage of a modeling tool chain, obeying a system architecture previously agreed on, and relying on CANopen messages as interface. Figure 3 shows a corresponding architecture, which is implicitly derived from CiA 417. We propose a modeling tool chain that includes:

- ◆ A mechanical model of the system that takes weight and load

parameters of the car into account, including a suspension model with – in case of a rope – appropriate tension and friction parameters as well as location, speed and acceleration,

- ◆ An electromechanical model that converts resulting load, speed and acceleration into drive engine load, torque and rotation and furthermore into electrical load,
- ◆ A logical model that calculates the user requests into drive parameters, which is what the lift control does. The logical model also represents the information flow in terms of CANopen messages.

Figure 4 shows some of the main parameters that have to be processed by the different models, which are connected by CANopen-like data structures. Step by step, the system model can be replaced by real components using a real time prototyping system that is directly programmed with Matlab/Simulink generated code as shown in Figure 5. A test bench realized this way consists of the real or simulated device under test (DUT), a so-called breadboard with real components (sometimes supported by substitute hardware that

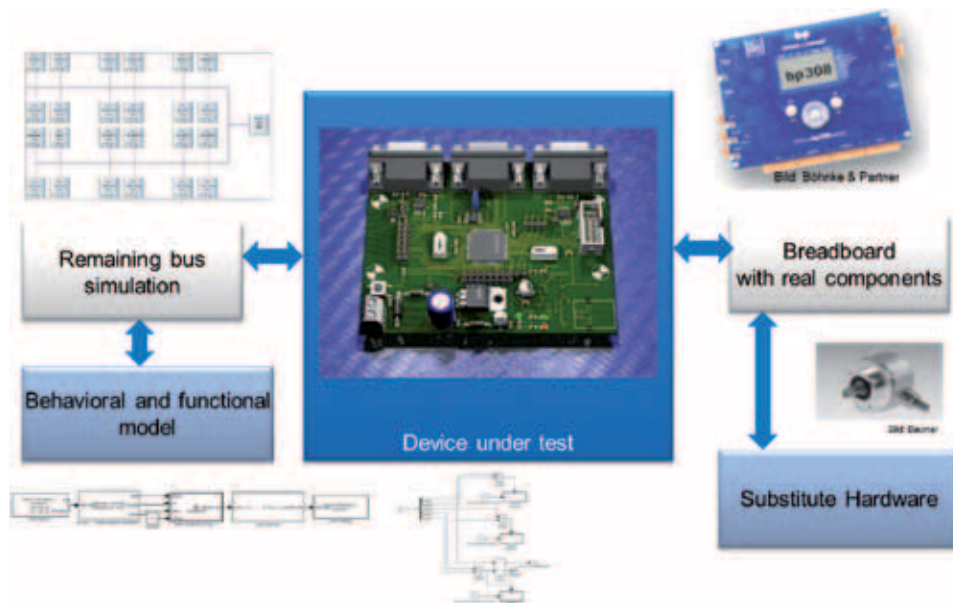


Figure 4: Hardware in the loop scheme

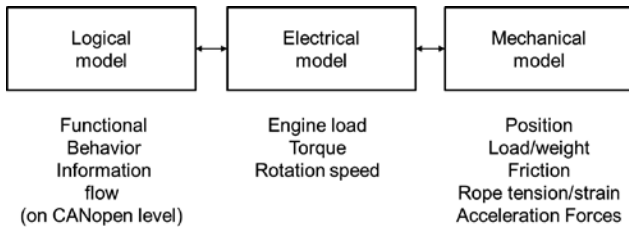


Figure 5: Model levels

simulates sensor input), a behavioral and functional model of the total system, and the remaining network traffic. In order to supervise the CAN network and to simulate remaining logical behavior, e.g. calls, CANoe by Vector can be used in addition to Matlab/Simulink.



Figure 6: Reference hardware model

### Test system

For the demonstration of the development life cycle stated above, we developed a 1:10 scale lift model as shown in Figure 6. This model was originally inspired by Jörg Hellmich, formerly at Böhnke + Partner and now CEO of Elfin. We used an aluminum frame made from industrial profiles for the two shafts and placed two cars on steel ropes with a counter weight and driven by DC motors commutated with electromechanical contactors. We hope to receive an asynchronous drive with an inverter from the lift industry in the future.

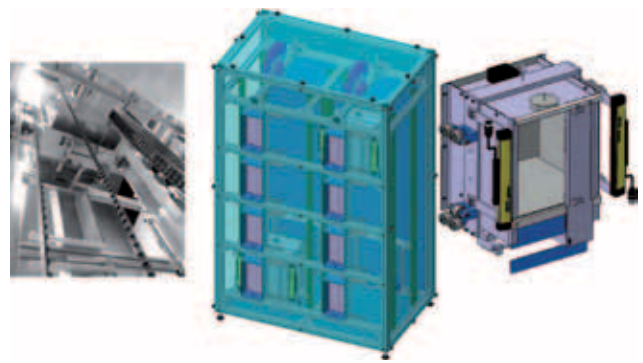


Figure 7: Selected components of the reference model

The system is controlled by two Bp308 controllers from Böhnke + Partner and takes advantage of original components, e.g. call units, light barriers, outputs, car electronics, position sensors and others. Even the safety circuit is constructed as close to an original system as possible. At the moment we are developing a virtual model of the components in order to replace the virtual and the real parts. For that reason, we have started to implement a simulation of CANopen messages of the system by means of Vector's CANoe and a be-

havioral model with Matlab/Simulink. Figure 7 gives impressions of some components of the real model. The final goal is to have a test system ready that can be used for static and dynamic conformity tests and allows a reduced integration and verification life cycle with single components. ◀



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# Magnetic encoders conquer safety-relevant applications

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## Outlook

*"We are currently developing a second, completely revised generation of magnetic absolute encoders, and aim to provide equivalent units to optical models", said Posital's CEO Dr. Michael Löken. "Users can then fully benefit from the advantages of magnetic technology, i.e. a more compact and cost-efficient design and reliable operation under rugged conditions. Moreover, we will introduce our first magnetic incremental encoders in September 2013. These units, which will be available at short notice, will allow users to configure the resolution depending on their requirements."*

Since errors in lift control systems can have potentially disastrous results, the sensor technology in such applications must be sufficiently reliable and safe. The following article describes encoder-based solutions, which have already proven themselves in practical use and, unlike non-contact measuring systems, have already established themselves on a large scale.

The position of an elevator car can, for instance, be measured by means of the steel cable by which it is suspended. This method, however, is not unproblematic, since slip, angular offset and multi-layer winding of the cable on the drum reduce the measuring accuracy considerably. Another obstacle is the fact that a full elevator car elongates the cable much more than an empty run. These challenges make it hard to ensure the desired measuring accuracy of 0,1 mm. Another approach, which is based on direct measurements at the cabin, allows users to sidestep these disadvantages: shaft copying, which



Figure 1: Magnetic Ixarc encoders are compliant with CiA 417

is carried out by absolute encoders and a belt drive or draw wire. The revolving belt can, for example, move a wheel fitted on the elevator car, whose revolutions are measured by an encoder. Alternatively, the encoder can be installed in a fixed location at the upper end of the shaft, measuring the cabin's position by means of a belt-driven wheel or draw wire. Thereby, the belt or draw wire is not burdened by the weight of the elevator car, thus preventing measurement errors through longitudinal strain.

## Compact magnetic solution

The Ixarc series of absolute magnetic encoders pro-

vides an innovative, robust solution for such applications. The units, which operate without batteries, do not require referencing. They instantly provide current position and revolution values even after power failure. This is an essential feature for elevator applications, where reference runs are often undesired or not permitted. Moreover, the magnetic functional principle of the encoders allows for a very compact design, which easily withstands high bearing loads up to 250 N that can occur in belt drives. It also allows users to implement especially cost-efficient systems, replacing incremental sensor solutions or optical absolute encoders. MCD encoders provide a maximum resolution of 12 bit per revolution. Additionally, they can cover up to 15 bit for measuring revolutions. Using an odometer wheel with a 50 mm diameter, this enables a linear resolution of 12  $\mu\text{m}$  and a 5,147 m measurement range. Higher resolutions are possible with smaller odometer wheels. The encoders feature a CANopen interface ▶

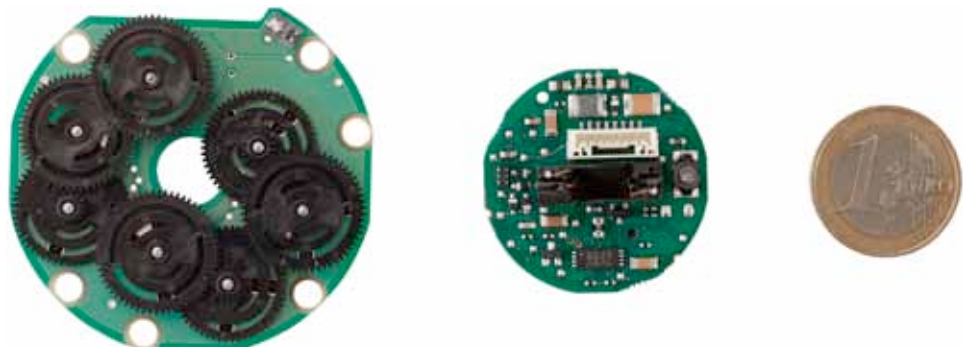


Figure 2: Posital's magnetic encoders (middle) require less space than opto-electronic models (left)





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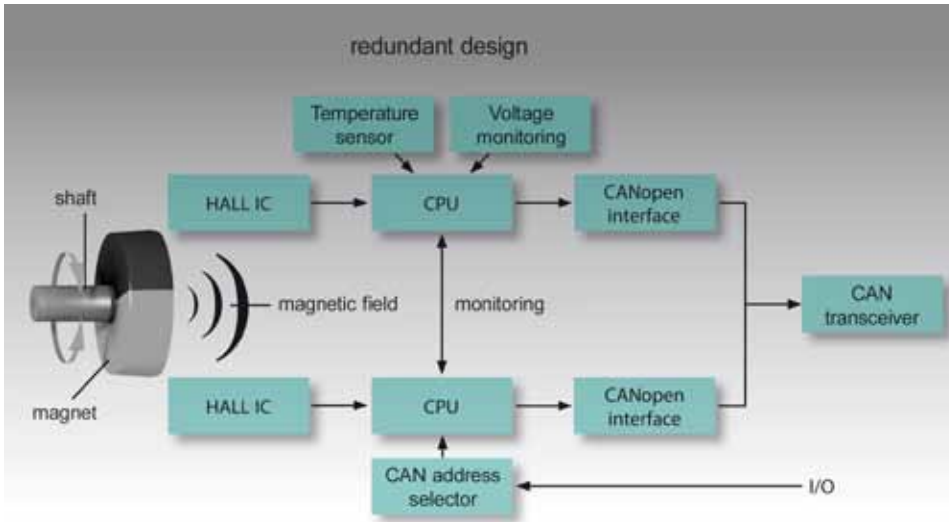


Figure 3: Building blocks of the magnetic SIL-2 encoder

with a lift application profile, which completely fulfills the requirements of the CiA 417 specification. Three modes of operation (cyclic, polled, and sync modes) provide high flexibility. Users can adjust the data transmission rate between 20 kbit/s and 1 Mbit/s. Parameterization and configuration, e.g. code sequence, preset value, and resolution per revolution,

are realized via the CAN network. Additionally, two programmable limit switch positions are available. All parameters can be stored in the encoder's nonvolatile memory. The sensors support LSS functionality (node number and bit-rate setting), allowing for a defined and cost-efficient integration into networks. Optionally, encoder models with an

SSI interface that enables the connection to all standard frequency inverters are also available.

### Storing revolutions without an external power supply

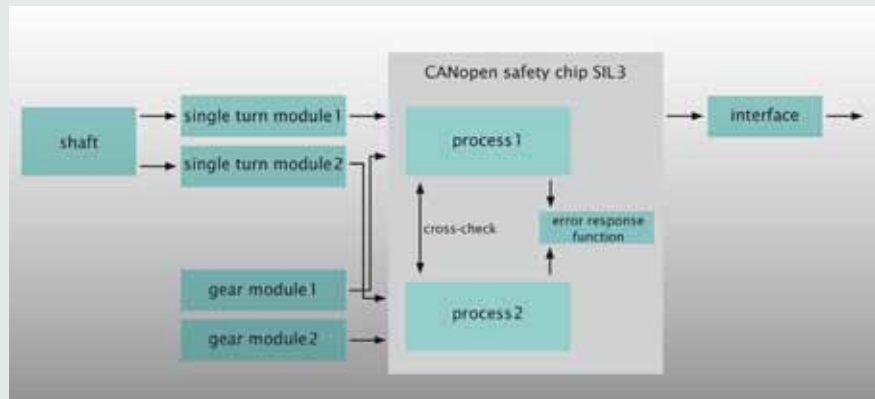
Encoders can be based on two technical solutions in order to count the number of revolutions: a gearing unit or

an electronic counter. The latter increments and decrements the number of revolutions depending on the direction, and then stores the value in a non-volatile memory. This method is not completely reliable, since the actual position can change during power failures. Batteries can be used as a buffer, but their lifetime and application range is limited. One approach to this problem is using the rotary motion of the shaft for the power supply of the counting electronics – similar to a bicycle dynamo. At a near-zero speed, however, this power generation method fails. This problem is solved by a patented magnetic encoder design, which is based on Wiegand technology. Regardless of the rotation speed, this proven technology generates short, powerful voltage pulses, which are sufficient for the power supply of the counting electronics. It enables the reliable measurement of absolute

## Certified optical SIL-3 encoder with a CANopen Safety interfacy

Posital's optical absolute rotary encoders have been certified by the TÜV Rhineland (Germany) testing authority. The sensors with a CANopen interface can be used in SIL-3 applications and are suitable for various elevator applications. The SIL-3 encoders support both the standard CANopen protocol and CANopen Safety protocol, allowing for mixed operation with Safety and non-Safety network devices. Like magnetic encoders, the safety encoders can be used for shaft copying and provide a safe position value.

Their safety design makes various other components unnecessary, or allows the encoders to perform additional functions. They could, for instance, replace other encoders at the drive or make position limit switches at the doors for floor identification obsolete. Moreover, standstill monitoring based on the safe position detection is also possible. The encoders transmit a safe position value, which can be directly processed by the safety controller, requiring no further checks in the PLC. Based on the position values, the PLC can also calculate the speed. A special feature is the redundant encoder design: thanks to a dual opto array and two gearboxes, the



The TÜV-certified optical safety encoders are suitable for SIL-3 applications

units ensure optimal reliability while measuring only 16 mm more in length than standard models. Node number and bit-rate (up to 1 Mbit/s) are configured via a rotary switch in the connection cap. The optical safety encoders use a proven opto-electronic scanning method to record position values. The single-turn sensor provides a maximum resolution of 16 bit per revolution. Additionally, up to 16384 revolutions (14 bit) can be detected in multi-turn mode, thereby covering a measuring range of up to 30 bit. The encoders are available as solid shaft, hollow shaft or synchronous shaft models. They provide IP65 protection on the housing side and IP64 on the shaft side (an optional shaft seal ensures IP66).

positions even in industrial environments. Normally, the counting electronics of the encoders are in a dead state. When the shaft moves, they are activated for a short time by a voltage pulse and analyze the rotating direction. The number of revolutions stored in a non-volatile memory is then incremented or decremented accordingly. Disturbances occurring during the dead state can therefore not influence the system. Unlike opto-electronic encoders, the magnetic encoders do not require gearing units or batteries, which minimizes production and material costs. Since only one permanent magnet is required to operate the Wiegand and Hall sensors, all elements can be fitted into a very small space.

Thanks to the magnetic technology, the encoders withstand rugged environmental conditions such as humidity, high and low temperatures, and vibrations. They are available as solid and hollow shaft versions, with a radial or axial cable exit, and with a maximum protection class of IP65. Posital provides a clamping flange model with robust bearings, which is especially suited for installation with the toothed belt where large forces can occur. The proven design ensures excellent reliability through oversizing.

### Magnetic SIL-2 absolute encoders

We have recently developed magnetic absolute encoders for measuring safety-relevant applications. The new encoders, which are operated with PELV (Protective Extra Low Voltage) fulfill the requirements of IEC 61508 / DIN EN 62061 (safety integrity level 2) and DIN EN ISO 13849 (performance level d). Featuring a wide input voltage range of 9 V to 35 V, they are suited for many different applications. The magnetic

single-turn encoders provide a 12-bit resolution and an accuracy of approximately 10 bit ( $\pm 0,35^\circ$ ) per revolution. We are currently planning to develop a magnetic multi-turn version similar to the already available standard safety encoder.

On the housing side, they ensure IP69K protection, while IP66 is reached on the shaft side. The encoder housings are available with two different diameters: one 25-mm model for restricted installation space and a flat 58-mm model that requires very little depth. Made from a special alloy, the magnetically shielding steel housing is also protected against salt mist. The SIL CL 2 encoders are based on two hall sensors that measure the magnetic field of a permanent magnet mounted on the shaft. The hall sensors are read out separately by two microcontrollers. The CAN controller, which is also redundant, is connected to the CAN network via a transceiver. Both microcontrollers ensure logical monitoring of each other's program sequence. Diagnosis functions include temperature monitoring inside the sensor and the output of emergency messages via the CAN network if preset limits are reached. Input voltage monitoring is also included in the diagnostic options. The sensor's node number can be optionally configured by means of four hardware inputs, which considerably simplifies installation and changeover since the devices no longer need to be configured via tools or require point-to-point wiring. ◀

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# Using the virtual terminal for universal remote access

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## Introduction

This article explains the concept of the virtual terminal interface defined in the CiA 417 Lift application profile.

It also describes the motivation and needs of this interface and tries to promote the power and the benefits given, together with a summary of the functionalities and the implementation.

## Links

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In a complete lift control system, there are many different intelligent devices today. Of course, first there is the main controller, which could be considered the “brain” of the system, but there are also the VVF inverter (for an electrical lift) or the hydraulic drive for a hydraulic lift, the door operator, the load measuring unit, the car and floor panels, and so on. All these interconnected devices are now complex electronic devices, and to best fit the targeted lift, most of the time a local HMI (human-machine interface) is integrated to adjust the parameters and give a better diagnosis when needed. Some of these devices also propose an optional remote tool, but very often with a specific protocol upon a specific wire, which offers a friendlier HMI. Now think of the lift technicians during installation or maintenance, as they have to master all of the tools of all the devices. Just think of your living-room table with the set of four or five remote controls – and sometimes more for your home audio-video devices (TV, DVD-player, recorder, audio amplifier, satellite decoder) – and you won't be far from the problem of our technician.

But even if the technicians are quite at ease with many different tools, the physical access to the devices becomes also more difficult. Nowadays, with the increase of machine roomless lifts, the frequency inverter and sometimes the main controller – the most consulted devices – are very often located in the lift shaft.



Figure 1: The inverter mounted on the top of the shaft is hard to access; the Zetadyn 3C inverter from Ziehl-Abegg is CiA 417 compliant and implements the virtual terminal interface

There are two issues to solve: the universality of the tool and the remote access with this tool. And for years, a solution has been offered by the CiA 417 CANopen application profile for lift control systems.

## Background

Members of the CANopen SIG (Special Interest Group) Lift have developed the CiA 417 application profile. These members are different designers and manufacturers of lift equipment located in different European countries. This profile, whose main objective is to ensure interconnectivity of lift devices, describes how data is exchanged over a CAN network based on the CANopen application layer (internationally specified in EN 50325-4, also known as CiA 301).

In the communication profile area of the CANopen object dictionary, the CiA 301 defines the “OS prompt”

object (Index = 1026<sub>h</sub>) in order to permit remote configuration and remote debugging of a can node. This is done by the use of well-known input and output streams: the stdin and stdout. Sub-index 01<sub>h</sub> of object 1026<sub>h</sub> is the stdin, and sub-index 02<sub>h</sub> is the stdout, each of one byte. These entries are intended to send a keyboard character to a node (the stdin) and receive a text character from this node (the stdout).

Inspired by this object, the CiA 417 profile introduces the Virtual Terminal Interface object (at index 600A<sub>h</sub>) with the two same sub-indices but with a size of 4 byte to improve the stream transfer rate. With the “front-end” contents of the standard input/output streams (keyboard/screen), this is the best way to achieve compatibility with any HMI, and therefore to have a unique tool, which is able to connect to every device of a lift system, while the remote access is inherently given

by the connection upon the CAN network.

## Implementation

Both nodes, the remote tool and the lift device consulted, shall implement the virtual terminal interface object, with opposite accesses (the remote tool sends the stdin, and receives the stdout, while the lift device receives the stdin and sends the stdout). But what is the best service to transmit this data? It clearly looks like the connection between both nodes should be in a peer-to-peer manner with client/server relationship: the remote tool is the virtual terminal client, which wants to virtualize the HMI of the lift device, which is then the virtual terminal server.

First we naturally think of SDOs, as SDOs are designed for a peer-to-peer connection in a client/server relationship and the range of CAN-IDs for SDOs have lower priority than PDOs so the transfer of HMI data won't disturb more important data. But for every SDO client request, there is a response of the SDO server. It could slow down the transfer rate and cause bad behavior of the remote tool because of a delay (remember how unpleasant it is to press a key and see the screen react one or two seconds after). SDOs should be used,

as the problem of the delay will only be relevant when using big HMI with a lot of characters to be transferred, but there is the need to find a more efficient transmission service.

Then we naturally think of PDOs, which are designed to process data, (this is the case with stdin/stdout), but the broadcasting of a PDO is a little bit annoying: every virtual terminal server will react to the transmission of the stdin (600A 01<sub>n</sub>) by the virtual terminal client! Because we need a peer-to-peer connection and because there are up to 127 nodes connected on a CANopen-Lift profile network, that means 127 different PDOs have to be defined only for the remote access of each device. This reduces the range of other PDOs available on the network for other purposes drastically. So normal PDOs are not the best solution either.

There is another service available, not the most well known, but recommended by the CiA 417 for transmission of virtual terminal data: the MPDO service. MPDO stands for Multiplexed Process Data Object. In a nutshell, these objects are hybrids between SDOs and PDOs.

There are no PDO mappings for MPDOs as the address of the object (index

and sub-index, called the multiplexer) is given in the message like a SDO, but this transfer is without confirmation, like for a PDO. MPDOs allow multicasting and unicasting with up to 4 byte of data within each message. There are two kinds of MPDOs: the DAM-MPDO and SAM-MPDO, meaning "Destination Address Mode" and "Source Address Mode". The names simply indicate that the multiplexer is a reference object of the transmitter in SAM mode or of the receiver in DAM mode. The SAM-MPDO allows multicasting, while the DAM-MPDO is used for unicasting.

Using a DAM-MPDO, the virtual terminal client (the remote tool) sends key-codes to the virtual terminal server, which answers by SAM-MPDO carrying screen characters. The used key-codes and screen characters are from standard ASCII codes according to ISO 88915. The virtual terminal server may also use control sequences (e.g. to clear lines or move the cursor in only one command), defined by the old but efficient VT52 terminal. More details on the contents of the transmission can be found in the CANopen-Lift wiki.

## Use cases

Let's go back to a whole lift installation compliant to the

German wiki:  
[http://www.canopen-lift.org/wiki/Virtuelle\\_Konsole](http://www.canopen-lift.org/wiki/Virtuelle_Konsole)



French wiki:  
[http://fr.canopen-lift.org/wiki/Console\\_virtuelle](http://fr.canopen-lift.org/wiki/Console_virtuelle)



English wiki:  
<http://en.canopen-lift.org/wiki/Terminal>

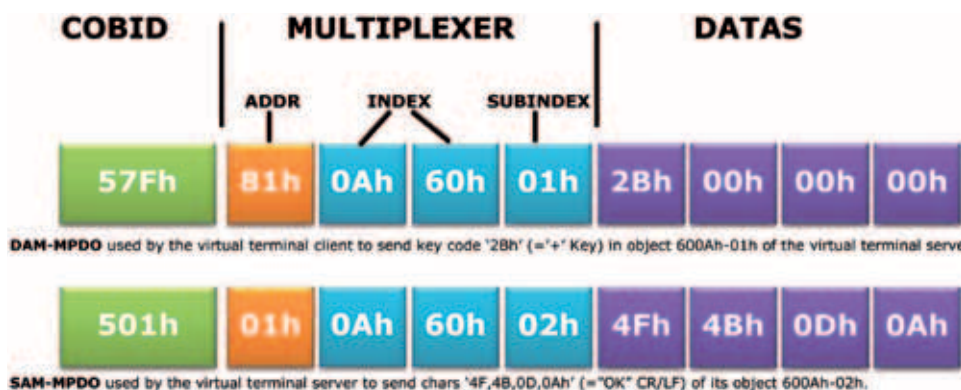



Figure 2: In Source Address Mode (SAM), the 4-byte multiplexer refers to the node-ID and the parameter address (index and sub-index) of the producer, while in Destination Address Mode (DAM), the 4-byte multiplexer refers to the node-ID and parameter address of the consumer; the used address mode of the MPDO is given within the first byte (ADDR = 80<sub>n</sub> + node-ID for a DAM-MPDO, and ADDR = node-ID for a SAM-MPDO); in the CiA 417 profile the CAN-ID of the MPDO is defined as 500<sub>n</sub> + node-ID

Table 1: Virtual terminal commands

<p>The Video Terminal VT52 by Digital Equipment Corporation introduced in 1974 and the description of the control sequences.</p> <p>The Virtual Terminal Interface defined in the CANopen-Lift profile still uses these control sequences.</p> <p>The sequences are sent by the virtual terminal server (in object 600A<sub>h</sub> - 02<sub>h</sub>) to operate on the display.</p>			
Decimal	Hexa-decimal	Code	Name
27 65	1B 41 <sub>h</sub>	ESC A	Cursor up
27 66	1B 42 <sub>h</sub>	ESC B	Cursor down
27 67	1B 43 <sub>h</sub>	ESC C	Cursor right
27 68	1B 44 <sub>h</sub>	ESC D	Cursor left
27 69	1B 45 <sub>h</sub>	ESC E	Clear home
27 72	1B 48 <sub>h</sub>	ESC H	Cursor Home
27 73	1B 49 <sub>h</sub>	ESC I	Cursor up and insert
27 74	1B 4A <sub>h</sub>	ESC J	Clear to end of frame
27 75	1B 4B <sub>h</sub>	ESC K	Clear to end of line
27 76	1B 4C <sub>h</sub>	ESC L	Insert line
27 77	1B 4D <sub>h</sub>	ESC M	Delete line
27 89	1B 59 <sub>h</sub>	ESC Yyx	Move Cursor
27 101	1B 65 <sub>h</sub>	ESC e	Cursor on
27 102	1B 66 <sub>h</sub>	ESC f	Cursor off
27 106	1B 6A <sub>h</sub>	ESC j	Store cursor
27 107	1B 6B <sub>h</sub>	ESC k	Restore cursor
27 108	1B 6C <sub>h</sub>	ESC l	Clear line
27 111	1B 6F <sub>h</sub>	ESC o	Clear line to cursor

CiA 417 profile and lets explore the benefits of the virtual terminal. With a main controller that implements the client interface, every HMI of each device is reachable from the cabinet where the controller is located. Directly from there, the lift's technician can access, configure and diagnose all other devices of the lift (which, of course, implements the virtual terminal server interface). The HMI of the controller is used first to set the controller, but in a dedicated menu, it can offer to connect to these other devices. The controller's HMI buttons then act on the HMI of the remote device, and the controller's HMI screen becomes the screen of the remote device's HMI: its terminal has been virtualized.

The controller may also implement the virtual terminal server in order to be accessed by a remote tool. Some manufacturers implement it in their controller and propose a smartphone application. This application is nothing more than a virtual terminal client, and with a wireless gateway connected to the CANopen bus, the smartphone becomes the remote tool of the controller, which is now accessible almost anywhere in the lift installation. It's very useful for the technician, who very often works around the lift's car.

Another very significant use case is the virtualization of the frequency inverter's terminal by the controller. As said before, in a machine room-less lift, the inverter

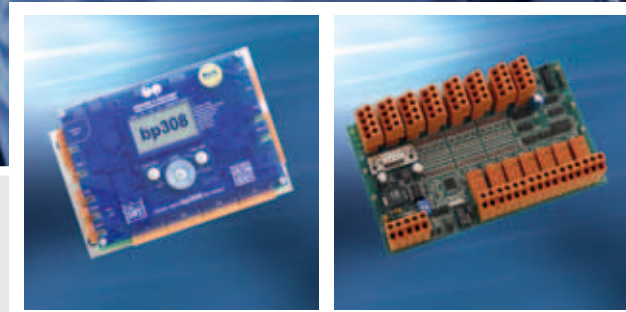
is located in the shaft, and thanks to the virtual terminal, the technician can configure it from the controller located on the floor, more at ease than if he had to be in the shaft. This case is such a frequent occurrence that the virtual terminal object is mandatory for an inverter device. It simply means that an inverter that doesn't implement this object can't be CANopen-Lift certified.

## Perspectives

HMIs in industrial equipment are evolving, especially in size and the kind of screen. The use of this kind of HMIs is growing in lift devices and so the virtual terminal interface has to evolve. The next step will be to define inside the application profile how to

virtualize the graphical displays and not only the alphanumeric displays, together with a complete description of the HMI, in order to be able to virtualize it in the best way.

Even with these needed evolutions, we can see the power and efficiency of the concept, as with it a lot of things become possible regarding accessibility of CANopen-Lift devices. So there are no boundaries to extend this virtual terminal interface from the lift profile to many other industrial profiles where the HMI's access to every device is needed. ◀



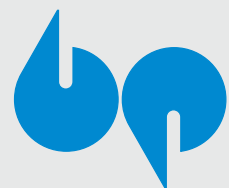
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# Black smoke-resistant shaft information system

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[www.elgo.de](http://www.elgo.de)



## Introduction

Elgo Electronic's TÜV-certified Limax33 Safe is a shaft information and control system using an encoded magnetic tape. It is equally suitable for new installations and for modernizations due to its easy installation and high saving potential.

Elgo Electronic is a pioneer in using shaft information systems based on absolute magnetic tape and has developed a reliable measuring and control system, which covers all requirements concerning the determination of the cabin position and the connected switching and control functions. One great advantage of this technology lies in the measuring system's resistance against dirt. The magnetic measuring system will work regardless of black smoke in case of a fire or of pollution in the elevator shaft.

Limax33 Safe consists of four components: a magnetic tape with absolute encoding, a presence detector for the magnetic tape, the Limax33 RED sensor for determining the absolute position of the elevator cabin, and the Safe Box, in which all switching and control functions are integrated.

The encoded magnetic tape is simply installed freely hanging in the elevator shaft using a mounting kit. The integrated safety switch serves to detect the presence of the magnetic tape. The redundant, SIL-3-certified sensor determines the momentary

absolute position of the elevator cabin through hall sensors, which scan the encoded magnetic tape contact-free. A wear-free plastic guiding guarantees that the correct distance between the sensor and the magnetic tape is maintained at all times. The position determined by the hall sensors is transmitted via a safe EIA-485 2-wire interface to a controller or to the Safe Box.

Additionally, the sensor has a push-pull output, which is switched inside the door zones of the stored floor positions in order to permit evacuation of the cabin via

the control room in case of a stop between two floors.

The most important features of the sensor are:

- ◆ Direct, redundant determination of the cabin position,
- ◆ Wear-free, contact-free magnetic measuring principle,
- ◆ Resistance against dirt, dust, smoke and humidity,
- ◆ Ideal for firemen's lifts,
- ◆ High system resolution of up to 62,5 µm for dynamic position controls,
- ◆ Lifting heights of up to 262 m are possible, speed up to 10 m/s,

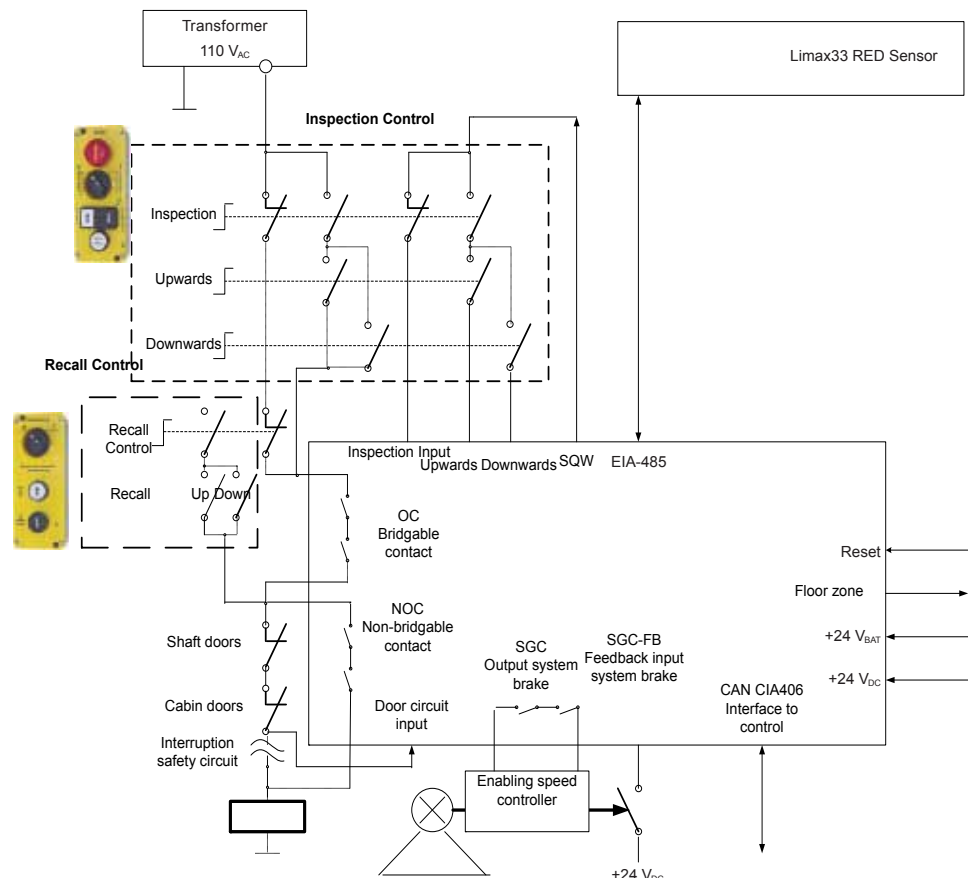


Figure 1: Integration of Limax33 Safe in the safety circuit





Figure 2: Example of mounting of Limax33 Safe

- ◆ SIL3-certified according to EN 61508,
- ◆ EIA-485 interface standard, CANopen Safety and other safe interfaces are possible,
- ◆ Easy and quick installation of magnetic tape and sensor,
- ◆ Low-energy 12 V operation.

As the Safe Box is connected to the sensor via a 2-wire interface, it can be installed either on the cabin roof or in the machine room. This allows the user to minimize the cabling works depending on the type of the elevator. The Safe Box also provides safe inputs and safety relays with normally open contacts. This helps to considerably decrease the number of components and the cabling in the elevator shaft.

The following functions are covered by the overall system:

- ◆ Speed limit, also relative to the distance from the shaft end: saves separate speed limit systems at the shaft end,
- ◆ Door overbridging function: saves floor magnets and floor switches,

- ◆ Limit switch functions: saves safety limit switches,
- ◆ Triggering of clasp break (optional),
- ◆ EN 81-A3 prevention of unintended cabin movements,
- ◆ EN 81-21 reduced heights of shaft pit and shaft head,
- ◆ Teach-in of the floor positions via conventional CAN interface (CIA 406 or CIA 417),
- ◆ Cyclical monitoring of the entire shaft image,
- ◆ Programming of door zone lengths, emergency and inspection limit switch offsets possible up to the limit values defined in EN 81.

Especially in the high-rise sector, customer-specific sensors, which are fixed directly in the molding of the rail, are already being used. For this sector, Elgo is currently developing the redundant Limax44 RED sensor, which will include all functional properties of Limax33 RED, but which will work with a sensor-tape distance of up to 12 mm and cover a measuring length of 1500 m. This will permit travelling speeds of up to 18 m/s. The sensor will be interface compatible to Limax33 RED and can also be connected to the Safe Box. ◀

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# Access control system for elevators

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## Introduction

An access control system for lifts has the purpose of regulating the access to particular floors within a building. Access control concepts are developed according to the specific building profile and to the building's occupancy: the demands in a hospital are different from those in an office building. A common building profile is the typical mixed-use apartment/office building with offices, surgeries, tenants, proprietors, etc. Based on the sometime difficult conditions, a concept must be created which fulfills the various requirements of all parties. Through suitable combinations of floor locking and floor release, compact access control concepts can be realized.

Schaefer offers, in cooperation with Böhnke + Partner, an access control system, which allows an inexpensive and reliable realization of demands in apartment/office buildings, banks, hotels, hospitals, etc. The employed RFID technology is distinguished by high-level data security and state-of-the-art security. The system consists of a reader unit, a lift controller with USB transponder reader, and of transponders. The communication as well as the control of the in-

stallation is realized via CANopen.

The EKS compact reader unit from Schaefer is an electronic device, which identifies electronic keys (transponders). This device replaces conventional key switches, instead of using transponders for contactless access authorization. Generally, the reader unit does not decide on access, but transfers the data of the identified transponder via CAN to the lift controller, which browses the database and initiates the actions configured for this particular transponder. Each access attempt is optically and acoustically signaled to the user. The EKS reader unit is available in various styles of the range of products and can also be



Figure 1: Floor buttons are available with various designs

mounted in a vandal-, splash- and dust-proof way on demand.

Each key transponder is a unique specimen with a non-recurring and unchangeable identifier. In case a transponder gets lost or is not returned when a tenant is moving out, it can be deleted or can be replaced by a new transponder. The new key is integrated into the system through the control device and the data of the previous transponder is overwritten – thus the costs are lower than those of a conventional steel and sheet locking system. Furthermore, additionally required transponders may be added easily. Transponders are available in four variants: as key ring pendant “Blue Tag”, ▶



“Key Tag”, “Strong Tag”, or as ISO card “Key Card”.

The transponder identifiers and the control concepts/actions must be stored in the lift controller; which is done by a matching USB transponder reader does this. The following actions can be configured through the controller: individual release of the authorized floor buttons, release of all floor buttons (up to eight floors, door selective), time-controlled floor locking and floor release, priority calls, rides for transport of chemical products and beds, rescue ride, and emergency ride. Table 1 shows an access control concept for an apartment/office building with five floors and floor occupancy.

By default, all floor buttons are locked. The floor buttons for access to the dentist and oculist are only released during their opening hours, which are set in the lift controller, and so that the patients only have access to the relevant floors

Table 1: Access control example

Floor	Occupancy	
	Door side A	Door side B
5	Apartment	Apartment
4	Apartment	Apartment
3	Apartment	Dentist
2	Apartment	Apartment
1	Apartment	Oculist
0	Exit	Exit



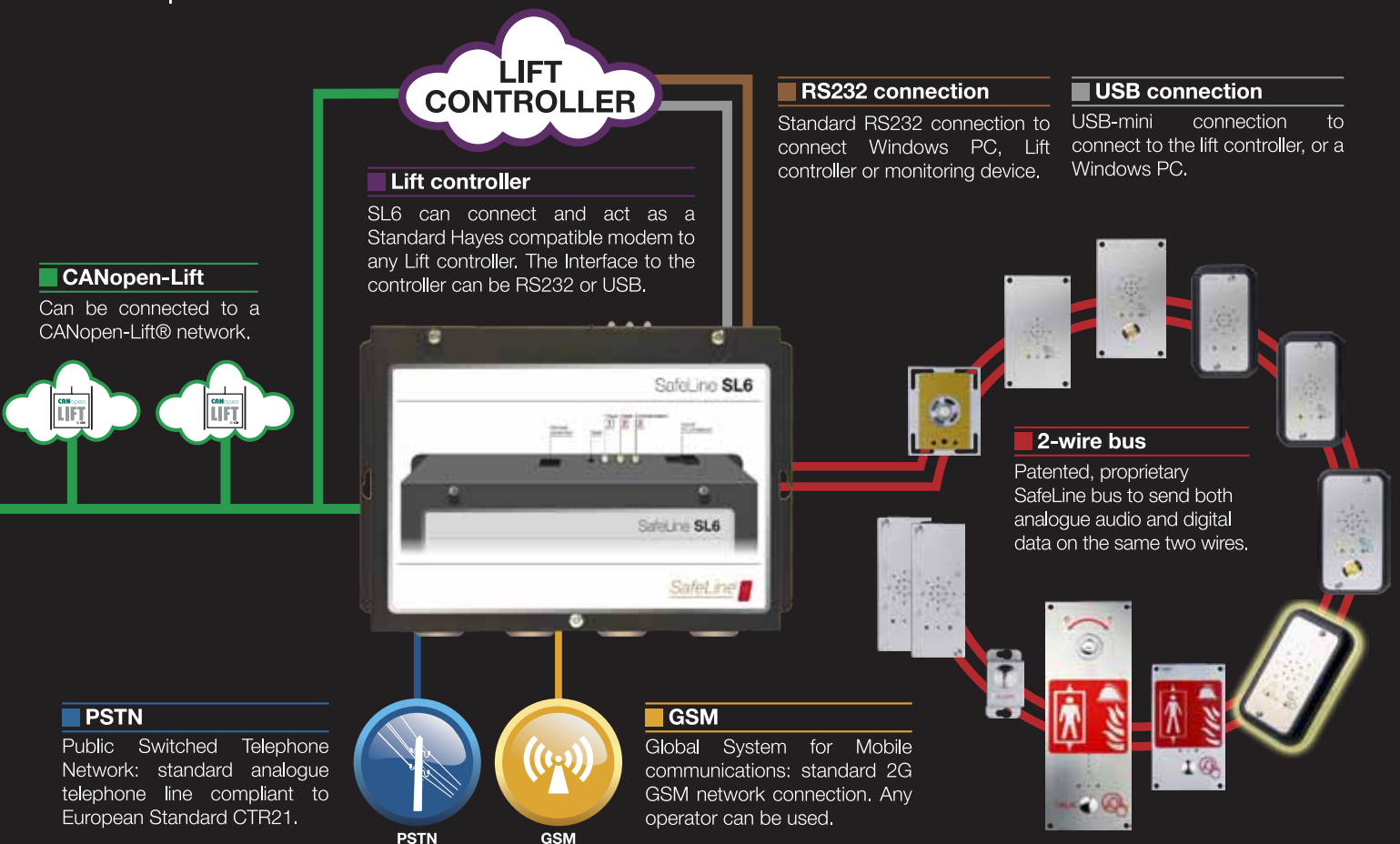
Figure 2: Key ring pendants Blue Tag, Key Tag and Strong Tag (from left to right)

(1 and 3, door side B), which allows a smooth handling of visitor traffic. The release of the apartment floors, however, is only possible by means of individual transponders held by the respective occupants and if necessary by further authorized persons (e.g. technicians). Occupants' guests can use the lift by means of a visitor ride function, which is initiated by the occupant.

Using the access control system from Schaefer and Böhnke + Partner, almost all access control concepts can be realized – thanks to the intelligent combination of reader unit and lift controller. Response to retroactive modifications of the building profile is effortless, inexpensive and fast.

# SafeLine SL6

The complete lift communication hub



# Project Mora Hospital: Six lifts in traffic systems

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## Introduction

About a century ago, on January 9<sup>th</sup> 1912, the first patient arrived at Mora Hospital. He was a little boy from Bergkarlås who came in with a fractured femur following a skiing accident, an injury that meant staying in the hospital for 50 days back then. A hundred years later, the lifts are undergoing modernization as one of the elements in the streamlining of care at Mora Hospital. Mora Hospital, which is situated in Dalarna, is the biggest place of work in Mora with around 800 employees.



Modernization of two passenger lifts and four bed/transport lifts in the main building of Mora Hospital was necessary in order to enhance accessibility, reliability and energy efficiency. This modernization included conversion with new gearless machines, including controllers, control cabinets and sensors, new automatic lift doors and shaft doors, new finishes, control panels, etc. All lifts had to stop at nine levels with a simple automatic door.

The system is fitted with three-stage Blue modus (energy saving mode): Switching off/dimming lift lighting, switching off floor indicator, and energy saving mode "Save mode" for frequency control. The lifts are also equipped with: "Revcon" (feedback of excess power to the mains

supply) and real-time energy metering with plain text in the display.

## I/O from CANopen-Lift

External calls and priority lift calls are freely programmable and made directly via I/O on the floor display FD4-

CAN. In this instance the following modes are operated: "Up call", "Down call", "Priority call 1: Emergency transport", and "Priority call 2: Bed transport".

Lift call and automatic door opening/closing functions are executed via I/O-8 cards; each card has eight combined inputs and



Figure 1: View of engine room during modernization

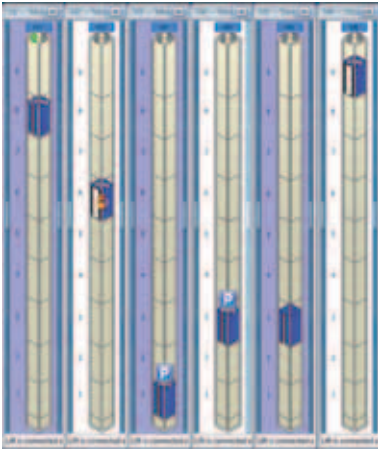


Figure 2: Winmos300 monitors up to 100 lifts

by TÜV. Implemented test functions allow the inspection body to easily carry out the necessary tests for the lift to gain approval. The LX control cabinet is always equipped and prepared for EN 81-A3. In lift and external calls, the card reader unit signals pass directly into what is known as a CAP-01 card, which has eight combined inputs and outputs.

outputs. These functions can be programmed to any task, either directly from a display on the control system or via the computer-based tool CANwizard.

### Service mode

With lifts in larger groups, it may be difficult to get hold of exactly the lift that needs to be serviced. To resolve this problem, every lift was fitted with an input function, which places the lift in what is known as "Service mode". When this input is activated, the lift leaves the group system, serves all pending lift calls, before then moving to the service floor (programmable). The lift opens and closes the doors and then travels 2400 mm down (programmable). The lift is now in service mode.

### EN 81-A3

UCM (unintended car movement) is - in accordance with EN 81-A3 - in control of involuntary lift movement and has been certified and approved

### Monitoring

A computer with Winmos300 for monitoring of the lifts has been placed in the engine room. It allows operating personnel to easily search for information and also has a 4G modem for remote connection. The software is capable of monitoring up to 100 lifts in the basic package, full access to errors, messages, weight, position, energy consumption; essentially, everything needed for diagnosis, programming, statistics and analysis of operating conditions. ◀

## Number of cable sections

#### Used in the lift cable:

- ◆ 230 V: 12
- ◆ 24 V: 2
- ◆ CANopen network: 2
- ◆ Emergency telephone: 4

#### Used in the shaft stem:

- ◆ Tensile weight: 2
- ◆ Emergency stop: 2
- ◆ Door contacts: 2
- ◆ Emergency telephone: 4
- ◆ 24 V: 2
- ◆ CANopen-network: 2



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# Lifts for public means of transport with CANopen

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[www.kronenberg-gmbh.de](http://www.kronenberg-gmbh.de)



[www.thyssenkrupp.com](http://www.thyssenkrupp.com)



[www.coopman.be](http://www.coopman.be)



[www.boehnkepartner.de](http://www.boehnkepartner.de)



Special demands are made on lifts for stops at tram and railway lines in local traffic. Because of their partially remote and outdoor location on the track, high protection against vandalism, dirt, dust and humidity is required. With regard to expectable EMV dysfunctions due to the railway traffic, high availability and reliability are also necessary. Individual requirements due to restrictions, e.g. for fire protection, demand particular functions of the signal processing for displays and speech announcements with regard to accessibility, for example during an evacuation. A non-halogen wir-

ing is also standard at these installations. Furthermore, low operating costs and investment security are required of such installations. Fast setting up on site, a reliable error diagnosis on request, and a quick and easy exchange of the components is also expected. This can largely be ensured by the employment of lift components according to the CiA 417 CANopen application profile for lift control systems.

All of these reasons have convinced the operators of the Kölner Verkehrs-Betriebe (KVB) and the Metro in Brussels to decide in favor of the CANopen



technique. Their new lifts are therefore equipped with controls, operating and display panels, and further assembly groups with CANopen technique.

## Kölner Verkehrs-Betriebe (KVB)

The construction of the north-stretch of the KVB comprises seven stations with a total of 13 lifts. Kronenberg has been supporting ThyssenKrupp AG in planning the lifts since 2009. For this purpose there have been constant exchanges with the project management of the group. Many of the lifts are already in operation.

V4A stainless steel, which has been electropolished to protect the surface, is used as a cover panel material. This was made for operating panels of particularly high quality and durability. The front of the control panels are designed to be water- and vandalism proof. To guarantee barrier-free, large, square push-buttons are installed. The pushbuttons are mounted





twice at different heights to facilitate visibility and operation for wheelchair and upright users. With their 50 mm x 50 mm button surface, outstanding color contrast and tactile surface, they meet the requirements of the EN 81-70 standard. The required acoustic acknowledgement of the call acceptance is part of the usual functions of the CBK1 CANopen module. Users receive additional information on the status of the lifts by the acoustic speech announcement DSA2, which has an excellent voice quality. In view of the high level of background noise at platforms and on streets, an additional speech announcement with greater amplifier power is used for operating panels and call columns on the platforms.



Passengers receive further information by floor position displays, illuminated fields, and information

fields, which are all fitted with the latest LED technology. Communication between the operating panel and the control is achieved over the CANopen-Lift network. The operating panels are delivered completely assembled, prewired and parameterized and can be put into operation immediately after plugging in the bus connection.

### Metro in Brussels

Coopman received a major order from the Brussels Metro in summer 2009 for over 30 lifts and decided to cooperate with Kronenberg. A year of lively and advanced exchanges between the two companies followed, until the components were released. The lion's share of these installations has already been put into operation.

Due to the heavy demands on the lifts, Coopman chose the RV34W pushbutton, which delivers

the highest requirements of Hans & Jos. Kronenberg's wide pushbutton range. The black and white pushbuttons, in combination with the blue dot matrix displays and stainless steel face plates, create a modern and harmonious look. The CANopen technique is also used for these installations, which greatly simplifies the programming and parameterization of these operating panels. Due to the open standard, long-term investment security is guaranteed.

For the first installations, Kronenberg only delivered single components and call columns. In the meantime, all of the operating panels and call columns are made by Kronenberg. Complete operating panels with all of the built-in parts are now delivered prewired and parameterized. For that, the three single CANopen modules of the past were exchanged for the CANopen module CBK1, which was especially developed by Kronenberg for lift operating panels.

Since then, the double-row display and the speech announcement are no longer controlled by screw terminals but by serial interfaces. Some signal connections for special functions are no longer parameterized by hardware but by software. The operating modules are also no longer connected by single conductors to screw terminals but by plug connectors. Thus, the extensive wiring of the single wires and the required both-sided marking of the wires have been simplified and reduced drastically.

Before being handed over to the customer, the operating panels undergo exhaustive testing both at Kronenberg as well as at the control manufacturer Böhneke & Partner in combination with the lift control to be delivered, in order to ensure that the initial operation on site will run smoothly.

The CAN knot type CBK1 according to CiA 417

was already developed in 2003 and has been updated constantly. In addition to its eight inputs and eight short-circuit proof outputs, further inputs and outputs can be provided by compact extension modules type. Floor position indicators and speech announcements can be controlled serially. For this purpose, two serial interfaces are available. An acoustic pushbutton acknowledgement is integrated in the standard and can be parameterized. By the galvanic bus separation and the installation of a CAN-choke a high interference resistance is achieved.



The CBE1 module has proved its reliable operation method in different lift installations for many years, as for example in the World Trade Center in Brussels, with a six-fold and a five-fold group up to 27 floors, skyscrapers in Cologne, Fraunhofer Heinrich-Hertz-Institut, and now also in the rough operation at stations of local transport. ◀

# CANopen-Lift, the logical further development of DCP

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## Links

[www.weber-lifttechnik.de](http://www.weber-lifttechnik.de)



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In 1997 a quantum leap in lift equipment technology happened: Lift controllers and frequency inverters communicated over a standardized network protocol. Designed specifically for lift application, DCP protocol (Drive Control & Positioning) stayed state of the art for a long time and was further developed over the years and adapted to the current technical requirements insofar as the technical structures allowed.

Advantages of DCP compared to the parallel control of the frequency inverter:

- ◆ Optimized start-up time due to less wiring work,
- ◆ Optimization of speed,
- ◆ Millimeter-precise stopping,
- ◆ Direct drive-in,
- ◆ Remote maintenance and configuration of the frequency inverter.

The technical evolution did not stop with the DCP protocol. Mass producers, such as the automotive industry, have long been technological leaders in the area of networked systems. With the CAN network system, they set new standards in response times, security and data throughput at an affordable price. Sensors, actuators and control loops must provide, receive and react to information in a split second.

The demands on modern lift technology and automotive technology are not so far apart. This provided the next development step: Moving away from the slow master-slave insular DCP application towards a networking of all microprocessor-controlled components via a CAN network system, in which the modules communicate with each other directly. The challenge in lift

technology was to provide compatibility for microprocessor-controlled components from various sources. For this reason, the CANopen-Lift working group, a special interest group of lift control and component manufacturers under the auspices of CiA (CAN in Automation), developed a standardized CAN network protocol for the lift technology sector (CANopen-Lift) in 2002.

## Functional principle

All microprocessor-controlled components provide information on a common CAN network. This information is called up, processed and answered as needed or depending on urgency. Thus, the component receives the desired information in real time, without the time delay of a master and can respond instantaneously. ▶

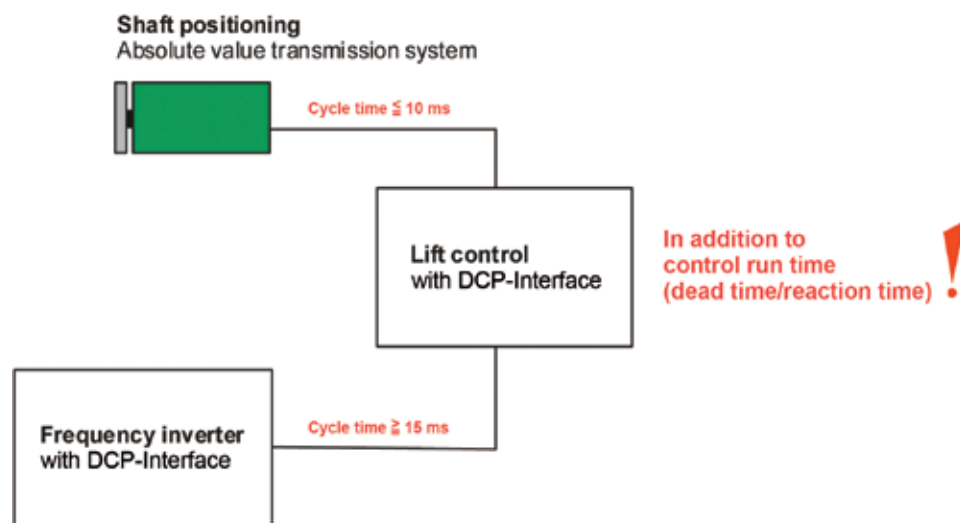


Figure 1: DCP frequency inverter connection – through the necessity to send all information through the lift control system, unnecessary dead times are created; information is delayed in reaching the available components, which, in part, causes impacts up to the control area



## CANopen-Lift: state of the art technology in modern lift construction

CANopen-Lift not only offers technical advantages for the interaction of lift control and frequency inverters. The benefits are also substantial for the people who come into contact with the lift system.

### Benefits for the on-site technician

- ◆ Improved start-up time
- ◆ Direct read outs and changes in the parameters of the frequency inverter without going through display imaging
- ◆ Easy debugging of the entire system
- ◆ Ability to read the error list in the native language

### Benefits for the passenger

- ◆ Improved riding comfort
- ◆ Optimized speed

- ◆ Millimeter-precise stopping
- ◆ Direct drive-in without creeping distances
- ◆ Variable specification of the speed respectively of the maximum speed
- ◆ Optimized speed for the shortest travel times

### Advantages for the operator

- ◆ Preventive maintenance (e.g. evaluation of sensor ball bearings)
- ◆ Simplest control of functions for saving energy
- ◆ Measurement of the drive energy consumption using the frequency inverter, read out of the measurement data is possible via the CAN network
- ◆ High data security = high system availability
- ◆ Direct connection to the Internet for remote maintenance and configuration

### CANopen functions in modern lift systems

By networking all components of lift systems with CANopen-Lift, many new options are provided for the interaction of the lift control and the frequency inverter: The ability to directly access the absolute encoder for the first time, gives the frequency inverter the ability to receive information of the position and movement of the car without time delay. The frequency inverter makes use of this in the following ways:

- ◆ Precise deceleration and positioning through faster detection of the position of the car with distance-dependent movement,
- ◆ Output of information about car movement during the test of the driving ability,
- ◆ Output of information about braking distances during the brake test.

The control offers the possibility of directly parameterizing the frequency inverter. A reproduction of the display of the frequency inverter is not necessary. Therefore learning the operation and configuration of

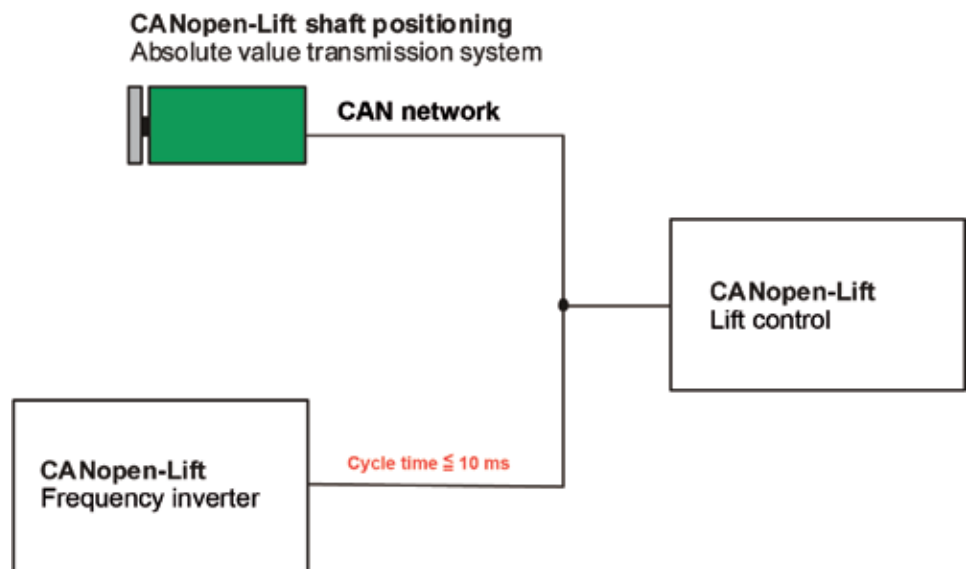


Figure 2: CANopen-Lift frequency inverter connection – the direct information flow generates short reaction times, which are essential for increased security and better riding comfort

various frequency inverter models is no longer needed, which is an advantage for the technician on site.

### Interface compatibility

The prerequisite of a cross-manufacturer system is the compatibility of the components and functionality of the overall system.

The manufacturers of the CANopen-Lift components subject their products to constant compatibility

checks. Under the leadership of the manufacturer-neutral CANopen-Lift working group, compatibility testing takes place regularly. This quality control gives the user security in the assembly of his lift system with CANopen-Lift components.

### Conclusion

The CAN network is used in millions of applications worldwide and is the basis of many requirements with a

high level of security such as lift technology.

This broad application front ensures continuous development of this network. In modern lift systems CANopen-Lift offers many advantages compared to DCP, which are reflected in noticeable added value for passengers and operators. ◀

# Value adding by linking CANopen CiA 417 devices

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In the CANopen application profile for lifts (CiA 417), the most essential devices with CAN network connections for entire lift groups are described. This has the advantage that the communication among units is standardized. Devices behave in the same manner, independent of the manufacturer. This can be illustrated particularly through the example of the load-measuring device and its connection to the lift controller bp308, of Böhnke + Partner GmbH.

The overload signal is mandatory for each lift. It sends the signal for an

overloaded car to the lift controller and consequently the lift doesn't work. A simple contact with a regulating screw can be used for this implementation. For a better transport efficiency, particularly in case of lift groups, the lift controller requires a signal for a full load, for example when the car is loaded by 80 %. For misuse detection or other special functions, the minimum load signal, which reports an empty car, is helpful.

A conventional load meter sends the signals of full load and overload. Threshold values can be set either by a potentiometer in the device, or via the menu. These devices can optionally send additional signals in the form of relay contacts, which must be wired to the lift controller. The lift controller requires appropriate inputs.

A load-measuring device with the CANopen lift interface provides additional discrete signals, such as reduced load, slack rope, or rope difference. Furthermore, it reports the effective car-load in kilogram (Figure 1). All this information is transmitted via the CAN network line, which consists of only two wires.

The information sent by the load-measuring device through the CAN network is available to all connected devices. This way the frequency converter (drive unit) can also use the effective car-load to optimize the start-up behavior and prevent unwanted turning away (undesirable car movement in the opposite direction) at the start.

The bp308 lift controller also transmits the effective car-load to the monitoring system Winmos300 (software package for remote monitoring of lifts). In case of a continuous connection to the lift system, the software can store these values cyclically in a database and provide subsequent statistical analysis. In the application profile for lifts, the parameters of the load-measuring device are defined. The lift controller can adjust the device via the control displays (Figure 2). This is of particular advantage, especially when the load-measuring device is inaccessible. The individual thresholds for reduced, full and overload can be modified and stored in the lift controller. If the substitution of the load-measuring device becomes necessary, the values can be written on the new device. The zero-point calibration of the load-meter (tare function) can also be done by the lift controller (Figure 3).

If the load-measuring device has a sensor at each track rope, the individual rope loads can also be displayed on the control display. This display can be used to balance the tension of the ropes, since the difference between the ropes must not be too great (Figure 4).

All these added values can be generated with a reasonable effort, since the used components are not wired together in a conventional way, but they communicate via the CAN network in accordance with the application profile CiA 417. ◀

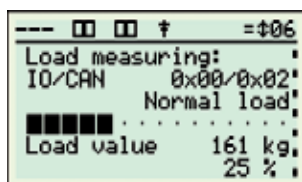


Figure 1: Diagnosis of the signals of the load-measuring device

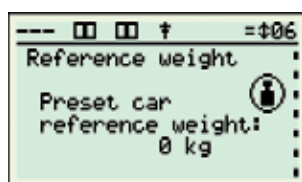


Figure 3: Setting the reference weight

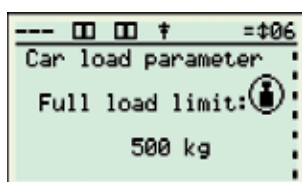


Figure 2: Setting the threshold for full load

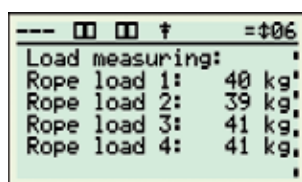


Figure 4: Diagnosis of the individual rope loads

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