R67072.0002 - 4

Manual

Ants LEB02 (Linear Encoder Base)

SSI RS485 CANopen LIFT © CiA

pulses for automation

Table of Contents

1 Document

This is the English translation of the original manual in German language.

Publisher	Kübler Group, Fritz Kübler GmbH Schubertstraße 47 78054 Villingen-Schwenningen Germany www.kuebler.com
Issue date	08/2021
Copyright	© 2021, Kübler Group, Fritz Kübler GmbH

Text sources	Technische Möglichkeiten mit CANopen Lift - CANopen Lift.org
	Das CANopen Applikationsprofil für Aufzüge CiA-417 - CANopen Lift.org
	Layer Setting Service (LSS) nach CiA-305 - CAN-CiA.org
Image sources	Shaft picture, non-proprietary - CANopen Lift.org
Text sources	SSI Application Note 2013; Posital GmbH
	Praxiswissen – Schnittstelle SSI; KUNBUS GmbH
Image sources	SSI Block Diagram; Posital GmbH
Text sources	Wiesemann & Theis GmbH
Image sources	Wiesemann & Theis GmbH

Legal Notices

2 General Information

Please read this document carefully before working with the product, mounting it or starting it up.

2.1 Target Group

The device may only be planned, mounted, commissioned and serviced by persons having the following qualifications and fulfilling the following conditions:

- Technical training.
- Briefing in the relevant safety guidelines.
- Constant access to this documentation.

2.2 Symbols used / Classification of the Warnings and Safety instructions

⚠ DANGER	**Classification:** This symbol, together with the signal word **DANGER** , warns against immediately imminent threat to life and health of persons. The non-compliance with this safety instruction will lead to death or severe adverse health effects.
⚠ WARNING	**Classification:** This symbol, together with the signal word **WARNING** , warns against a potential danger to life and health of persons. The non-compliance with this safety instruction may lead to death or severe adverse health effects.
⚠ CAUTION	**Classification:** This symbol, together with the signal word **CAUTION** , warns against a potential danger for the health of persons. The non-compliance with this safety instruction may lead to slight or minor adverse health effects.
ATTENTION	**Classification:** The non-compliance with the **ATTENTION** note may lead to material damage.

NOTICE	**Classification:**
	Additional information relating to the operation of the product, and hints and recommendations for efficient and trouble-free operation.

2.3 Use According to the Intended Purpose

Combined with a suitable evaluation unit, the measuring system serves for the determination of the absolute position of elevator cars. The measuring system can be used as a position and speed sensor.

The measuring system and its evaluation unit must meet the requirements mentioned in chapter Technical Data [▷ 7].

2.4 Other Applicable Documents

All technical data, as well as the mechanical and electrical characteristics, are specified in the corresponding data sheets of the system components.

3 Product Description

3.1 Function of the Measuring System

The sensor that is mounted on the elevator car and the coded band that is tensioned in the shaft form together the measuring system. The sensor converts a linear motion into a digital position signal. To this purpose, it evaluates the band, which is coded by two rows of holes.

3.2 Technical Data

NOTICE	**Technical Data** All technical data, as well as the mechanical and electrical characteristics, are specified in the data sheets of the corresponding device variant, for special versions in the.corresponding quotation / customer drawing of the product.

NOTICE	**Observe the configuration** The performance characteristics and the mechanical design of the product depend on the selected configuration (according to order code).

3.2.1 Sensor

Mechanical characteristics sensor

Operating temperature	-10 °C … +70 °C [14 °F … 158 °F]
Storage temperature	-20 °C … +80 °C [-4 °F … 176 °F]
Protection level according to EN 60529	IP54
Air humidity	< 90 % (non-condensing)
Installation height	< 2000 m [6562 ft]
Material Housing	Aluminum
Weight	appr. 0.55 kg [19.40 oz]
Maximum measuring length	392 m [1286 ft]
Maximum speed	8 m/s [26.25 ft/s]
Resolution	1 mm
Accuracy	± 1 mm

Electrical characteristics sensor

Supply voltage	10 … 30 V DC
Supply voltage according to UL 1310	Class 2
Supply voltage according to EN 60950	PELV
Current consumption	max. 100 mA
Protection class according to EN 61140	III

EMC

Relevant Standards	EN 12015:2014 EN 12016:2013

UL - Underwriters Laboratories

UL approval	File E498900
Relevant Standards	UL 508

CANopen Lift Characteristics

Bit rate	250 kbit/s
Identifier	0x18C
Node ID	0x04
Event timer	10 ms
Resolution	1 mm
Heartbeat	500 ms
Terminated	yes

For more detailed information please refer to the CiA homepage www.canopen-lift.org.

RS485 Characteristics

Baud rate	19,200
Number of data bits	8 bits
Number of start bits	1 bit
Number of stop bits	1 bit
Parity	none
Repetition rate	150 Hz
Number of bytes/transmission	9 bytes
Position resolution	1 mm
Speed resolution	1 mm/s
Position value	24 bits, binary
Speed value	16 bits, two's complement

SSI Characteristics

Data Transmission	in slave mode double data transmission
Resolution	0.25 mm
Data length	25 bits + 1 Power failure bit (Low)
MSB	First
Coding	Gray
Clock frequency	max. 200 kHz
Monoflop time	< 50 µs

A position value must be read out by the SSI master over 52 clock cycles.
1 ... 25: MSB first absolute position in Gray code
26: Data Low (PFB)
27 ... 51: Second transmission (see 1-25)
52: Data Low (PFB)

3.2.2 Coded Band

Material	V2A spring-tensioned stainless steel, edges broken
Dimensions	16 x 0.4 mm
Weight	50 g / m
Thermal expansion	16 x 10^{-6} / K

3.3 CANopen Lift Interface Description

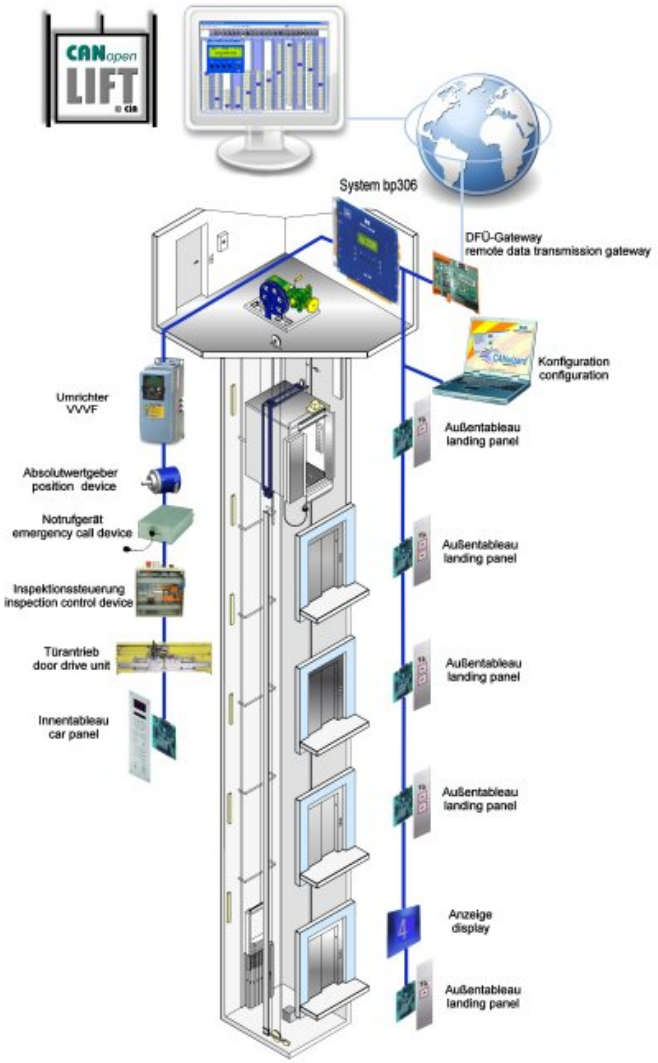
CANopen Lift was standardized in 2003 as a universal solution for elevator control and thus a comprehensive network system for elevator operation, analysis, management and updates was set up. It includes as well hydraulic or traction elevators as single elevators or groups of 8 elevators, with two or 254 stops: CANopen Lift covers the majority of the possible elevator applications.

Features overview

The outstanding feature of CANopen Lift is the provision of a manufacturer-independent plug-and-play system for the user, which allows realizing and controlling all elevator construction applications. For this purpose CANopen provides the common procedure for network management to control the connected components. All electronic components that can be found in elevators have been described as virtual devices in the standard. All parameters, messages and services have been defined for these devices. CAN serves for the transmission of the process messages. The methods common for CAN are used for the prioritization of messages. A real-time-capable transmission of process messages is possible.

CANopen Lift thus allows the technician to parameterize all components with a unified configuration tool, independently of the manufacturer. This minimizes the familiarization time, simplifies the handling and reduces the costs. In addition, a standardized diagnostics management allows capturing and logging centrally the condition of the elevator. The technician can thus carry out conveniently also the necessary system analyses.

Moreover, the integrated energy management provides a method for the continuous acquisition and reduction of the energy demand of elevators. The activation of various stand-by modes in the components allows controlling the energy consumption of the elevator according to the needs.



IMG-ID: 120524299

Organized components

Each of the represented devices is responsible for determined functions. E. g. the landing panel at every floor is the device that receives the user request for a car and transmits it to the controller. This request includes information on the geographic position of the request (where does it come from and where is it supposed to go) and on the request type (normal request, priority request such as e. g. emergency requests). These requests collected by the controller are processed, sending a request confirmation to the floor panel (e. g. light change in the pushbutton) when all the information is in order.

As a result of the processing, the controller that processes the entering requests must also inform the controllers for the drive and for the doors, which leads to the car travel requested by the user and – once the desired floor is reached – to the opening of the car doors.

Besides the normal information path, the mentioned controllers (request, door and drive controller) receive moreover status information from the measuring system, e. g. the shaft copying system LEB02 and several other sensors.
Such a sensor can be e. g. a presence sensor that detects every person in the car. Further sensors can be among others smoke detectors, load-measuring sensors or light barriers at the car door, which help deciding whether the car is allowed to move or whether the car door has to open when reaching a determined floor.

The CANopen Lift standard is constantly developed further. Therefore, CANopen lift will in the future be the basis for the remote diagnosis via Internet of all components and for the safety-relevant data transmission in elevators.

3.4 Interface Description RS485/ EIA-485

The RS485 standard is the physical specification of a series of bidirectional connections via a differential lines pair. RS485 only defines the physical characteristics of an interface; it is not an independent transmission protocol! The physical interface requires a 130 Ω terminal resistor, two biasing resistors and a standard RS485 transceiver.

Features overview

- Voltage range -7 … 12 V
- Serial, asynchronous, continuous and bidirectional data communication
- Digital, bidirectional 2-wire (half duplex) or 4-wire version of the (duplex) interface
- Connection structure always as a line, never star or with drop lines
- Line pair(s) if possible realized as twisted pair cables (protection against electrical and magnetic interference fields)
- Line ends terminated if possible (transmission speed / greater distances)
- Compensation of transmission delays for high-speed data transmission
- Use by different (field bus) protocols possible (application-specific)
- Bus-capability for several transmission and receiving devices in a chain (max. 32)

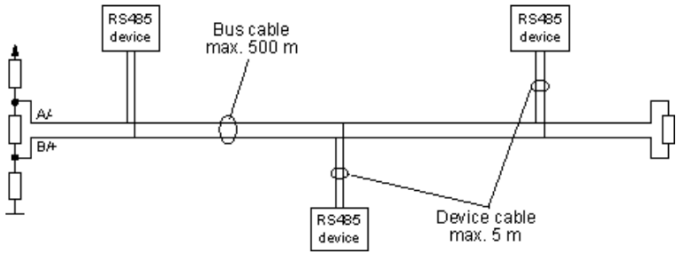


Fig. 1: Source: Wiesemann & Theis GmbH

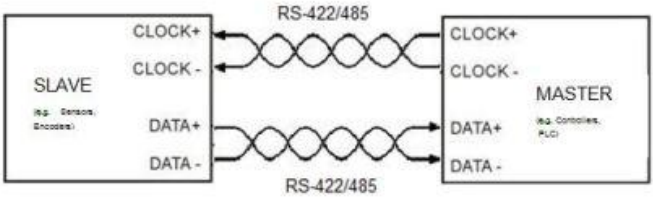
IMG-ID: 9007199376272139

Serial protocol

As a standard, the interface is configured for 9600 bd. The bidirectional RS485 interface is in principle bus-capable. This is why every communication from the master, hence from the controller, starts with the slave address. To minimize transmission times, the information is transmitted in binary format. Every protocol ends with an easily calculated XOR checksum. The protocol end detection is based on a timeout control.

3.5 SSI Interface Description

The Synchronous Serial Interface (SSI) is a widespread standard for serial interfaces of industrial applications, e. g. for displacement measurement systems using absolute encoders. This interface is based on the RS422 standard. SSI allows point-to-point communication between master and slave, to obtain absolute values for the respective position of a device. For this purpose, the position data of the measuring system is continuously updated and provided to the output register.



SSI BLOCK DIAGRAM

IMG-ID: 120955531

Features overview

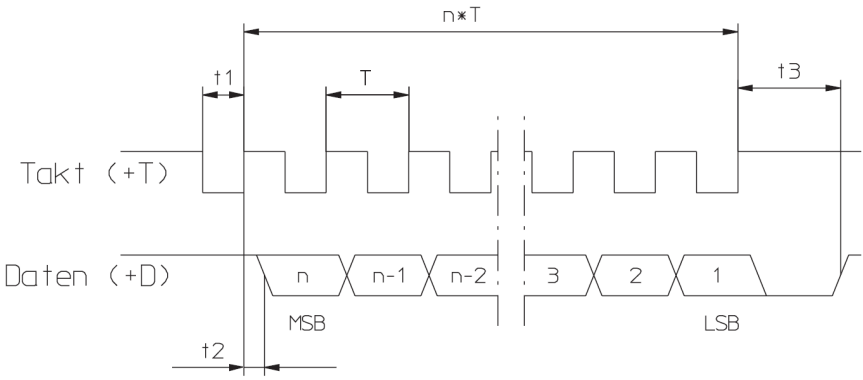
This interface is particularly suitable for application in industrial environments, where reliability and robustness are indispensable. The synchronous serial interface has moreover a very simple structure, as it requires only two line pairs (for the clock [master] and the data [slave]. In the sensor itself, a shift register and a monoflop for controlling the register are required. Moreover, the SSI allows connecting up to three measuring systems to a common clock. This allows the controller to read several measuring systems at a determined point in time.

Further advantages:

- Little wiring work thanks to serial data transmission
- Line lengths up to 1,200 m
- High immunity to electromagnetic interferences (EMC) thanks to the RS422 standards
- High data transmission reliability thanks to differential signals
- Complete protocol flexibility both with regard to data quantity and to data size
- Prevents ground loops thanks to galvanically isolated functional areas of the system (master)

SSI defines two signal types: CLOCK and DATA When the clock and data lines are in the idle status, the levels are set to High. Position value transmission begins with the most significant bit (MSB) as soon as the clock signal changes from Low to High. Subsequently, the next least significant bit is transmitted with every further clock signal change from Low to high. The transmis-

sion ends with the output of the least significant bit (LSB). This takes place after the clock signal switches from Low to High (and remains High) and the data line remains at Low until the end of the monoflop time. Then both levels are again High.



IMG-ID: 149180939

t1 = T / 2

t2 < 1 / (4 x fmax)

t3 = monoflop time (see below)

n = resolution in bits

Besides the clock frequency, which takes account of the respective line length, also the number of data bits can be configured, to allow keeping the resolution flexible. For transmission safety and for displaying the end of the data transmission, parity bits can be added (as implemented by certain manufacturers).

3.6 Supported Standards and Protocols

CANopen Lift

CiA® 301 CANopen application layer and communication profile, version: 4.2.0, 21 February 2011

CANopen Lift according to CiA® 417, version: 2.3.0, 10 December 2018

RS485

RS485 (Radio Sector / Recommended Standard) is used as a synonym to EIA485 (Electronic Industries Alliance) and TIA485-A (Telecommunications Industry Association).

Standard according to: Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems (ANSI/TIA/EIA-485-A-98) (R2003).

SSI

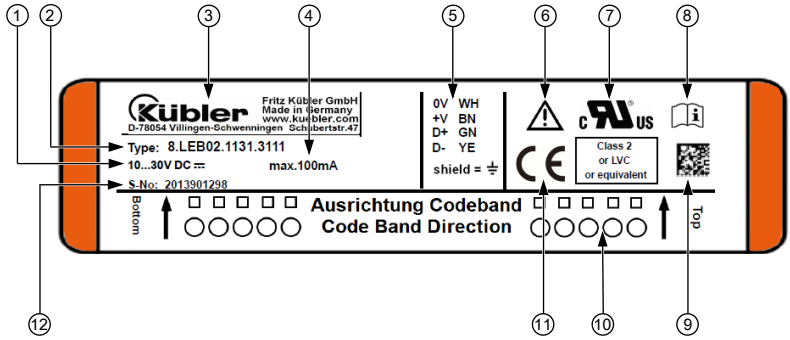
SSI based on the RS422 standard according to: Electrical Characteristics of Balanced Voltage Digital Interface Circuits (ANSI/TIA/EIA-422-B-1994) (R2000) (R2005).

3.7 Variants Overview

Sensor type	Safety classes
LEB02	-
LES02	SIL3 (EN 81-50)
LES02 mit PSU02	SIL3 Functional Safety EN 81

3.8 Type plate

Example of a type plate on the product:



IMG-ID: 27021597902745355

1	Supply voltage	7	UL marking
2	Type / Order code	8	Observe the operation manual
3	Manufacturer and address	9	Datamatrix code
4	Current consumption	10	Coded band orientation
5	Terminal Assignment	11	CE marking
6	Observe the operation manual	12	Serial number

4 Installation

4.1 Electrical Installation

4.1.1 General Information for the Connection

ATTENTION	**Destruction of the device** Before connecting or disconnecting the signal cable, always disconnect the power supply and secure it against switching on again.

NOTICE	**General safety instructions** Make sure that the whole plant remains switched off during the electrical installation. Make sure that the operating voltage is switched on or off simultaneously for the device and the downstream device.

4.1.2 Connection Color Coding

Part of the cables are identified by a color coding, part of them by a numerical coding. Abbreviation of the colors :

Abbreviation	Color	Abbreviation	Color
WH	White	BU	Blue
BN	Brown	RD	Red
GN	Green	BK	Black
YE	Yellow	VT	Violet
GY	Gray	GY-PK	Gray-Pink
PK	Pink	RD-BU	Red-Blue

ATTENTION 	**Destruction of the electronics** When confectioning the sensor cable, always take care to ensure sufficient ESD protection.

4.1.3 Connection Legend

+V:	Supply voltage +V DC
0V:	Voltage supply GND (0 V)
CAN_H:	Positive CAN Signal (Dominant High)
CAN_L:	Negated CAN-Signal (Dominant Low)
C+, C:	Clock signal
D+, D:	Data signal
n.c.:	Do not connect

4.1.4 Sensor Terminal Assignment

Interface	**Cable, 3 m, shielded, open cable end**							
CANopen Lift (DS417)	Signal:	+V	0 V/GND	CAN_H	CAN_L	n.c.	n.c.	
	Core color:	BN	WH	GN	YE	GY	PK	

Interface	**Cable, 3 m, shielded, with Sub-D male connector, 9-pin**									
CANopen Lift (DS417)	Signal:	n.c.	CAN_L	0 V/GND	n.c.	Shield	0 V/GND	CAN_H	n.c.	+V
	Pin:	1	2	3	4	5	6	7	8	9

Interface	**Cable, 3 m, shielded, open cable end**						
SSI	Signal:	+V	0 V/GND	C+	C-	D+	D-
	Core color:	BN	WH	GN	YE	GY	PK

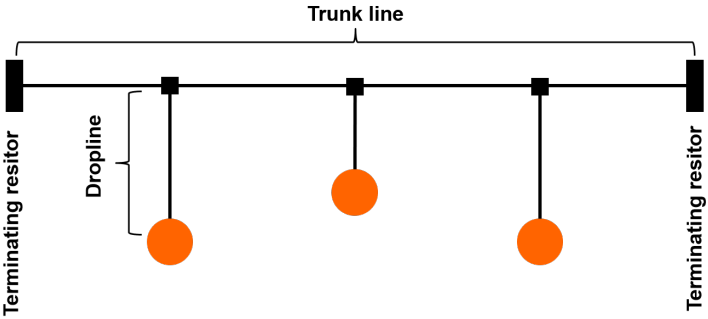
Interface	**Cable, 3 m, shielded, Sub-D male connector, 9-pin**									
SSI	Signal:	n.c.	C+	Shield	D+	0 V/GND	+V	C-	D-	+V
	Pin:	1	2	3	4	5	6	7	8	9

Interface	**Cable, 3 m, shielded, open cable end**						
RS485	Signal:	+V	0 V/GND	T/R-	T/R+	n.c.	n.c.
	Core color:	BN	WH	GN	YE	GY	PK

4.1.5 CAN network topology

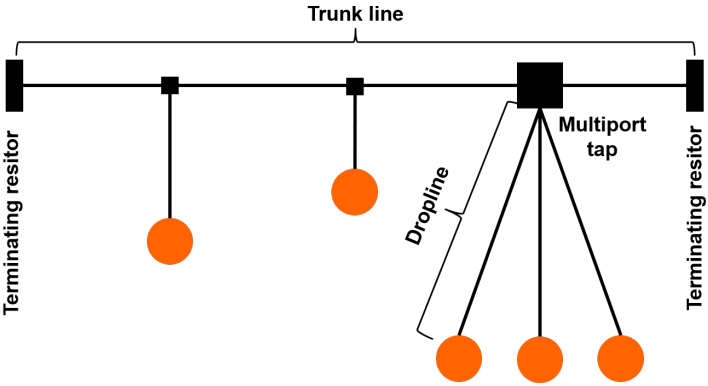
According to DIN ISO 11989, a CAN bus system can basically only have a line bus structure. In variation of this, repeaters or gateways can be used to realize other network topologies.

When designing the network topologies, it must be differentiated between the trunk line and the drop lines.
The trunk line must be terminated at both ends with a 120 ohm resistor. Drop lines may not be terminated with terminal resistors.



IMG-ID: 60283275

Baud rate [kbit/s]	Drop line length [m]	Total length of all drop lines [m]
1000	< 1	< 5
500	< 5	< 25
250	< 10	< 50
125	< 20	< 100
50	< 50	< 250



IMG-ID: 60285707

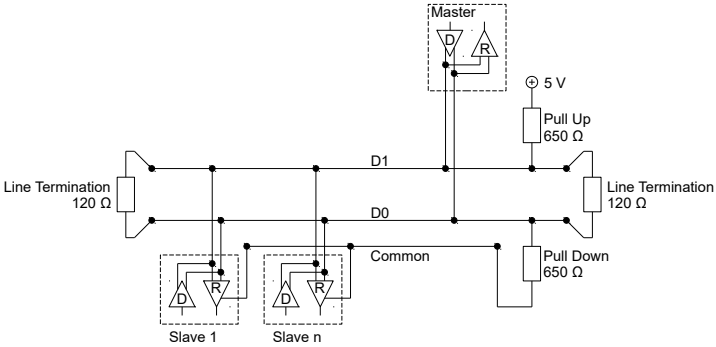
Baud rate [kbit/s]	Drop line length without multiport [m]	Trunk length without drop lines [m]
1000	< 0.3	< 25
500	< 1.2	< 66
250	< 2.4	< 120
125	< 4.8	< 310

Drop lines must be avoided to the greatest possible extent as they inevitably cause reflections. However, these reflections are uncritical as long as they have entirely decayed before the sampling time. For the bit timing settings chosen in the bus couplers, it can be assumed that this is the case.

4.1.6 RS485 Network Topology

The parameters channel is an asynchronous half-duplex interface that complies physically with the RS485 specification. To ensure disturbance-free transmission, the transmission lines must be provided with pull up/down resistors.

In order to also ensure independence from line transceiver manufacturers, we give the following recommendations for the dimensioning of the interface:

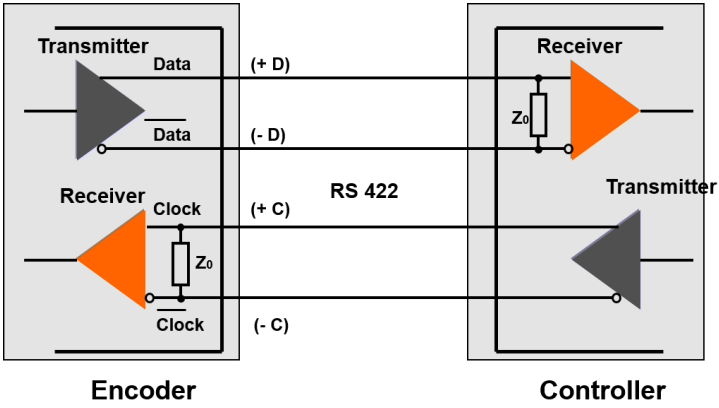


IMG-ID: 58511243

The 120 … 130 ohm terminating resistor and the 650 … 1k ohm pull up/down resistors are integrated as a standard. For bus operation (more than 1 encoder), no terminating resistor is integrated in the encoder. This resistor must be mounted by the customer on the device furthest from the master.

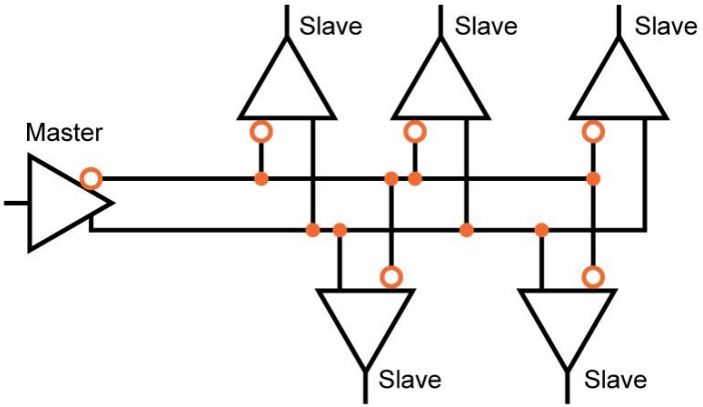
4.1.7 SSI Network Topology

SSI is based in essence on 2 parallel RS485 network circuits and thus defines a classical RS422 circuit. As a standard, 120 Ω terminating resistors are used.



IMG-ID: 143594763

The topology of a RS422 network can include a maximum of 11 participants. For this purpose SSI defines a master and a slave. Therefore, max. 1 master and 10 slaves can be realized. Communication is always unidirectional (simplex).



IMG-ID: 143611403

Both lines (data and clock) are transmitted differentially. Maximum line lengths reaching 1,200 m are possible For the physical connection, standard twisted pair cables are used according to RS422. As a guideline, the following baud rates can be achieved, depending on cable length:

Cable length [m]	13	44	85	300	750
Maximum baud rate [MHz]	2	1	0.6	0.2	0.08

4.1.8 General Errors

4.1.8.1 Operational mode cannot be selected

a) Make sure that the coded band is correctly positioned. To do so, compare the information about the orientation of the coded band on the type plate of the sensor; see Sensor Type Plate.

b) Check the degree of wear of the slides.

4.1.8.2 The measuring system does not communicate with the control

a) Check the supply voltage.

b) Check the proper connection of the 4 wires.

c) Make sure that the connection to the selected communication interface is properly installed. If necessary check data transmission.

5 Commissioning and Operation

5.1 Status LED

A one-color LED signals the status of the measuring system:

Display	LED	Meaning
LED off		No voltage
LED on		Supply voltage is applied to the device

5.2 CANopen Lift

5.2.1 Quick Start Guide

5.2.1.1 Default Settings

All parameters are created as objects in CANopen. The most important parameters for CANopen are specified with their default values in the table below:

Index	Name	Default	Note
0x1000	Device type	0x060001A1	
0x1017	Producer heartbeat time	0x1F4	500 ms
0x1018	Identity object		
0x1018 Sub1	Vendor Id	0x13	KÜBLER
0x1018 Sub 2	Product code	0x248	
0x1906	Transmit PDO communication parameter 263		
0x1906 Sub 1	COB-ID	0x0000018C	396
0x1906 Sub 2	Transmission type	0xFE	254 = Asynchronous – Depending on the event timer
0x1906 Sub 3	Inhibit time	0x0	Blocking time = 0 s
0x1906 Sub 5	Event timer	0x0A	10 ms
0x1B06	Transmit PDO mapping parameter 263		
0x1B06	Mapping entry	0x63830120	Mapping entry
0x2000	Node address	0x4	
0x2001	Bit rate	0xFA	250 kbit/s
0x2002	NMT status	0x00	0 = Initialization
0x6001	Elevator number	0x00	
0x6380	Operating parameter	0x00	
0x6383	Position value	0x00	
0x6384	Encoder measuring step settings position unit 1		
0x6384 Sub 1	Measuring step	0x64	100
0x6384 Sub 2	Speed measuring step	0xA	10
0x6390	Speed value car	0x00	
0x63C0	Operating status	0x00	
0x63C1	Singleturn resolution	0xF4240	Resolution of 1,000,000 increments
0x63C2	Number of distinguishable revolutions	0x8CA0	36,000

5.2.1.2 Operating modes

NOTICE	**Operating mode validity**
	The operating mode sent in the interval applies to all slaves.

The master sends the respective operating mode (operational, pre-operational and STOP mode) in the specified interval:

ID	DLC	Data	Interpretation
00	2	01 00 00 00 00 00 00 00	Operational
00	2	80 00 00 00 00 00 00 00	PRE-Operational
00	2	02 00 00 00 00 00 00 00	STOP mode

5.2.1.3 Programming

NOTICE	**Preparation of the programming**
	Make sure that there is always a coded band in the sensor during programming.

When connecting the sensor, the sensor issues an information to the controller:

✓ the electrical installation is completed (voltage supply, bus connection).

a) Connect the device.

b) Check the status of the device.

⇨ If the LED does not light up, check the voltage supply connection.

⇨ Once the device is properly connected to the voltage supply, the LED lights up green. Programming can start.

5.2.1.4 Layer Setting Service (LSS)

Exactly two conditions must be met for devices connected to a CANopen network:

- All devices must have the same baud rate.
- A unique node address applies within the network.

CANopen provides the Layer Setting Service (CiA DSP-305) for all CANopen devices that, due to the planned place of operation or the design conditions, do not have an equipment for the mechanical configuration of the mentioned basic parameters (e. g. DIP switches).

A 1:1 CAN connection to a device must be available to allow the settings via Layer Setting Service.

If this condition is met, the special dialog mode allows setting the baud rate and the node address. The COB-ID 0x7E5 is used from the master to the slave. The slave answers with COB-ID 0x7E4. LSS messages always have a length of 8 bytes. Unused bytes are reserved and must be filled with 0.

NOTICE	Switchover to the configuration mode The transmission of the CAN message for configuration sets all integrated LSS slaves in a configuration mode.

✓ The measuring system is in PRE-Operational operating mode or in STOP mode.

a) Prepare the LSS master if you want to switch to the LSS configuration mode.

b) Set the LSS slaves in the configuration mode with a CAN message.

⇨ To reset the LSS slaves to the Operational mode, see Saving the LSS values [▶ 33].

ID	DLC	Data	Interpretation
7E5	8	04 01 00 00 00 00 00 00	LSS mode

5.2.1.5 Setting the Baud Rate

✓ The measuring system is in PRE-Operational operating mode or in STOP mode.

a) Transmit the new baud rate via LSS master:

ID	DLC	Data	Interpretation
7E5	8	13 00 XX 00 00 00 00 00	New baud rate
XX = 1->800kb, 2->500kbits, 3->250kbits, 4->125kbits, 5->100kbits, 6->50kbits, 7->20kbits			

b) Check the feedback from the LSS slaves whether they support the new baud rate or not:

ID	DLC	Data	Interpretation
7E4	8	13 00 00 00 00 00 00 00	New baud rate confirmed

c) To save and modify, follow the information for Saving the LSS values [▶ 33].

5.2.1.6 Setting the Node ID

✓ The measuring system is in PRE-Operational operating mode or in STOP mode.

a) Transmit the new node number via LSS master:

ID	DLC	Data	Interpretation
7E5	8	11 XX 00 00 00 00 00 00	New node ID
XX = 01-7F // Default CANopen Lift: 04			

b) Check the feedback from the LSS slaves whether they support the new node number or not:

ID	DLC	Data	Interpretation
7E4	8	11 00 00 00 00 00 00 00	New node ID confirmed

c) To save and modify, follow the information for Saving the LSS values [▶ 33].

5.2.2 Protocol Features

5.2.2.1 CANopen Lift Application Profile CiA 417

The device uses the CANopen Lift application profile according to CiA 417. Basically, also this application and communication profile uses the same four communication objects (COBs) as all other CANopen communication protocol participants. Unlike the device profiles, which define the functionality as well as the object dictionary for the respective devices group (e.g. drives, encoders), the application profiles focus on the function of an application (e.g. elevator plants, railway vehicles).

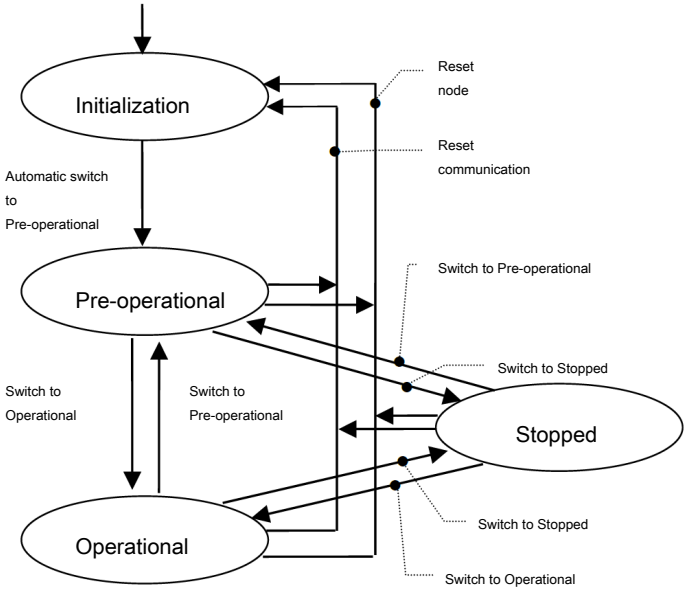
Therefore, the application and communication profile CiA417, defines the functions necessary for building an elevator controller and ensuring the communication between all devices. For this purpose, the application profile describes all devices necessary in the control system for elevators. These devices are described as virtual devices.

The decisive point is that the device fulfills the requirements of the defined range of functions of the virtual device.

The application profile defines the contents and the behavior of the process data objects (PDO). Thus, the application profile determines the communication relation of the single (virtual) devices, with which also the CAN IDs are determined in the same time.

5.2.2.2 Network Management

The following status diagram according to DS 301 shows the various node statuses and the corresponding network commands (controlled by the network master via NMT services).



IMG-ID: 109579787

Initialization

After power supply is applied or after a reset, the device is in the original status Initialization. After performing the reset/initialization routines, the node switches automatically to the Pre-operational status. The LEDs display the momentary status.

Pre-Operational

The CAN node can now be addressed by SDO messages or NMT commands under the standard identifier. Then follows the programming of the encoder or communication parameters.

Operational

The node is active. Process values are supplied via the PDOs. All NMT commands can be evaluated.

Prepared or Stopped:

In this status, the node is no longer active, i.e. neither SDO nor PDO communication is possible any longer. The node can be set to Operational or Pre-operational status by means of NMT commands.

5.2.3 CANopen Object Dictionary

The object dictionary describes the whole range of functions (parameters) of a CANopen device and is organized in the form of a table. The object dictionary not only contains the standardized data types and objects of the CANopen communication profile and the device profiles, but also, if applicable, manufacturer-specific objects and data types.

The description of the object directory entries is structured as follows:

Index (hex)	Subindex (hex)	Object	Name	Type	Attr.	M/O

Index

16-bit address of the entry

Subindex

8-bit pointer to a subentry

- Is only used with complex data structures (e. g. record, array)
- No subentry Subindex=0

Object

- NULL entry without data
- DOMAIN larger variable volume of data, e. g. program code
- DEFTYPE data types definition, e. g. boolean, float, unsigned16
- DEFSTRUCT definition of a record entry, e. g. PDO mapping structure
- VAR single data value, e. g. boolean, float, unsigned16, string
- ARRAY field with similar data, e. g. unsigned16 data
- RECORD field with arbitrarily mixed data types

Name

Short description of the function

Type

Data type, e. g. boolean, float, unsigned16, integer

Attribute

Specifies the access rights for the object:

- rw read and write access
- ro only read access
- const only read access, value = constant

M/O

- M Mandatory: The object must be implemented in the device
- O Optional: The object must not be implemented in the device

5.2.3.1 Structure of the object dictionary

The whole object dictionary is subdivided into several areas:

Index range	Use
0x0000	Unused
0x 0001-0x009F	Data types (special case)
0x 00A0-0x0FFF	Reserved
0x 1000-0x1FFF	Communication profile
0x 2000-0x5FFF	Manufacturer-specific area
0x 6000-0x9FFF	Up to 8 standardized device profiles
0x A000-0xAFFF	Process images of IEC61131 devices
0x B000-0xBFFF	Process images of CANopen gateways according to CiA 302-7
0x C000-0xFFFF	Reserved

5.2.3.2 Communication Objects

Index range	Description
0x1000 to 0x1029	General communication objects
0x1200 to 0x12FF	SDO parameter objects
0x1300 to 0x13FF	CANopen safety objects
0x1400 to 0x1BFF	PDO parameter objects
0x1F00 to 0x1F11	SDO manager objects
0x1F20 to 0x1F27	Configuration manager objects
0x1F50 to 0x1F54	Program control objects
0x1F80 to 0x1F89	NMT master objects

Objects [hex]	R/W	Object name	M/O	Data type
0x1000	CONST	Device type	M	unsigned32
0x1001	RO	Error register	M	unsigned8
0x1008	CONST	Manufacturer device name	O	visible string
0x1010	RW	Store parameters (device profile)	O	unsigned32
0x1017	RW	Producer heartbeat time	O	unsigned16
0x1018	RO	Identity object	M	PDOComPar
0x1906	CONST	Transmit PDO communication parameter 263	M	
0x1B06	CONST	Transmit PDO mapping parameter 263	M	

5.2.3.3 Manufacturer-Specific Objects

Objects [hex]	R/W	Object name	M/O	Data type
0x2000	R/W	Node address		
0x2001	R/W	Bit rate		
0x2002	R/W	NMT status		
0x2003	RO	Cyclic error and confirmation array		
0x2004	RO	Cyclic error and confirmation array		

5.2.3.4 Device-Specific Objects

Objects [hex]	R/W	Object name	M/O	Data type
0x6001	RO	Lift number	O	
0x6380	RO	Position unit 1	M	
0x6383	RO	Position value	O	
0x6384	RO	Encoder measuring step settings position unit 1	O	
0x6390	RO	Speed value car	O	
0x63C0	RO	Operating status	O	
0x63C1	RO	Singleturn resolution	M	
0x63C2	RO	Number of distinguishable revolutions	M	

5.2.4 Description of the Objects

VAR	Variable
ARRAY	Array of variables
RW	Read/Write
RO	Read only
Const	Constant
Name	Object name
M/O	Mandatory or optional

5.2.4.1 Object 0x1906 - Transmit PDO Communication Parameter 263

This object contains the main communication parameters required for SDO and PDO transmission.

- COB-ID
- Transmission type
- Inhibit time
- Compatibility entry
- Event timer

5.2.4.2 Object 0x1B06 - Transmit PDO Mapping Parameter 263

Contains the mapping of the device. Various mapping entries can be set for devices supporting dynamic mapping.

5.2.4.3 Object 0x2000 - Node ID

Returns the node address of the device. The node address can be set manually or automatically via LSS.

5.2.4.4 Object 0x2001 - Bit Rate

Returns the defined bit rate of the device. Every baud rate is assigned to the true value in hex.

Hex value	Baud rate [kbit/s]
0x1F4	500
0xFA	250
0x7D	125
0x32	50
0x14	20
0xA	10

5.2.4.5 Object 0x2002 - Start Operational

This object allows setting the device to Operational mode. The object can have the status 0 or 1.

Hex code	Operational Mode
0x00	Off
0x01	On

5.2.4.6 Object 0x2003 - Max Length Steel Tape

Returns the maximum length of the coded band.
Values range is from 0 to 100,000.

5.2.4.7 Object 0x2004 - Error Codes

This object contains different error states of the device. A specific subindex is assigned to every possible error cause.

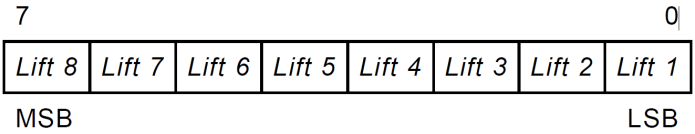
Subindex	Error	Meaning
1	unknown nonius (2)	At least 2 nonius increments of the coded band are not recognized
2	nonius fast skip	Nonius increments skipped
3	skip 10mm	Measuring skip of (exceeding) 10 mm
4	nonius slow skip	Nonius increments skipped
5	not used	
6	not used	
7	unkonwn nonius (5)	At least 5 nonius increments of the coded band are not recognized
8	no tape	Coded band not (no longer) recognized

5.2.4.8 Object 0x6001 - Lift Number

Returns the number of the respective elevator car assigned to this device.
This object can moreover be used to get information about every application object.

The values range lies between 0 and 254, thus counting 8 bits. Therefore, up to 8 elevator cars can be assigned to this object.

The illustration shows the object structure.



IMG-ID: 9007199399853451

Bit field	Value	Description
Elevator 1	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 2	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 3	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 4	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 5	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 6	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 7	0b	Lift application is not supported
	1b	Lift application is supported
Elevator 8	0b	Lift application is not supported
	1b	Lift application is supported

Example

Object 6001h has the value 03h. This means that elevators number 1 and 2 are supported ($2^0+2^1 = 3$). The application parameter range lies between 6200h and 67FEh and 6B00h to 6FFEh. The indexes for input group 1 and door control word are calculated as follows with start index 6100h for input group 1 and 6300h for the door control word of elevator control application 1:

The index is given by formula (1).

6XXXh + ((elevator number-1)*800h) (1)

- Elevator 1: 6100h + ((1-1)*800h) = 6100h and 6300h + ((1-1)*800h) = 6300h
- Elevator 2: 6100h + ((2-1)*800h) = 6A00h and 6300h + ((2-1)*800h) = 6B00h

5.2.4.9 Object 0x6380 - Operating Parameter

This object contains the operating parameter of the car position units. Up to 4 subindexes are possible. Subindexes 1 to 4 correspond to object 6000h according to CiA406.

Subindex	Name	Meaning
1	Position unit 1	Operating parameter of the 1st device

5.2.4.10 Object 0x6383 - Position Value

This object indicates the position value of the device. The position value is reproduced in subindex 1. Up to 4 position values can be output.

Subindex	Name	Meaning
1	Position unit 1	Position value of the elevator car

5.2.4.11 Object 0x6384 - Encoder Measuring Step Settings Position Unit 1

This object contains the position and speed resolution.
The position is given as a multiple of 10 µm.
The speed is given as a multiple of 0.1 mm/s.

Subindex	Name	Meaning
1	Measuring step	Position resolution
2	Speed measuring step	Speed resolution

5.2.4.12 Object 0x6390 - Speed Value Car

Returns the speed of the device.

Subindex	Name	Meaning
1	Position unit 1	Speed value of the elevator car.

5.2.4.13 Object 0x63C0 - Operating Status

This object contains the operating status.

Subindex	Name	Meaning
1	Position unit 1	Operating status

5.2.4.14 Object 0x63C1 - Singleturn Resolution

Returns the resolution of the device.

Subindex	Name	Meaning
1	Position unit 1	Resolution

5.2.4.15 Object 0x63C2 - Number of Distinguishable Revolutions

Returns the number of distinguishable revolutions.

Subindex	Name	Meaning
1	Position unit 1	Number of distinguishable revolutions

5.2.5 Examples

5.2.5.1 Saving the LSS values

Permanent storage of the baud rate and of the node number must be performed as follows:

✓ The measuring system is in PRE-Operational operating mode or in STOP mode.

a) Once the LSS slaves have accepted both the baud rate and the node number, the command for storing the LSS values can be transmitted:

ID	DLC	Data	Interpretation
7E5	8	17 00 00 00 00 00 00 00	Saving baud rate and node ID.

b) Check the feedback of the slaves whether the LSS values have been stored:

ID	DLC	Data	Interpretation
7E4	8	17 00 00 00 00 00 00 00	Saving baud rate and node ID complete

NOTICE	**Implementation of new LSS values**
	The changes made only become active after the power cycle of the measuring system.

c) Switch to Operational mode:

⇨ The communication objects now work with the assigned baud rate and node number (node ID).

ID	DLC	Data	Interpretation
7E5	8	04 00 00 00 00 00 00 00	Switch to Operational

5.2.5.2 Saving the Parameters

Parameters saving must be prepared as follows:

✓ The measuring system is in PRE-Operational or Operational mode.

a) If necessary, switch to one of these operating modes; see Operating modes [▶ 23].

b) Send the following command to the slaves:

ID	DLC	Data	Interpretation
600 + Node ID	8	23 10 10 01 73 61 76 65	Send the saving command

c) Check the feedback from the slaves whether the permanent saving of the changes at the intervals is possible:

⇨ Start transmitting the changes, e. g. the interval for operational readiness.

ID	DLC	Data	Interpretation
580 + Node ID	8	60 10 10 01 00 00 00 00	Saving successful

5.2.5.3 Setting the Heartbeat Cycle

✓ The measuring system is in PRE-Operational or Operational mode.

a) If necessary, switch to one of these operating modes; see Operating modes [▶ 23].

b) Send the following command to the slaves:

ID	DLC	Data	Interpretation
600+Node ID	8	2b 17 10 00 f4 01 00 00	Heartbeat cycle set e. g. to 500 ms

c) Check the feedback from the slaves whether they accept the change request and the new interval.

⇨ If necessary, continue with the transmission of the changes of the interval for the position.

ID	DLC	Data	Interpretation
580+Node ID	8	60 17 10 00 00 00 00 00	Change successful

5.2.5.4 Setting the Interval for the Position Data

✓ The measuring system is in PRE-Operational or Operational mode.

a) If necessary, switch to one of these operating modes; see Operating modes [▶ 23].

b) With the master, announce the change and – if accepted – set the interval for the display of the position data:

ID	DLC	Data	Interpretation
600+Node ID	8	2b 06 19 05 LSB MBS 00 00	Call for the change
604	8	2b 06 19 05 0a 00 00 00	e. g. set to 10 ms

c) Check the feedback from the slaves whether they accept the change request and the new interval:

ID	DLC	Data	Interpretation
580+Node ID	8	60 06 19 05 00 00 00 00	Change callback
584	8	60 06 19 05 00 00 00 00	New interval of 10 ms confirmed

The changes of the operational readiness and position intervals have been set by the slaves.

5.3 RS485

5.3.1 Features

5.3.1.1 Data Transmission

5.3.1.1.1 Frames Structure

The data of the RS485 interface has the following basic format:

- 1 start bit (STX)
- 8 data bits (MSB first)
- 1 parity bit (optional): none

- 1 stop bit (ETX)
- Baud rate: 19200 bauds

Every message through the data line is sent per frame in 8 data bits as described above. The whole message consists in 9 bytes. A CRC checksum is added at the end of every message.

1	2	3	4	5	6	7	8	9
STX 02h	MSB position	… position	LSB position	MSB speed	LSB speed	ETX 03h	NUL 00h	CR 0Dh

NUL = zero area - protocol-dependent

CR = control byte

5.3.1.1.2 Description

- Communication is unidirectional
- Ants LEB02 is the only participant
- Data transmission (9 bytes) takes place all 6.6 ms (150 Hz)
- 24 bits for position
- 16 bits for speed
- Position resolution is 1 mm
- Speed resolution is 10 mm/s
- Transmission is continuous
- Position value FFFFFFh indicates that no band is installed

5.4 SSI

5.4.1 Protocol Features

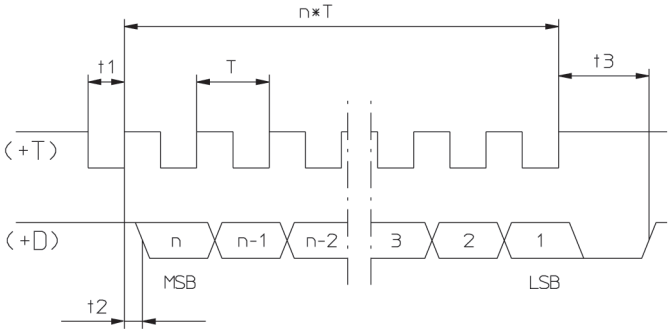
5.4.1.1 Data Transmission

The SSI interface transmits the absolute position as a digital data word to the device evaluation system. The serial differential transmission consists of two clock lines and two data lines.

NOTICE	**Use a terminating resistor**
	Make sure that a 120 ohm terminating resistor is connected to the data line at the input of the device evaluation system.

The device evaluation system sends clock pulses via the clock line. The device provides the position data via the data lines. SSI substantially defines the code format (Gray or binary) and the transmission behavior:

- The maximum transmission frequency is 2 MHz
- When the clock and data lines are in the idle status, the levels are set to High. With the first falling clock edge, the current device data is saved in the buffer for transmission. With the subsequent rising clock edges, the data is transmitted by bits starting with the MSB (most significant bit).
- The transmission of a complete data word requires n+1 rising clock edges (n = resolution in bits), e. g. 14 clock signals to read completely a 13-bit device.
- After the last positive clock edge, the data line remains Low for the duration of monoflop time t3, until the device is ready for a new data word.
- The clock line must remain High at least for the same period; it can then start a new device reading sequence with a falling edge.



IMG-ID: 52124939

t1	T / 2
t2	< 1 / (4 x fmax)
t3	Monoflop time (see below)
n	Resolution in bits
1/ fmax	< T =< 1 / fmin
fmin	min. SSI clock rate (see data sheet)
fmax	max. SSI clock rate (see data sheet)
+T	Clock
+D	Data

6 Disposal

6.1 Disposal

Always dispose of unusable or irreparable devices in an environmentally sound manner, according to the country-specific provisions and in compliance with the waste disposal regulations in force. We will be glad to help you dispose of the devices.

See chapter Contact [▶ 40].

NOTICE	**Environmental damage in case of incorrect disposal**
	Electrical waste, electronic components, lubricants and other auxiliary materials are subject to hazardous waste treatment. Problem substances may only be disposed of by licensed specialist companies.

Dispose of disassembled device components as follows:

- Metal components in the scrap metal.
- Electronic components in the electrical waste.
- Plastic parts in a recycling center.
- Sort and dispose of the other components depending on the material type.

Also refer to

Contact [▶ 40]

7 Annex

7.1 Decimal / Hexadecimal conversion table

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
0	*0*	51	*33*	102	*66*	153	*99*	204	*CC*
1	*1*	52	*34*	103	*67*	154	*9A*	205	*CD*
2	*2*	53	*35*	104	*68*	155	*9B*	206	*CE*
3	*3*	54	*36*	105	*69*	156	*9C*	207	*CF*
4	*4*	55	*37*	106	*6A*	157	*9D*	208	*D0*
5	*5*	56	*38*	107	*6B*	158	*9E*	209	*D1*
6	*6*	57	*39*	108	*6C*	159	*9F*	210	*D2*
7	*7*	58	*3A*	109	*6D*	160	*A0*	211	*D3*
8	*8*	59	*3B*	110	*6E*	161	*A1*	212	*D4*
9	*9*	60	*3C*	111	*6F*	162	*A2*	213	*D5*
10	*0A*	61	*3D*	112	*70*	163	*A3*	214	*D6*
11	*0B*	62	*3E*	113	*71*	164	*A4*	215	*D7*
12	*0C*	63	*3F*	114	*72*	165	*A5*	216	*D8*
13	*0D*	64	*40*	115	*73*	166	*A6*	217	*D9*
14	*0E*	65	*41*	116	*74*	167	*A7*	218	*DA*
15	*0F*	66	*42*	117	*75*	168	*A8*	219	*DB*
16	*10*	67	*43*	118	*76*	169	*A9*	220	*DC*
17	*11*	68	*44*	119	*77*	170	*AA*	221	*DD*
18	*12*	69	*45*	120	*78*	171	*AB*	222	*DE*
19	*13*	70	*46*	121	*79*	172	*AC*	223	*DF*
20	*14*	71	*47*	122	*7A*	173	*AD*	224	*E0*
21	*15*	72	*48*	123	*7B*	174	*AE*	225	*E1*
22	*16*	73	*49*	124	*7C*	175	*AF*	226	*E2*
23	*17*	74	*4A*	125	*7D*	176	*B0*	227	*E3*
24	*18*	75	*4B*	126	*7E*	177	*B1*	228	*E4*
25	*19*	76	*4C*	127	*7F*	178	*B2*	229	*E5*
26	*1A*	77	*4D*	128	*80*	179	*B3*	230	*E6*
27	*1B*	78	*4E*	129	*81*	180	*B4*	231	*E7*
28	*1C*	79	*4F*	130	*82*	181	*B5*	232	*E8*
29	*1D*	80	*50*	131	*83*	182	*B6*	233	*E9*
30	*1E*	81	*51*	132	*84*	183	*B7*	234	*EA*

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
31	*1F*	82	*52*	133	*85*	184	*B8*	235	*EB*
32	*20*	83	*53*	134	*86*	185	*B9*	236	*EC*
33	*21*	84	*54*	135	*87*	186	*BA*	237	*ED*
34	*22*	85	*55*	136	*88*	187	*BB*	238	*EE*
35	*23*	86	*56*	137	*89*	188	*BC*	239	*EF*
36	*24*	87	*57*	138	*8A*	189	*BD*	240	*F0*
37	*25*	88	*58*	139	*8B*	190	*BE*	241	*F1*
38	*26*	89	*59*	140	*8C*	191	*BF*	242	*F2*
39	*27*	90	*5A*	141	*8D*	192	*C0*	243	*F3*
40	*28*	91	*5B*	142	*8E*	193	*C1*	244	*F4*
41	*29*	92	*5C*	143	*8F*	194	*C2*	245	*F5*
42	*2A*	93	*5D*	144	*90*	195	*C3*	246	*F6*
43	*2B*	94	*5E*	145	*91*	196	*C4*	247	*F7*
44	*2C*	95	*5F*	146	*92*	197	*C5*	248	*F8*
45	*2D*	96	*60*	147	*93*	198	*C6*	249	*F9*
46	*2E*	97	*61*	148	*94*	199	*C7*	250	*FA*
47	*2F*	98	*62*	149	*95*	200	*C8*	251	*FB*
48	*30*	99	*63*	150	*96*	201	*C9*	252	*FC*
49	*31*	100	*64*	151	*97*	202	*CA*	253	*FD*
50	*32*	101	*65*	152	*98*	203	*CB*	254	*FE*
								255	*FF*

8 Contact

You want to contact us:

Technical advice

Kübler's worldwide applications team is available on site all over the world for technical advice, analysis or installation support.

International support (English-speaking)

+49 7720 3903 952

support@kuebler.com

Kübler Germany +49 7720 3903 849

Kübler France +33 3 89 53 45 45

Kübler Italy +39 0 26 42 33 45

Kübler Austria +43 3322 43723 12

Kübler Poland +48 6 18 49 99 02

Kübler Turkey +90 216 999 9791

Kübler China +86 10 8471 0818

Kübler India +91 8600 147 280

Kübler USA +1 855 583 2537

Repair service / RMA form

In case of returns, please package the product sufficiently and attach the completed "Returns form".

www.kuebler.com/rma

Please send your return to the address below.

Kübler Group
Fritz Kübler GmbH

Schubertstraße 47
D-78054 Villingen-Schwenningen
Germany

Phone +49 7720 3903 0
Fax +49 7720 21564

info@kuebler.com
www.kuebler.com

Glossary

ASCII

American Standard Code for Information Interchange. 7-bit coding

Baud Rate

The baud rate is the transmission rate. It is related with the nominal bit timing. The maximum possible baud rate depends on many factors that influence the signal propagation time on the bus. There is a substantial link between the maximum baud rate and the bus length and cable type. Various baud rates are defined between 10 kbit/s and 1 Mbit/s in CANopen.

Bit rate

Ratio of a data volume versus a time period. Measured in bits per second. Bit/s

CA

Command Address

CAL

CAN Application Layer. Application layer (layer 7) in the CAN communication model

CAN

Controller Area Network

CANopen

CANopen is a CAN-based protocol developed originally for industrial control systems. The specifications include various device profiles as well as the framework for specific applications. CANopen networks are also used in off-road vehicles, marine electronics, medical appliances and trains. The very flexible application layer and the many optional features are ideal for customized solutions. A wide range of configuration tools is moreover available. The user can define on this basis application-specific device profiles.

Further information about CANopen can be found in the Internet at the address www.can-cia.org.

CiA

CAN in Automation. International association of CAN products users and manufacturers

CiA 406

The CANopen device profile 406 describes the standardized interface for incremental and absolute, linear and rotary encoders. It also specifies the safety functions for encoders.

CMS

CAN Message Specification. Service element of CAL

COB

Communication Object. Transport unit in the CAN network (CAN message). Data is sent through the network in a COB.

CRC

Cyclic Redundancy Check

CRLF

Carriage Return - Line Feed

DBT

Distributor. Service element of CAL, responsible for the dynamic allocation of identifiers.

DR

Direction

DS

Draft Standard

DSP

Draft Standard Proposal

EDS File

The EDS (Electronic Data Sheet) file is provided by the manufacturer of a CANopen device. It has a standardized format for the description of devices. The EDS file contains information about: • File description (name, version, creation date, etc.) • General device information (manufacturer name and code) • Device name and type, version, LMT address • Supported baud rates and boot-up capability • Description of the supported objects by their attributes.

EEPROM

Electrically erasable programmable read-only memory. Nonvolatile electronic memory elements whose saved information can be erased electrically.

ERR

Error

ETX

End of Transmission

HEX

Hexadecimal

HMI

Operating and monitoring equipment of the automation system (Human Machine Interface)

ID

Identifier. Univocal designation of a CAN message. The identifier determines the priority of the COB in the network.

LEB02

Linear Encoder Base, Generation 2

LMT

Layer Management. Service element of CAL, responsible for the configuration of the parameters in the various layers of the communication model.

LRC

Longitudinal Redundancy Check

LSB

Least Significant Bit

LSS

Layer Setting Service - Dynamic node number allocation

LVDS

Low Voltage Differential Signaling. Interface standard for high-speed data transmission

M

Mandatory

MSB

Most Significant Bit

MUR

Measuring Units per Revolution

NDR

Number of Distinguishable Revolutions

NMT

Various tasks are to be performed in a distributed system in connection with the configuration, initialization and monitoring of the network participants. The service element "Network Management (NMT)" defined in CANopen provides this functionality.

Node number

Within a CanOpen network, every device is defined by its node number (node ID). The permissible node numbers are in the range of 1-127 and can only be used once within a network.

O

Optional

OEM

Original Equipment Manufacturer. Original Equipment Manufacturer

OSI

Open Systems Interconnection. Layers model for describing the functional areas in a data communication system.

PDO

The process data objects (PDO) are the actual means of transport for the transfer of process data (application objects). A PDO is sent by a producer and can be received by one or several consumers.

PDO Mapping

The size of a PDO can reach 8 bytes. It can be used to transport several application objects. The PDO mapping describes the arrangement of the application objects within the data field of the PDO.

PDU

Protocol Data Unit

PELV

Protective Extra Low Voltage. Functional extra-low voltage with electrically safe isolation

RMA

Return Material Authorization (complaint)

RO

Read only

rpm

Rounds per Minute

RTR

Remote Transmission Request; data request telegram

RW

Read Write

SDO

Service data objects (SDO) are used for the confirmed transfer of data of any length between two network participants. Data transfer takes place in client-server mode.

SSI

Synchronus Serial Interface

STX

Start of Transmission

Sync

Synchronization

SYNC

Synchronization telegram Bus participants answer the SYNC command with their process value.

TPDO

Transmit PDO. A PDO transmitted via a CANopen device.

Kübler Group
Fritz Kübler GmbH
Schubertstr. 47
D-78054 Villingen-Schwenningen
Germany
Phone +49 7720 3903-0
Fax +49 7720 21564
info@kuebler.com
www.kuebler.com