



*History and trends:
CAN in elevators*

In 2002, CiA members started to develop the CiA 417 profile for lift control systems. CANopen used in lifts became CANopen Lift. The goal was to agree to a common specification, which enables suppliers to design interoperable CAN-connectable devices for elevators.

(Source: Adobe Stock)

The history of elevators begun with human or animal powered hoists. Some early ones were even driven by water power. Modern elevators started in the 19th century: In 1852, Elisha Graves Otis introduced safety contrivance for elevators. The first electric-driven elevator was manufactured by Werner von Siemens in 1880.

Nowadays, there are millions of elevators in operation. Most of them use electrical drives, the other ones are driven by hydraulics. Just in 2020, over one million units were installed and many others were retrofitted. Vertical transportation of human beings is very safe (some people state that elevators are the most reliable transportation technology) and very resource efficient in comparison with horizontal transportation.

Electric control systems for elevators are used for a long time. Beginning of the 90ties, Kone was one of the first companies using CAN networks to control elevators. Today most of the control systems for elevators make use of CAN networks. In the beginning, the CAN networks implemented proprietary higher-layer protocols. In 2002, some CAN in Automation (CiA) members started to develop a CAN-based application profile for lift control systems. The initiator was Joerg Hellmich working with Boehnke & Partner (now he is the Managing Director at

Elfin). The profile is now known as CANopen Lift and it is specified in the CiA 417 document series.

CANopen Lift: Specifying virtual devices

The CiA 417 document series specifies an application profile based on the classic CANopen application layer (CiA 301). Application profiles describe the functional communication interfaces for the whole network. CiA 417 specifies the interfaces of functional entities called virtual devices. This includes call, car drive, and car door controllers as well as input panel, output panel, car drive, car position, load measuring, car door, light barrier, remote data transmission, and power-measuring units. A CANopen Lift device can implement one or multiple virtual devices. This allows very flexible network system designs. Usually, a CANopen Lift network system comprises two network segments connected via a transparent PDO bridge. This means, from a logical point of view it looks like a single seamless network.

All necessary PDOs for a single-shaft lift control system are specified; some of them are distributed in broadcast other peer-to-peer. For multi-shaft lift control systems, the communication between the controllers is manufacturer-specific. Nevertheless, each device can implement up to eight instances of the application profile, so it can be ▶

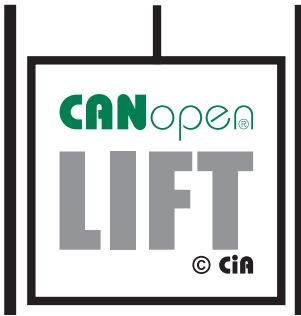


Figure 1: CiA's official CANopen Lift logo (Source: CiA)

used in up to eight lift control systems.

As already mentioned above, the virtual device concept allows the design of PDO-transparent bridges. The virtual device definitions for the car drive unit (motion controller) and car position unit (encoder) follow the generic CANopen device profiles for motion controllers and encoders. However, in lift control applications different object dictionary entries are used. The CiA 417 specification comprises several parts: Part 1 describes general definitions (including additional error codes), Part 2 specifies virtual devices, Part 3 specifies PDOs, and Part 4 specifies application objects (process data and configuration parameters). All parts are available on [CiA's website](#).

As far as possible, the virtual device definitions are implementation-independent. The CANopen Lift specification enables system designers to select CiA 417 compliant devices from different suppliers and to integrate them into networks without huge efforts. For example, the car position unit can be implemented in traditional rotary encoders as well as sensors using other technologies to measure the position, such as ultrasound or magnetic tape. Usage of standardized interfaces allows the lift operator an open maintenance of the lift system. Software tools for implementation and diagnosis are available by different providers.

CANopen Lift is suitable for very small applications as well as for complex systems. Over the last ten years, the CiA 417 specification has been extended. It covers modern system requirements including pre-emptive maintenance and the link to cloud services. Since CiA 417 version 2.1.0, the boot-up and program download procedure is introduced. The CiA 814-1 application note provides the implementation hints for the CiA 417 compliant bootloader.

In the first days of CANopen Lift, there were available just a very few car drive units compliant with CiA 417. But ▶

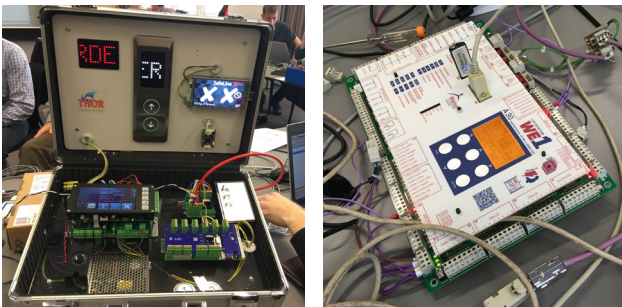
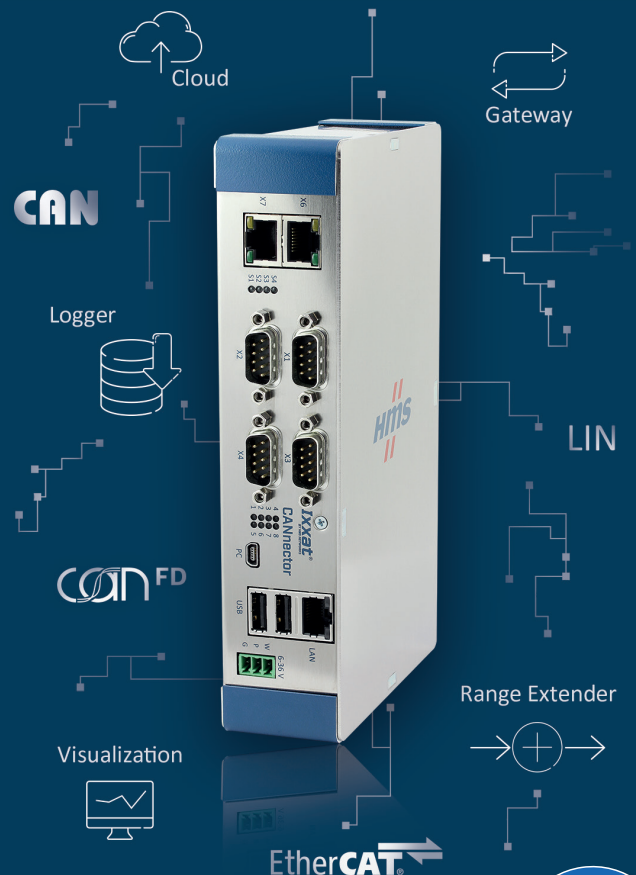


Figure 2: 2019, live in one of CiA's CANopen Lift plugfests: On the left, CANopen Lift controller and units in one box connected to car drive units from other companies; On the right, CANopen Lift host controller tested on interoperability with drives and panels (Source: CiA)

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Figure 3 In the Globen Shopping mall 29 lifts use CANopen Lift controllers (Source: Hisselektronik)

those days are gone, nowadays, there are several manufacturers offering CANopen Lift electric inverters. Some companies providing CANopen Lift inverters are, in alphabetic order, for example Control Techniques, Fuji, Gefran, Liftequip, Yaskawa, and Ziehl-Abegg. Most of them have already participated in CANopen Lift plugfests organized by CAN in Automation. In these plugfests, the interoperability to CANopen Lift host controllers featuring car drive controller functionality is approved. One of the market-leading CANopen Lift controller suppliers is Boehnke & Partner. In the last years, the company alone has delivered already about 25 000 CANopen Lift based host controllers. The potential of CANopen Lift has been recognized and so further devices are currently being developed.

Other lift controller providers include, for example in alphabetic order, Bucher Hydraulics ([on page 39](#) you will find an article from them), Elfin, Elgo, Intec, Kollmorgen, RST, Safeline, Sprinte, Thor Engineering, Weber, and of course, a range of others. The list of companies providing CANopen Lift capable products is a very long one.

A little throwback

In 2019, the [CAN Newsletter](#) reported about one of the biggest projects with a CANopen Lift control system almost done in Sweden. In the Globen Shopping mall 29 lifts use CANopen Lift controllers. In a special issue of the CAN Newsletter in 2013, the project Mora Hospital was described. The lifts were undergoing modernization as one of the elements in the streamlining of care at Mora Hospital. The CANopen Lift control system collects external calls and priority lift calls are freely programmable. The position of the car is indicated on the FD4-CAN floor displays connected to the CANopen Lift network. In the same CAN Newsletter issue, there are reports about CANopen Lift applications for public means of transport.

Kölner Verkehrs-Betriebe (KVB) in Cologne (Germany) and the Metro in Brussels (Belgium) decided to equip their new lifts with controls, operating and display panels, and further assembly groups with CANopen technique. These examples prove, CANopen Lift can be found everywhere.

CANopen Lift plugfests

As already mentioned above, many providers of CANopen Lift products test their devices on interoperability during plugfests organized by CiA. On request, the nonprofit association organizes plugfests for its members. This is done to detect system integration problems before the products are shipped to customers. CiA members implementing the CiA 417 profile in their CANopen Lift devices prove jointly that their products provide plug-and-play capability. CANopen Lift controller suppliers can provide a list of interoperable devices and CANopen Lift unit vendors can provide a list of interoperable controllers. This helps to simplify system integration. System designers get a better understanding of the problems occurring during component respectively device integration. The participants learn from each other, together they solve interoperability issues. They share their experiences regarding functionality of CAN components, CANopen devices, and CAN-based network systems. Last but not least, the results of plugfests are a valuable input for improving of the related CiA specifications. The CiA association is a neutral platform to maintain the CiA 417 application profile specification and to organize plugfests. It also provides supplier- and product-independent training and education services.

CANopen Lift today

The [CiA special interest group](#) (SIG) lift control (CANopen Lift) maintains the CiA 417 specification series. The SIG ▶

Since many years, the following basic building blocks are standardized in CiA 417:

- ◆ Call controller: It manages the call requests from the input panel units and acknowledges them to the output panel units. It requests the car drive controller to move the car and requests the car door controller to open or close the doors.
- ◆ Input panel unit: It is installed as in-car call panel or as floor call panel. There are also general input devices (e.g. for key-switch or fire alarm).
- ◆ Output panel unit: It is installed as in-car display panel or as floor display panel. It could be also a generic output panel providing acoustic announcements.
- ◆ Car drive controller: It commands the car drive unit to move the car.
- ◆ Car drive unit: It moves the car upwards and downwards.
- ◆ Car position unit: It measures the position of the car. Optionally, it provides speed, acceleration, and jerk values. There may be four units in the lift control system.
- ◆ Car door controller: It commands to open and to close up to four car lift doors. It receives optionally data from the light-barrier unit.
- ◆ Car door unit: It opens or closes the car lift doors.
- ◆ Light barrier unit: It detects subjects and objects entering the protected area of the car doors.
- ◆ Load-measuring unit: It provides the current load of the car and indicates overload situations to the car drive controller.

In the last few years, the following functional entities have been added to the CiA 417 set of specifications:

- ◆ Power-measuring unit: It provides the measured power consumption. It can measure the overall or the device-individual power consumption.
- ◆ Remote data transmission unit: It features gateway functionality for remote control or remote diagnostics purposes.
- ◆ Access remote unit: It reads different media to allow access, e.g. chip and smart cars, RFID tags, bar codes, or finger prints.
- ◆ Monitoring unit: It serves as condition monitoring as recommended in VDMA 24582.
- ◆ Position supervisor unit: It comprises the car position unit 1 and monitors speed, deceleration, door contacts, safety limit switches, and unintended car moves.

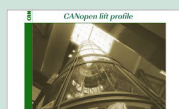
(Source: Adobe Stock)

constantly improves functional description of the application and communication interface for specified CiA lift components and the lift host controller. Furthermore, SIG also introduces new application functions and new lift component specifications. The purpose is to provide highly-readable specifications for implementing interoperable CiA 417 devices for lift manufacturers and system designers. SIG lift control approves release of CiA 417 specification versions with key functionalities and even retains previous specification versions to become publicly available to widespread and improve acceptance of CANopen in the elevator markets. In April 2022, CiA provides a free-of-charge webinar regarding lift control.

There is a range of CANopen Lift related products and it would be impossible to mention all of them. Langer & Laumann provider of door solutions for lifts, for example, offers the TSG V4 lift door operator with CANopen

CiA 417 on Youtube

On its [Youtube channel](#), CiA also provides content regarding CANopen Lift. Watch here:



CANopen Lift profile

Webinar from 2021-02-02



CANopen Lift CiA 417

Webinar from 2021-10-14 in Chinese language



CANopen Lift

Technology day 2020

CANopen Lift at Interlift

At the biannual Interlift trade show in Augsburg (Germany), CiA members presented several times the CANopen Lift demonstrator, the first one in 2009. The marketing group (MG) CANopen Lift initiated the development of this demonstrator. It demonstrated the interoperability of CiA 417 compliant devices. The modular system consisted of different independent lift control systems implemented in building blocks comprising a host controller, a car drive unit, a positioning unit, I/O



..and now

panels, and a car door unit). Usually, four building blocks make one lift application. Each building block hosts one or two devices. In 2019, CiA didn't show the demonstrator but continued the activity with several members presenting their CANopen Lift products and generic CAN tools and gateways by means of product panels on the CiA stand. Unfortunately, CiA is not present at the Interlift 2022 due to the Covid-19 pandemic.



Then...

Lift profile. The TSG is available in different variants. The company Elfin Technology, is specialized in the development and design of electronic components and software as a service in the lift industry. With more than ten years of experience in the development of CANopen (Lift), they are one of the pioneers of the industry. They support users to implement this technology in their products and also offer a range of CiA 417 based TFT displays suitable for lifts in hotels, office buildings, hospitals, shopping malls, airports, or railway stations. The Flexpage displays can be used in elevators of all brands, for new installations and modernization. Via the integrated CANopen interface, the displays can be used in elevators from various providers and by means of input/output modules parallel wiring is also possible for elevators without a bus connection. CANopen Lift allows them to be flexibly adapted to design requirements and application areas.

With the Limax series, Elgo Electronic provides an absolute measuring shaft information system, which is used for positioning the elevator cab. It supports CiA 417 and can be connected to the controller via CAN interface. The lift controller MLC-8000 from Intec also uses CAN technology. It can be used for small lifts as well as in the high-end range (up to 64 floors, up to 8 lifts per group). The controller was developed based on the CiA 417. The units in the CANopen Lift supported Zadyne range of frequency inverters from Ziehl-Abegg, were developed exclusively for lift technology. The varied housing designs

and construction make them suitable for either control cabinet installation or wall mounting in the machine room or elevator shaft.

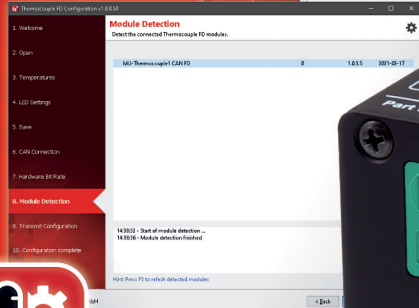
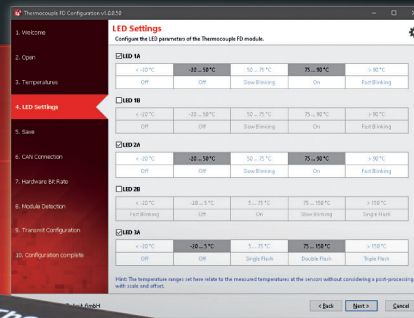
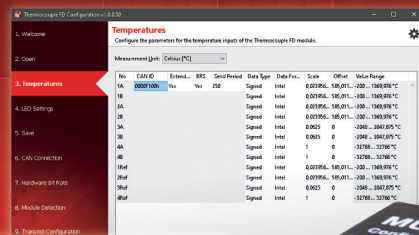
Today, many controllers and devices from different manufacturers are already available with CANopen Lift. This profile is the open network approach for elevators. It enables to buy and use devices from different manufacturers depending on own application requirements. ◀

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Measuring Unit with CAN FD Interface

■ MU-Thermocouple1 CAN FD

The MU-Thermocouple1 CAN FD from PEAK-System allows the measurement of 8 temperatures via thermocouples of the types K, J, or T depending on the product version. The measurement data is transmitted via a CAN interface that supports the modern standard CAN FD in addition to CAN 2.0.

Data processing, message transmission, and LED indication are set up with a free Windows software. The configuration created on the computer is transferred via CAN to the device which then runs as an independent CAN node. Multiple devices can be configured independently on a CAN bus.

Specifications

- 8 Mini sockets for thermocouple types J, K, or T
- 4 galvanically isolated measuring modules, each with 2 thermocouple sockets of the same type
- Measuring ranges:
 - J: -210 to +1121 °C (-346 to 2050 °F)
 - K: -200 to +1370 °C (-328 to 2498 °F)
 - T: -200 to +400 °C (-328 to 752 °F)
- Measurement accuracy: 0.2 % or 1 K
- Accuracy of the reference temperature sensors at +25 °C ambient temperature: typically ±0.5 K, maximum ±1.0 K
- Maximum resolution of temperature data: 1/16 °C

- High-speed CAN connection (ISO 11898-2) for data transfer and configuring
 - Complies with CAN specifications 2.0 A/B and FD
 - CAN FD bit rates for the data field (64 bytes max.) from 25 kbit/s up to 10 Mbit/s
 - CAN bit rates from 25 kbit/s up to 1 Mbit/s
 - NXP TJA1044GT CAN transceiver
 - Galvanic isolation up to 500 V
- LEDs for measurement channels and power supply
- Configuration with a Windows software via CAN (requires a PEAK CAN interface)
- Voltage supply from 8 to 30 V
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

Scope of Supply

- MU-Thermocouple1 CAN FD in aluminum casing
- Mating connector for voltage supply
- Configuration software for Windows
- Manual in PDF format



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Take a look at our website for the international sales partners. Scan the QR code on the left to open that page.

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