



Manual

Ants LES02

The CAN logo is the word 'CAN' in a bold, green, sans-serif font.

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1 Document

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Subject to errors and changes. The stated product features and technical data shall not constitute any guarantee declaration.

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 / Warnings and Safety instructions

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

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 [▶ 6].

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 products, for special versions in the corresponding customer drawing of the product.

The above mentioned documents, the original declarations of conformity and the relevant certificates can be downloaded from our homepage:

www.kuebler.com/docufinder.

For the evaluation of the safe sensor, observe the respective operation manual of the system to be commissioned. The evaluation unit or control must comply with the requirements of the interface description and with the safety-related technical specifications.

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.

The PSU02 evaluation unit serves for the safe position detection, for the implementation of the limit switch, inspection limit switch, time-delayed limit switch, unintended car movement (UCM) functions and for the safe bypass of the safety circuit in case of early door opening/car level control for elevator facilities in accordance with EN81-20 and EN81-21.

3.2 Technical Data

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

Extracts of the main technical data are listed below. All other characteristic values can be found in the corresponding product data sheets.

3.2.1 Sensor

Mechanical characteristics sensor

Operating temperature	-10 °C ... +70 °C [14 °F ... 158 °F]
Storage temperature	-15 °C ... +80 °C [5 °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	certified 8 m/s [26.25 ft/s] functional 12 m/s [39.37 ft/s]
Resolution	certified 1 mm functional [0.5 mm]
Accuracy	± 1 mm

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
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UL - Underwriters Laboratories

UL approval	File E498900
Relevant Standards	UL 508

CAN Characteristics


Protocol	CAN proprietary
Transmission interval	every 2 ms
Baud rate	250 kbits
Terminated	yes
Max. distance to an evaluation unit	100 m (CAN bus), twisted pair 0.5 mm ² , with shield

For further information, refer to the Ants LES02 CAN manual.

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 Variants Overview

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

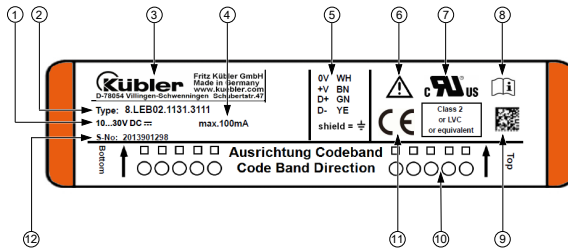
ATTENTION

Limited combination

The PSU02 evaluation unit may only be operated in combination with the Ants LES01 or Ants LES02 sensor.

3.4 Sensor Type Plate

Example of a type plate on the product:



27021597902745355

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

4 Installation

4.1 Electrical Installation

4.1.1 General Information for the Connection

ATTENTION	<p>Destruction of the device</p> <p>Before connecting or disconnecting the signal cable, always disconnect the power supply and secure it against switching on again.</p>
NOTICE	<p>General safety instructions</p> <p>Make sure that the whole plant remains switched off during the electrical installation.</p> <ul style="list-style-type: none"> • Make sure that the operating voltage is switched on or off simultaneously for the device and the downstream device.
NOTICE	<p>Traction relief</p> <p>Always mount all cables with traction relief.</p>
NOTICE	<p>Interference susceptibility</p> <p>Proceed as follows:</p> <ul style="list-style-type: none"> • Connect the shield to the device housing. • Comply with the maximum cable length for stub lines and for the total length of the bus network. • Check the maximum supply voltage on the 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						
CAN	Signal:	+V	0 V/GND	CAN_H	CAN_L	n.c.	n.c.
	Core color:	BN	WH	GN	YE	GY	PK

5 Commissioning and Operation

5.1 Status LED

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

Display	LED	Meaning
LED off		No voltage
LED green		Supply voltage is applied to the device
LED green flashing		Communication with the bus present
LED red		The sensor is in locked mode
LED red flashing		An error that did not lead to the locked mode occurred

5.2 Failures

The measuring system does not communicate with the control

- a) Check the supply voltage.
- b) Check the correctness of the electrical installation, in particular of the wiring.
- c) Make sure that the CAN bus connection is properly installed. If necessary use a CAN monitor to check data transmission.
- d) Make sure that the evaluation unit is compatible with the sensor.
- e) Make sure that the orientation of the coded band after installation matches the orientation indicated on the sensor type plate (orientation of the large and small holes).
- f) Check the slides for important wear.
- g) In the event of an error, perform a sensor reset.

5.3 CAN Communication

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 a certified evaluation device. 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 device with an external evaluation unit. An evaluation device wanting to use this device must comply with all specifications. If all indicated measures are implemented, an SFF exceeding 99% is achieved.

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.



Safety functions of the evaluation unit

In the event of the absence of position data, the evaluation unit must use suitable means to achieve a safe state of the elevator plant (also depending on the safety function).

Whether operation can be resumed after a failure, thus whether a re-set is allowed, is determined by the commands stored in the evaluation unit.

The architecture of the device 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 are 4 bytes long, all other CAN packets are 8 bytes long.

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 device.

5.4 Data Transmission

Measure	Description
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.
Permitted 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 sensor by sending the LES lock(ed) subsystem message.

Continuation: Data Transmission

<p>Ants LES02 transmits detected errors</p>	<p>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 is issued according to the error type. This information is not specified more in detail, but it 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.</p>
<p>Ants LES02 transmits status messages</p>	<p>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), 0xF0 channel ready. In channel ready, the meaning of the byte is not specified.</p>
<p>Ants LES02 transmits position data</p>	<p>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 is not specified further.</p>
<p>Ants LES02 is in locked state</p>	<p>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 sensor by sending a LES unlock subsystem 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.</p>
<p>Only Ants LES02 is allowed to send via the CAN bus</p>	<p>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 sensor locks.</p>

5.5 CAN Error Codes

In general, the sensor cannot be repaired. A defective device must be replaced as a whole.

<p>NOTICE</p>	<p>Traceability of safety components</p> <p>It must be noted that the device generally is a subsystem of a safety system and that therefore the traceability of safety components must be ensured.</p> <p>So please record which device (serial number) has been replaced with which new device (serial number).</p>
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In the event of an error due to the sensor, a number of measures must be implemented. The error can be read out via the connected evaluation unit for error detection (see the corresponding operating manual for details).

Error causes and measures to be implemented

Worn slides (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.

- Check whether the coded band is mounted vertically and firmly tensioned. It must travel through the slides without exerting pressure on the slides.

Dirt on the coded band causing dirt in the sensor (rare error):

- Check and clean the coded band.
- Disconnect the sensor before cleaning it with compressed air.
- Wait at least one minute before re-connecting the device.



Behavior in the event of an error

After every error switching the device in the locked state, an error-free travel along the whole length of the elevator shaft must imperatively be performed in normal operation. Only after this the elevator can be released for operation

If errors occur repeatedly, their causes must be determined. If the standard troubleshooting measures have not been sufficient, the whole device must be replaced.

If mechanical parts of the device are bent or damaged, the device must in any case be replaced. It must furthermore be checked how a mechanical stress could be exerted on the device, since in normal operation no forces shall be applied on the device (except the low friction forces due to the band).

Error code	Description	Rating
0x01	Position code invalid. This error can only occur when starting / restarting due to an unlock.	Critical error. Possible causes: Coded band defective or dirty. Slides worn. Measuring system failed.
0x02	Coded band not tensioned in the device	No coded band in place. Put the coded band in place and unlock the device.
0x03	-	-
0x04	Clock track measurement impossible (small holes)	Critical error. Possible causes: Band defective or dirty. Slides worn. Measuring system failed.
0x05	Measures in the channel not plausible	Critical error. Possible causes: Band defective or dirty. Slides worn Measuring system failed.
0x06	Code track measurement impossible (large holes)	Critical error. Possible causes: Band defective or dirty. Slides worn. Measuring system failed.
0x07	The device is not vertical (as an average value inclined by more than 15 degrees)	Critical error. Device is inclined. Check device installation.
0x08	Difference between channels during operation	Critical error. Possible causes: Band defective or dirty. Slides worn. Measuring system failed.
0x09	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 device must be replaced.
0x0D	Acceleration values not plausible	Critical error.

Error code	Description	Rating
		Possible causes: Device got stuck. Check the complete coded tape.
0x0E	Not used	-
0x0F	Device is not upright. This error can only occur when starting / restarting due to an unlock.	Critical error. Check device installation.
0x10	Too fast device displacement detected (system limits 12 m/s)	Critical error. Check the speed of the elevator facility.
0x11	Partial voltage drop in the device	Critical error. Possible causes: wrong coded band. Slides 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 plant.

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 Contacts [▶ 20].

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 and 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.

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 support

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

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Kübler China +86 10 8471 0818

Kübler India +91 8600 147 280

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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

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D-78054 Villingen-Schwenningen

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Phone +49 7720 3903 0

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Glossary

CAN

Controller Area Network

SFF

Safe Failure Fraction



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