Manual

Ants LES02 (Linear Encoder Safe)

CAN

SIL3 Functional Safety EN 81

english

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Table of contents

1. General Information

Please read this manual carefully before working with Ants LES02, mounting it or starting it up. This manual guides the technical personnel of the machine manufacturer or of the machine operator for safe assembly, electrical installation, commissioning and operation of the Ants LES02. Moreover, the planning and use of safe sensors in the complete elevator system requires further technical knowledge that is not provided in this document. Basically, the official and legal provisions must be complied with when operating the Ants LES02.

1.1 Target Group

Ants LES02 may only be mounted, commissioned, tested, serviced and operated by authorized persons. Authorized persons

- are persons who possess a suitable technical training and
- have been instructed in the operation by the machine operator and
- have been instructed in the relevant safety directives and
- have access to this manual.
- In case of electrical equipment for explosive atmospheres, the specialized personnel needs knowledge about the ignition protection category concept.

1.2 Abbreviations Used

Ants LES02	Ants LES (Linear Encoder Safe, Generation 2)

1.3 Symbols Used / Warnings and Safety Instructions

Particularly important information is marked as follows in this manual:

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.

1.4 Transport

Inspect the delivery immediately upon receipt for possible damages due to the transport. Report such damages immediately to the transport company. If necessary, commissioning of the device must be precluded. If you do not mount the device immediately, store it at a dry and dust-free location, preferably in its transport package.

1.5 Storage

The device is to be stored as follows:

- Dry and dust-free
- Avoid mechanical shocks
- Do not store outdoors
- Do not exceed the temperature and humidity limits (see technical data)

1.6 Other Applicable Documents

All technical data, as well as the mechanical and electrical characteristics, are specified in the corresponding data sheets of the Ants LES02.
Refer to the operating instructions of the Ants LES02 (document no. R60205).

The above mentioned documents, the original declarations of conformity and the relevant certificates can be downloaded from our homepage: www.kuebler.com/docufinder.

2. Exchange Protocol and Error Codes Description

This chapter only relates to the programming and configuration of an external evaluation circuit, which needs to use the safe position transmission as a partial function of a safety function, as well as the handling of the facility in the event of an error.
A thorough knowledge in the structure, use and evaluation of CAN buses, as well as in BUS protocols, is a prerequisite for understanding the first section of this chapter.
This section is not necessary for the functional installation and commissioning of an evaluation device certified for the Ants LES02. If the complete system is not operational, the section below describes possible error diagnoses and recoveries. In case of doubt, contact the manufacturer.
The univocal exchange protocol described below applies to the use of the Ants LES02 with an external evaluation unit. An evaluation unit wanting to use Ants LES02 must comply with all specifications. If all indicated measures are implemented, an SFF exceeding 99% is achieved.

DANGER	In any case, when position data is missing, the evaluation unit must take suitable measures (depending on the safety function) to set the elevator facility in a safe state. Deciding whether the facility can resume operation and thus a reset is allowed is the responsibility of the evaluation circuit.

In the event of mechanical damages of any kind, the complete system must be replaced. Only worn slides are excluded here. These indicate a mounting error of the facility.
The architecture of the Ants LES02 provides that two independent channels (called Master and Slave below) send alternately position data. Even ID numbers are assigned to the master, uneven ID numbers to the slave. Standard position CAN packets have length 4, all other CAN packets have length 8. The meaning, timing and other constraints are specified as follows. The possible 8 data bytes of a CAN message are numbered from 1 to 8, 1 being the chronologically first. The preamble "0x" indicates hexadecimal figures. Data values not described in more detail here are reserved for internal use in the Ants LES02.

Measure	Description
The evaluation unit must implement the full CAN specification 2.0 according to Bosch. Speed is 250 kbits.	
Alternating transmission by the channels	In normal operation, every channel sends its position data all 4 ms. The Slave synchronizes on the half of the Master interval, in order to send positions all 2 ms.
The data must be checked for plausibility	The positions must be checked for plausibility in an evaluation unit in order to detect transmission errors that could not be corrected by the CAN protocol (depending on the SIL value of the complete system).
Specified CAN-ID use	The CAN IDs are used in the 11-bit standard. The Master is always assigned even IDs, the Slave is assigned the corresponding ID + 1.

Permissible CAN IDs	The following CAN IDs are allowed: 0x10(0x11) system messages, 0x20(0x21) error messages, 0x30(0x31) status messages, 0x80(0x81) position messages. Sending these messages may only be performed by the Ants LES02 (exception: (un)lock message, see below).
Ants LES02 transmits system messages	System messages have ID 0x10(0x11). Length of the message is 8 bytes. Byte 8 describes the status of the subsystem message: 0xF0 LES lock(ed), 0xFF LES unlock. Bytes 1-2 contain the unlock key (only in case of LES locked, LES unlock). An external participant may lock the LES by sending the LES lock(ed) subsystem message.
Ants LES02 transmits detected errors	Every channel transmits detected errors via error messages. Error messages have ID 0x20(0x21). Length of the message is 8 bytes. Byte 8 describes the error type. Bytes 1-7 show additional information, which are transmitted according to the error type. These are not specified more in detail, but they should be recorded in the event of an error for diagnostic purposes by the manufacturer. A list of all error codes is attached. The evaluation unit must make the recorded errors available to specialized personnel. This must be described in the operation manual.
Ants LES02 transmits status messages	Every channel also transmits status messages outside of normal operation. Status messages have ID 0x30(0x31). Length of the message is 8 bytes. Byte 8 describes the sub status message: 0x0F channel starts (here byte 1-4 CRC of the LES software).
Ants LES02 transmits position data	Every channel transmits its position data. Length of the message is 4 bytes. Bytes 1-3 show the global position of the channel (MSB first). This data must be checked for plausibility (see above). Byte 4 indicates the 0.5 mm resolution.

Ants LES02 is in locked state	Ants LES02 is in locked state and no longer sends messages, excepted the LES locked subsystem message (see above) with the current unlock key. An evaluation unit can unlock the LES by sending a LES unlock system message together with the currently valid unlock key in bytes 1-2. The key of the LES locked message is constantly changing. The validity time window of an unlock key is 30 ms. Therefore, an evaluation unit must read this key and send without great delay a LES unlock subsystem message (ID 0x10, see above) including the key read. The repeated unlocking of the LES after an error is the responsibility of the evaluation circuit.
Only Ants LES02 is allowed to send via the CAN bus	Only Ants LES02 itself is allowed to send messages via the CAN bus. The only exception is the sending of LES unlock subsystem messages by the evaluation unit. In an unauthorized message is detected, an error is issued and the LES02 locks.

Possible errors, their meaning and handling (IDs : 0x20 or 0x21, byte 8)

In general, the Ants LES02 cannot be repaired. A defective device must be replaced as a whole. Please note that generally the Ants LES02 is a partial system of a safety system. Therefore, in order to ensure the traceability of safety components, it must be recorded which Ants LES02 (serial number) has been replaced with which new Ants LES02 (serial number). In the event of an error, the error of the Ants LES02 must be identified and suitable measures (see below) must be taken. The connected evaluation unit provides possibilities to read the error. To this purpose, please read the corresponding operation manual.

Errors may occur due to worn slides (also a critical error). In this exceptional case, it is allowed to replace only the slides (see above).

Since, if mounting has been performed properly, no forces act on the slides, worn slides indicate an installation error. Please make sure that the coded band is mounted vertically and runs straight through the sensor, without exerting pressure on the slides.

In rare cases, errors may also occur because of dirt on the coded band and therefore in the sensor. In this case, check and clean the coded band, and clean the disconnected sensor with compressed air. Before re-connecting the Ants LES02, wait at least one minute to allow possible condensate to dry.

⚠ CAUTION	After every error switching the Ants LES02 in the locked state, an error-free travel along the whole length of the elevator shaft must in any case be performed in normal operation before the elevator can be released for operation. If errors occur repeatedly, their causes must be determined. If they cannot be remedied with the allowed measures described above, the whole Ants LES02 must be replaced. If mechanical parts of the Ants LES02 are bent or damaged, the Ants LES02 must in any case be replaced. In addition, the cause must be identified, to find out how a mechanical stress is (has been) applied on the Ants LES02, since, in normal operation, no force (except low friction forces due to the coded band) are allowed to act on the Ants LES02.

A list of the possible error codes, of their meaning and rating, is given below.

Error code	Description	Rating
0x01	Position code invalid. Can only occur when starting / restarting due to an unlock.	Critical error. Possible causes: Coded band defective/dirty. Slide worn. Measuring system failed.
0x02	Coded band not tensioned in the sensor	No coded band in place. Unlock Ants LES02 after having put the coded band in place.
0x03	Not used.	-
0x04	Clock track (small holes) measurement impossible.	Critical error. Possible causes: Coded band defective/dirty. Slide worn. Measuring system failed.
0x05	Implausible measurements in the channel.	Critical error. Possible causes: Coded band defective/dirty. Slide worn. Measuring system failed.
0x06	Code track (large holes) measurement impossible.	Critical error. Possible causes: Coded band defective/dirty. Slide worn. Measuring system failed.
0x07	Ants LES02 not vertical.	Critical error. Sensor inclined. Inspect the installation of the sensor.

0x08	Difference between channels.	Critical error. Possible causes: Coded band defective/dirty. Slide worn. Measuring system failed.
0x09	A channel failed.	Critical error. Interferences on the bus line, measuring system defective.
0x0A	BUS communication error.	Non-critical error. Possible causes: other unauthorized participants on the bus.
0x0B	Unauthorized communication on the bus.	Non-critical error. Possible causes: other unauthorized participants on the bus.
0x0C	CRC checksum error via program code.	Critical error. The sensor system must be replaced.
0x0D	Implausible acceleration values.	Critical error. Possible causes: Sensor got stuck. Check the complete coded tape.
0x0E	Not used.	-
0x0F	Sensor not upright. Can only occur when starting / restarting due to an unlock.	Critical error. Check the installation of the sensor.
0x10	Detects a too fast move of the Ants LES02 (> 12 m/s).	Critical error. Check the speed of the elevator facility.
0x11	Partial voltage drop in the Ants LES02.	Critical error. Possible causes: wrong coded band. Slide worn. Measuring system failed.
0x12	Not used.	-
0x13	Not used.	-
0x14	Logic failure.	Critical error. Replace the sensor if this error occurs repeatedly.
0x15	Logic failure.	Critical error. Replace the sensor if this error occurs repeatedly.
0x16	Free fall (1 g).	Critical error. Check the acceleration values of the elevator facility.

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R67063.0002 - Index 1