Safety Manual

SERIE LIMAX33 CP-00

Safe Magnetic Absolute Shaft Information System - STANDARD VERSION

(Original Safety Manual)

- Easy and flexible installation
- Replaces various electromechanical components in the elevator shaft
- Resistant to dirt, smoke and humidity
- Absolute position is always and directly available, no referencing even after long power failure
- Noiseless measuring principle
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3 General

3.1 Information on the Safety Manual

This manual contains important information regarding the handling of the device. For your own safety and operational safety, please observe all safety warnings and instructions.

Precondition for safe operation is the compliance with the specified safety and handling instructions. Moreover, the existing local accident prevention regulations and the general safety rules at the site of operation have to be observed.

Please read the operating manual carefully before starting to work with the device! It is part of the product and should be kept close to the device and accessible for the staff at any time. The illustrations in the manual are for better demonstration of the facts. They are not necessarily to scale and can slightly differ from the actual design.

3.2 References

/LIMAX33CP-00-MI/ Mounting Instructions for LIMAX33 CP-00 with installation kit LIMAX S-RMS2
/CiA DR303-3/ CiA Draft Recommendation 303, Part 3: Indicator specification; CAN in Automation
/EN81-20/ Safety rules for the construction and installation of lifts
/EN81-21/ Safety rules for the construction and installation of lifts

3.3 Explanation of Symbols

Special notes in this manual are characterized by symbols. The notes are introduced by signal words which express the magnitude of danger. Please follow this advice and act carefully in order to avoid accidents and damage and injuries.

Warning notes:

DANGER!
This symbol in connection with the signal word “Danger” indicates an immediate danger for the life and health of persons. Failure to heed these instructions can result in serious damage to health and even fatal injury.

WARNING!
This symbol in connection with the word „Warning” means a possibly impending danger for the life and health of persons. Failure to heed these instructions can result in serious damage to health and even fatal injury.

CAUTION!
This symbol in connection with the signal word “Caution” indicates a possibly dangerous situation. Failure to heed these instructions can lead to injuries or damage of property.

Special safety instructions:

DANGER!
This symbol in connection with the signal word “Danger” indicates an immediate danger for the life and health of persons due to voltage. Failure to heed these instructions can result in serious damage to health and even fatal injury. The operations may only be carried out by a professional electrician.
Tips and recommendations:

NOTE!
... points out useful tips and recommendations as well as information for an efficient and trouble-free operation.

References:

() This symbol marks a reference to a chapter of this document

() This symbol marks a reference to chapter of another document
### 3.4 Statement of Warranties

The statement of warranties is enclosed separately in the sales documents.

**Guarantee**

The producer guarantees the functional capability of the process engineering and the selected parameters. The period of warranty is one year and begins with the date of delivery.

### 3.5 Demounting and Disposal

Unless acceptance and disposal of returned goods are agreed upon, demount the device considering the safety instructions of this manual and dispose it with respect to the environment.

**Before demounting:**

Disconnect the power supply and secure against re-start. Then disconnect the supply lines physically and discharge remaining energy. Remove operational supplies and other material.

**Disposal:**

Recycle the decomposed elements:

- Metal components in scrap metal
- Electronic components in electronic scrap
- Recycle plastic components
- Dispose the remaining components according to their material consistence

![CAUTION!](image)

Wrong disposal causes environmental damages!

Electronic scrap, electronic components, lubricants and other auxiliary materials are subject to special refuse and can only be disposed by authorized specialists!

Local authorities and waste management facilities provide information about environmentally sound disposal.
4 Safety

CAUTION!
Please read the operating manual carefully, before using the device! Observe the installation instructions!
Only start up the device if you have understood the operating manual.

The operating company is obliged to take appropriate safety measure.
The initial operation may only be performed by qualified and trained staff.

Selection and installation of the devices as well as their embedding into the controlling system require qualified knowledge of the applicable laws and normative requirements on the part of the machine manufacturer.

4.1 General Causes of Risk

This chapter gives an overview of all important safety aspects to guarantee an optimal protection of employees and a safe and trouble-free operation.
Non-observance of the instructions mentioned in this operating manual can result in hazardous situations.

4.2 Personal Protective Equipment

Employees have to wear protective clothing during the installation of the device to minimize danger of health.

Therefore:
Change into protective clothing before performing the works and wear them throughout the process.
Additionally observe the labels regarding protective clothing in the operating area.

Protective clothing:

PROTECTIVE CLOTHING
… is close-fitting working clothing with light tear strength, tight sleeves and without distant parts. It serves preliminarily for protection against being gripped by flexible machine parts.

Do not wear rings, necklaces or other jewelry.

PROTECTIVE GLOVES
… for protecting the hands against abrasion, wear and other injury of the skin.

PROTECTIVE HELMET
… for protection against injuries of the head.
4.3 Conventional Use

The product described in this manual was developed to execute safety-related functions as a part of an entire assembly or machine. It is the responsibility of the manufacturer of a machine or installation to ensure the proper operation of the system. The ELGO-device is conceived only for the intended use described in this manual.

The ELGO length measuring system LIMAX33 CP-00 serves only to measure lengths in lift systems and to fulfill the required safety functions (described in chapter 13).

CAUTION!
Danger through non-conventional use!

Non-intended use and non-observance of this operating manual can lead to dangerous situations.

Therefore:
- Only use the device as described
- Strictly follow the instructions of this manual

Avoid in particular:
- Remodeling, refitting or changing of the construction or single components with the intention to alter the functionality or scope of the device.

Claims resulting from damages due to non-conventional use are not possible.
Only the operator is liable for damages caused by non-conventional use.
5 Transport and Storage

5.1 Safety Instructions for Transport, Unpacking and Loading

CAUTION!
Transport the package (box, palette etc.) professionally. Do not throw, hit or fold it.

5.2 Handling of Packaging Material

Notes for proper disposal: $\approx 3.5$

5.3 Inspection of Transport

Check the delivery immediately after the receipt for completeness and transport damage. In case of externally recognizable transport damages:

- Do not accept the delivery or only accept under reserve.
- Note the extent of damages on the transportation documents or delivery note.
- File complaint immediately.

NOTE!
Claim any damage immediately after recognizing it. The claims for damage must be filed in the lawful reclaim periods.

5.4 Storage

Store the device only under the following conditions:

- Do not store outside
- Keep dry and dust-free
- Do not expose to aggressive media
- Protect from direct sun light
- Avoid mechanical shocks
- Storage temperature ($\approx 7$) needs to be observed
- Relative humidity ($\approx 7$) must not be exceeded
- Inspect packages regularly if stored for an extensive period of time (>3 months)
6 Product Features

LIMAX33 CP-00 is a magnetic tape-based shaft information and safety system which covers:

- Several safety functions named in the EN81-20/21
- The requirements regarding cab position measurement (e.g. as information for lift control)
- Non safety relevant functions like door zone indication for emergency release

The magnetic measuring principle makes the sensor insensitive even to black smoke and splash water. Magnetic tape and sensor can be mounted easily.

ADVANTAGES

The drastic reduction of the components offers significant cost advantages. Time for installation and maintenance is reduced significantly. A possible troubleshooting is also simplified, especially since the electronic provides diagnostic options.

LIMAX33 CP-00 is as well suitable for serial production with new installations as for upgrading existing elevator systems.

6.1 Functional principle

The tape carries the unique positioning information as a magnetic code. It is installed free hanging in the elevator shaft by use of a mounting kit. The LIMAX33 CP-00 is mounted to the elevator car. While the actual measurement is contactless the tape must be kept within a maximum distance to the sensor head. Therefore, the tape is guided along the LIMAX33 CP-00 by use of the polymer tape guide which is an integral component of the sensor head.

The magnetic measurement principle is extremely robust. Dust, dirt and humidity do not affect the measurement in any way. Also, smoke and even higher temperatures have no influence on the measuring quality. Further the tape is robust enough to withstand the harsh conditions in elevator shafts.
7 Technical Data

7.1 Identification

7.1.1 Type Label

The type label serves for the identification of the unit. It is located on the housing of the sensor and gives the exact type designation (= order reference, see \( \geq 9 \)) with the corresponding part number. Furthermore, the type label contains a unique, traceable device number, the production date as well as the hardware and software versions. When corresponding with ELGO always indicate this data.

![Figure 1: Example of a type label for identification of the sensor](image)

**NOTE!** For traceability of chance history concerning LIMAX33 CP-00 and its configuration, a corresponding table is prepared on the bottom of the info sheet.

It is recommended to maintain this table like this: update this table whenever the LIMAX33 CP-00 is exchanged to one with the identical configuring and add an actual info sheet whenever the configuration has been changed.

7.1.2 Info Label and Info Sheet

The Info label (Figure 2) contains general information about the device.

Each system needs a specified configuration which must fit to the corresponding lift (\( \geq 14.1 \)).

On the info label a space is reserved to attach the CRC-info-sticker, which contains the CRC of the configuration.

As an alternative, the CRC of the configuration and the date can be handwritten on the space provided on the info label.

For subsequent transparency of the respective configuration it is strongly recommended to attach an info sheet (Figure 3) with all important settings to the documentation of the installation.

The CRC on the info sheet must fit the CRC on the info label.
Technical Data

CRC-Info-Sticker, to be attached as soon as configuration is written

Alternatively handwritten CRC and date on space provided

Figure 2: Example of an info label on the housing with a specific system configuration

WARNING!

Removing, exchanging or distorting of the information on the info label is prohibited.

If the Info-label is accidently damaged so that the information – especially the configuration-CRC - is not clearly recognizable anymore, the device has to be treated in the same way like a defective device. Any distortion of the information noted on the info-label can cause a dangerous situation.

There is one exception from this rule: If the configuration is erased in order to download a new configuration (refer to section 14.1.1.4) the CRC-info-sticker must be exchanged to a sticker fitting the new configuration.
### Info sheet „Configuration Data“

**Configuration CRC = 0xabcd1234**

<table>
<thead>
<tr>
<th>Safety functions (enabled/disabled)</th>
<th>Actuators (enabled/disabled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door (bridging + UCM) enabled</td>
<td>OC enabled</td>
</tr>
<tr>
<td>Final limit switches enabled</td>
<td>eSGC enabled</td>
</tr>
<tr>
<td>Deceleration control enabled</td>
<td>SR1 enabled</td>
</tr>
<tr>
<td>Over speed pre-tripping enabled</td>
<td>SR2 disabled</td>
</tr>
<tr>
<td>Over speed final-tripping enabled</td>
<td></td>
</tr>
<tr>
<td>Over speed teach pre-trip. disabled</td>
<td></td>
</tr>
<tr>
<td>Over speed teach fin-trip.</td>
<td></td>
</tr>
<tr>
<td>Working platform enabled</td>
<td></td>
</tr>
<tr>
<td>Final tripping speed teach</td>
<td></td>
</tr>
<tr>
<td>Inspection functions (global)</td>
<td></td>
</tr>
<tr>
<td>Upper offset</td>
<td></td>
</tr>
<tr>
<td>Lower offset</td>
<td></td>
</tr>
<tr>
<td>Deceleration control</td>
<td></td>
</tr>
<tr>
<td>Deceleration a</td>
<td>1.2 m/s²</td>
</tr>
<tr>
<td>Delay of brake</td>
<td>200 ms</td>
</tr>
<tr>
<td>Buffer speed</td>
<td>600 mm/s</td>
</tr>
<tr>
<td>Upper offset</td>
<td>0 mm</td>
</tr>
<tr>
<td>Lower offset</td>
<td>0 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limit switch offsets (with reference to the shaft ends)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper pre-triggered stopping system limit</td>
</tr>
<tr>
<td>Lower pre-triggered stopping system limit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip direction of eSGC („BOTH“/„Only DOWN“)</td>
</tr>
<tr>
<td>UCM acts („only OC“/ „eSGC and OC“)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Device installed or changed (same configuration)</th>
<th>Serial No.</th>
<th>Device changed (different configuration =&gt; refer to successor info sheet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 10.08.2018</td>
<td>✗</td>
<td>12345678</td>
<td></td>
</tr>
<tr>
<td>2. 03.04.2019</td>
<td>✗</td>
<td>87654321</td>
<td></td>
</tr>
<tr>
<td>3. 03.04.2019</td>
<td>✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. 03.04.2019</td>
<td>✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. 03.04.2019</td>
<td>✗</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Example of an info sheet for the documentation of the installation with a specific system configuration.
7.2 Dimensions of LIMAC33 CP-00

Figure 4: Dimensions of the sensor
### LIMAX33 CP-00 (Standard version)

#### Mechanical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>Absolute</td>
</tr>
<tr>
<td>Repeat accuracy</td>
<td>±1 increment</td>
</tr>
<tr>
<td>System accuracy in µm at 20°C</td>
<td>±(10000 ± 100 x L) L = measuring length in meters</td>
</tr>
<tr>
<td>Distance sensor / magnetic tape</td>
<td>the correct distance is guaranteed by guidance</td>
</tr>
<tr>
<td>Basic pole pitch</td>
<td>8 mm</td>
</tr>
<tr>
<td>Sensor housing material</td>
<td>aluminum</td>
</tr>
<tr>
<td>Sensor housing dimensions</td>
<td>L x W x H = 354 x 136 x 54 mm</td>
</tr>
<tr>
<td>Necessary magnetic tape</td>
<td>AB20-80-10-1-R-D-15-BK80</td>
</tr>
<tr>
<td>Maximum measuring length</td>
<td>260 m</td>
</tr>
<tr>
<td>Connections</td>
<td>2 outlets with open wire ends for PIO and SCA cables (plug connectors on request)</td>
</tr>
<tr>
<td>Sensor cable (PIO, SCA)</td>
<td>standard length: 3.0 m (others on request)</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 1400 g without cable; cable: approx. 60 g per meter</td>
</tr>
</tbody>
</table>

#### Electrical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>18 ... 30 VDC (stabilized). A SELV/PELV power supply must be used</td>
</tr>
<tr>
<td>Residual ripple</td>
<td>&lt; 100 mV</td>
</tr>
<tr>
<td>DZO rating</td>
<td>+ 24 VDC −20 %, max. 200 mA (push-pull)</td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td>integrated</td>
</tr>
<tr>
<td>Power input</td>
<td>max. 600 mA at 24 VDC</td>
</tr>
<tr>
<td>Interfaces</td>
<td>CAN: CANopen DS406 or DS417 (others on request)</td>
</tr>
<tr>
<td>Digital input voltage</td>
<td>18 ... 30 VDC for high level; open for low level</td>
</tr>
<tr>
<td>Relay contact rating</td>
<td>0 ... 230 VAC (max 250 VAC), max. 2 A; or 24 VDC (max. 30 VDC), max. 1 A; or 110 VDC, max. 250 mA; each with a resistive/inductive load with L/R &lt; 40 ms</td>
</tr>
<tr>
<td>Rating for external supply of SGC-actuator</td>
<td>24 VDC, min. 18 V; max. 30 V; constraints for connected trip coil to be observed (refer also to chapter 8, topic 23 and 24)</td>
</tr>
</tbody>
</table>

#### Environmental Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature</td>
<td>−25 ... +85° C</td>
</tr>
<tr>
<td>Operation temperature</td>
<td>−20 ... +65° C (−25 ... +85° C on request)</td>
</tr>
<tr>
<td>Humidity</td>
<td>max. 95.5%, non-condensing</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP54 (according to EN60529), higher on request</td>
</tr>
<tr>
<td>Interference emission / immunity</td>
<td>EN 12015 / EN 12016</td>
</tr>
<tr>
<td>Vibration / shock resistance</td>
<td>EN 60068-2-6 / EN 60068-2-27, EN 60068-2-29</td>
</tr>
</tbody>
</table>

#### Others

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating time</td>
<td>20 years</td>
</tr>
<tr>
<td>Safety relay contact reaction time</td>
<td>&lt; 55 ms</td>
</tr>
<tr>
<td>Solid state contact (eSGC) reaction time</td>
<td>&lt; 45 ms</td>
</tr>
</tbody>
</table>
8 Constraints for Use (Safety requirements for integration)

The general constraints for use of LIMAX33 CP-00 are listed here:

1. Configuration of LIMAX33 CP-00 and the elevator (where it is installed) must fit. The configuration is noted on the info sheet § 7.1.2. The following topics must be taken into consideration when defining the configuration:

   a. It is possible to disable all safety functions related to inspection and/or “EN81-21” state in combination. In this case neither upper resp. lower “pre-triggered stopping system”, nor upper resp. lower inspection limit switch nor overspeed inspection (pre-/final-tripping) are performed by the LIMAX33 CP-00. In this case these safety functions must be implemented by other means (if necessary) outside of the scope of LIMAX33 CP-00.

   b. All actuators necessary for the safety functions which are enabled, must be enabled in the configuration and connected to the safety circuit resp. an external braking element for eSGC following § 10.4.3, § 10.4.4, § 10.4.5 and § 10.4.8. Section § 14.1.4 shows an overview over the actuators necessary for the single safety functions.

   c. In case of upper resp. lower “pre-triggered stopping system” = DISABLED, it must be ensured that there is
   - either ample survival space for a man on the car roof resp. in the shaft pit even if the car is on the highest resp. lowest possible position.
   - or survival space for a man on the car roof resp. in the shaft pit is implemented by other means outside of the scope of LIMAX33 CP-00.

   The combination upper “pre-triggered stopping system” = ENABLED and “trip direction = only down” is forbidden. It is also prevented by the software of the LIMAX33 CP-00 that this combination is programmed.

   d. If all safety functions related to inspection and/or “EN81-21” state in combination are disabled, also the upper and lower inspection limit switches are disabled. In this case must be ensured that EN81-21 § 5.5.3.4 § 5.7.3. resp. EN81-20 § 5.12.1.5.2.1 g) are implemented by other means outside of the scope of LIMAX33 CP-00.

   e. In case of upper or lower “pre-triggered stopping system” are enabled (not disabled) it is recommended not to disable the safety function “overspeed inspection final tripping”. If “overspeed inspection final tripping” is disabled while upper or lower “pre-triggered stopping system” is enabled, the user must ensure the worst-case speed for calculation of braking distance for pre-triggered stopping system (refer to point § n) be other means.

   f. In case safety function “ETSLS” = DISABLED, it must be ensured that
   - either ETSLS is not needed because the buffers are designed for nominal speed of the lift
   - or safety function ETSLS is implemented by other means outside of the LIMAX33 CP-00 scope

   g. In case safety function “final limit switches” = DISABLED, it must be ensured that safety function “final limit switches” is implemented by other means outside of the scope of LIMAX33 CP-00.

   h. Safety function “door bridging” and “UCM” can only be disabled in combination. “door bridging” / “UCM” = DISABLED, neither door bridging nor UCM will be performed by LIMAX33 CP-00.

   i. In case safety function “over-speed final-tripping” = DISABLED, it must be ensured that this safety function is implemented by other means outside of the scope of LIMAX33 CP-00

   (usually by a conventional speed governor). In case safety function “over-speed final-tripping” = ENABLED, safety function “over-speed final-tripping” will only fulfill EN81-20 § 5.6.2.2.1 a.) in case the eSGC actuator is connected to a suitable (electronic triggered) safety gear. In case “over-speed final-tripping” = ENABLED and “trip direction” = “only down”, it must be ensured that the safety function “overspeed (final tripping)” is either not needed in upwards direction (may be due to the construction of the lift), or that “over speed (final tripping)” in upwards direction is secured by other means (outside the scope of LIMAX33 CP-00).

   j. The nominal speed of the LIMAX33 CP-00 must fit with the nominal speed of the lift

   k. Pre-tipping and final tripping speed must be chosen in compliance with EN81-20 with respect to the nominal speed.

---

1 Some, but not all of the “inspection/ EN81-21-state” safety functions can also be disabled individually
1. The speed limited by safety function “inspection overspeed (final tripping)” can be used to ensure the worst-case speed for the determination of the braking distance for “pre-triggered stopping system” (see point \( \varphi \ n \))

m. The inspection speed is normally limited by lift control. LIMAX33 CP-00 supervises this limitation by safety function “inspection overspeed (pre-tripping)”. The tripping speed should be chosen so that is
- big enough, so that this safety function does not trip by fail if the car travels in an inspection trip with normal inspection speed.
- small enough so that - in case of a too fast inspection trip by failure - this safety function has the chance to stop the car by machine brake via safety circuit before the car is stopped by safety gear (tripping of safety gear cause by “inspection overspeed (final tripping)”

n. The offset of limit positions for upper resp. lower “pre-triggered stopping systems” must be chosen in such a way, that ample survival space for a person on car roof resp. in the shaft pit is ensured after the sequence car stopped \( \rightarrow \) safety gear tripped \( \rightarrow \) limit positions for upper resp. lower “pre-triggered stopping systems” have been over travelled. Braking distance under worst case conditions must be considered when defining the offsets. Braking distance depends on actual speed (due to worst case assumption, refer to \( \varphi \ l \) and \( \varphi \ e \), reaction time of CP (see point \( \varphi \ 8 \). below) and delay and the deceleration of the safety gear.

o. The feature “trip direction” = “only down” may be used if the safety gear is only unidirectional. In this case all safety function using the eSGC as an actuator will trip only in downwards direction. Therefore, the combination “trip direction” = “only down” is forbidden in combination with some of the safety functions (refer also to \( \varphi \ c \) and \( \varphi \ p \)). Other safety functions can only be used under constraints if “trip direction” = “only down” (refer to \( \varphi \ l \) and \( \varphi \ q \))

p. LIMAX33 CP-00 is able to fulfill EN81-20 §5.2.6.4.3.1 b.), but only if safety function “working platform” is enabled. The combination “working platform is enabled” and “trip direction = only down” is forbidden. It is also prevented by the software of the LIMAX33 CP-00 that this combination is programmed.

q. If “door bridging / UCM” is enabled and “trip direction = only down” is enabled, tripping of UCM will act the braking element connected to the eSGC actuator (normally the safety gear) only in downwards direction. If UCM trips in upwards direction only OC opens (additional to SR1 and SR2). In this case it must be either ensured that it is in compliance with the EN81-20 that UCM can be fulfilled with the machine brake in upwards direction or “UCM in upwards direction” must be secured by other means (outside the scope of LIMAX33 CP-00).

r. If “UCM only OC” is enabled, only OC will open (additional to SR1 and SR2). In this case the machine brake is the braking element for the safety function “UCM”. Therefore, the machine brake must be a certified safety brake in order to fulfill EN81-20 §5.6.7.

s. Safety function “over speed teach (pre-tripping)” is intended to be used as a substitute for ETSL during teach mode. If this safety function is not needed, it may be disabled. If it is needed, the tripping speed for “over speed teach (pre-tripping)” should not be higher than the buffer speed.

t. Safety function “over speed teach (final-tripping)” is intended to be used for general additional safety (without a reference to the EN81-20). It may be disabled if not desired.

u. The Parameter “\( \alpha \)”, “\( V_{\text{fl}} \)”, “\( V_{\text{fw}} \)” and “offset” must be adjusted in such a way, that – in case ETSL trips - the car hits the buffer surface with a speed not bigger the buffers are designed for.

v. The OC actuator must be enabled in any case

2. To prevent any short-circuit between the 24 VDC UP/DOWN signals of the inspection control or the 24 VDC “EN21-21” signal of the electrical safety device and adjacent circuits, the requirements of EN81-50§5.15 must be met.

3. The technical data (mechanical, electrical and environmental) concerning the LIMAX33 CP-00 - sensor as defined in chapter \( \varphi \ 7.3 \) are valid for constraints for use.

4. The technical data (mechanical, magnetically and environmental) concerning the magnetic tape as defined in a separate data sheet are valid for constraints for use.

5. The value of fuse protecting the safety circuit must be in compliancy with the electrical data of safety circuit defined in chapter \( \varphi \ 7.3 \)

6. The value of fuse protecting the eSGC circuit must be in compliancy with the electrical data of eSGC-circuit defined in chapter \( \varphi \ 7.3 \)

7. Operation height: up to 2000 m above sea level
8. The worst case reaction times of relay contacts OC, SR1 and SR2 when a safety function is triggered is <55 ms and concerning the eSGC <45 ms.

9. Constraints for Installation of magnetic tape according to its instruction manual must be observed. A tape presence detector securing the risk of demolition of the magnetic tape must be integrated into the safety circuit, see also the installation schemes (Figure 8, Figure 9 and Figure 12).

10. The OC-actuator must always be integrated in the safety circuit, see Figure 8 and Figure 9.

11. The eSGC-actuator must be connected to an electromechanical braking element following the idle current principle.

12. The inspection controls signals must be connected following Figure 8.

13. The braking element connect to the eSGC actuator may be:
   a) an electronic triggered safety gear,
   b) a conventional safety gear triggered by a conventional speed governor, which in turn is triggered via the remote triggering of the LIMAX33 CP-00
   c) another braking element the safety gear or the machine brake (e.g. a rope gripper)

The braking element following a.) can always be chosen, no matter if safety function “over speed final tripping” UCM, pre-triggered stopping system or working platform should be fulfilled by the eSGC-actuator.

The braking element following b.) can be chosen, no matter if safety functions “UCM”, “pre-triggered stopping system” or “working platform” should be fulfilled by the eSGC-actuator. Overspeed (final tripping) following EN81-20 §5.6.2.2.1.a.) is normally fulfilled by the conventional speed governor in this case.

The braking element following c.) can only be used for the safety function “UCM”. The safety functions “working platform” or “pre-triggered stopping system” can only be fulfilled by a brake acting on the rails (due to EN81-20).

14. The earthling lug on the LIMAX33 CP-00 must be connected to protection earth.

15. The braking element following c.) can be chosen, no matter if safety function “over speed final tripping” UCM, pre-triggered stopping system or working platform should be fulfilled by the eSGC-actuator.

16. The safety functions over speed final tripping, pre-triggered stopping system and ETSL must fulfill SIL 3 and therefore the PFHD of the whole functional chain must be smaller than 100 FIT. Concerning the PFHD capability of the LIMAX33 CP-00 (☞ 16.1).

17. The braking element connect to the eSGC actuator may be:
   a) an electronic triggered safety gear,
   b) a conventional safety gear triggered by a conventional speed governor, which in turn is triggered via the remote triggering of the LIMAX33 CP-00
   c) another braking element the safety gear or the machine brake (e.g. a rope gripper)

The braking element following a.) can always be chosen, no matter if safety function “over speed final tripping” UCM, pre-triggered stopping system or working platform should be fulfilled via the eSGC-actuator.

The braking element following b.) can be chosen, no matter if safety functions “UCM”, “pre-triggered stopping system” or “working platform” should be fulfilled via the eSGC-actuator. Overspeed (final tripping) following EN81-20 §5.6.2.2.1.a.) is normally fulfilled by the conventional speed governor in this case.

The braking element following c.) can only be used for the safety function “UCM”. The safety functions “working platform” or “pre-triggered stopping system” can only be fulfilled by a brake acting on the rails (due to EN81-20).

18. The CAN bus is not intended to be used for safety relevant purposes.

19. After commission, the floor table must be checked before the lift is allowed to be released for public use.

20. A power cycle or a reset must be d to the LIMAX33 CP-00 at least once per year.

21. The braking element connect to the eSGC actuator may be:
   a) an electronic triggered safety gear,
   b) a conventional safety gear triggered by a conventional speed governor, which in turn is triggered via the remote triggering of the LIMAX33 CP-00
   c) another braking element the safety gear or the machine brake (e.g. a rope gripper)

The braking element following a.) can always be chosen, no matter if safety function “over speed final tripping” UCM, pre-triggered stopping system or working platform should be fulfilled by the eSGC-actuator.

The braking element following b.) can be chosen, no matter if safety functions “UCM”, “pre-triggered stopping system” or “working platform” should be fulfilled by the eSGC-actuator. Overspeed (final tripping) following EN81-20 §5.6.2.2.1.a.) is normally fulfilled by the conventional speed governor in this case.

The braking element following c.) can only be used for the safety function “UCM”. The safety functions “working platform” or “pre-triggered stopping system” can only be fulfilled by a brake acting on the rails (due to EN81-20).

22. It must be ensured that the eSGC-braking element trips (goes to safe state) if the voltage on its trip coil amounts to 2 V or below.

23. The braking element connect to the eSGC actuator must fulfill the following conditions (refer also to Figure 5), Remark: if resistance or inductivity of the wire from eSGC-connector to the trip coil have a relevant magnitude, this must also be taken into account
   a) L < 1.5H
   b) Current consumption < 1A => R > 24Ohm @24V (the eSGC – actuator is secured inside the CP with a 1A self-resetting polyfuse)
   c) L/R > 1ms (recommended); for L/R << 1ms there is a danger that the braking element would fall during the test of the eSGC-actuator, refer also to chapter ☞ 12.5.
   d) L/R < 10 ms (recommended). The L/R influences – beside the mechanical construction – the time for the braking element to fall. A big L/R causes a slower falling of the current through the coil after the voltage has been switched off. The current again influences the holding force of the coil, refer also to topic ☞ 21.
24. SG_pow – SG_GND connection must be supplied with a 24V SELV/PELV power supply. It must be guaranteed that 30 V cannot be exceeded.

25. UCM is only supervised by the LIMAX33 CP-00, if the door circuit(s) is/are bridged by SR1 and/or SR2.
### 9 Type Designation

#### Designation 1 (example): LIMAX3CP - 00 - 030 - 1000 - COOTG - 0

<table>
<thead>
<tr>
<th>Series / Type:</th>
<th>LIMAX3CP = LIMAX33 CP (2-channel safety system)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version:</td>
<td>00 = Standard version, 01 = 1. special version etc.</td>
</tr>
<tr>
<td>Signal Cable Length:</td>
<td>030 = 3.0 m (Standard), 050 = 5.0 m</td>
</tr>
<tr>
<td>Resolution:</td>
<td>1000 = 1000 µm = 1.00 mm at delivery state*</td>
</tr>
<tr>
<td></td>
<td>* Freely configurable according to CiA 406</td>
</tr>
<tr>
<td>Interface:</td>
<td>COX = CANopen [special protocol separately defined by version number]</td>
</tr>
<tr>
<td></td>
<td>COOTG = CANopen [Encoder Profil DS406]</td>
</tr>
<tr>
<td></td>
<td>CO1TG = CANopen [Elevator Profil DS417 on request]</td>
</tr>
<tr>
<td>Floor Sensors:</td>
<td>0 = no floor sensor, 1 = 1 floor sensor, 2 = 2 floor sensors</td>
</tr>
<tr>
<td>CAN Bitrate:</td>
<td>125k = 125 kbps, 250k = 250 kbps, 500k = 500 kbps</td>
</tr>
<tr>
<td>eSGC - actuator:</td>
<td>0 = without eSGC, 1 = with eSGC</td>
</tr>
<tr>
<td>SR - relay pairs:</td>
<td>0 = no SR - relay pair, 1 = 1 SR - relay pair, 2 = 2 SR - relay pairs</td>
</tr>
</tbody>
</table>

#### Designation 2 (example): P-0001 / 250k / 0 / 1

<table>
<thead>
<tr>
<th>Designation 2 (example):</th>
<th>P-0001 / 250k / 0 / 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-XXXX = Parameter set (will be defined by the customer)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**
- The CAN interface is with 120Ω terminated (T) and galvanically isolated (G)

#### Additional information about the parameter set (Designation 2):

The parameter set is used to designate devices that are preconfigured at the ELGO Batscale on special customer request or 14.1.1.3. For the standard devices (delivered with an "empty" configuration which is configured by the customer) the parameter set is P-0000.

**NOTE:**
- When ordering, please use the here described ordering code (Type Designation).
- Options that are not required are filled in with "-".
10 Installation and First Start-Up

**CAUTION**
Please read this safety manual carefully before using the device! Strictly observe the Installation instructions! In case of damage caused by failure to observe this safety manual, the warranty expires.

ELGO is not liable for any secondary damage and for damage to persons, property or assets.

The operator is obliged to take appropriate safety measures. The first start-up may only be performed by staff that has been trained and authorized by the operator.

10.1 Operating Area

**WARNING!**
Do not use the device in explosive or corrosive environments!
The device must not be installed close to sources of strong inductive or capacitive interference or strong electrostatic fields!

**CAUTION!**
The electrical connections must be made by suitably qualified personnel in accordance with local regulations. Wiring works may only be performed in the de-energized state!

Thin cable strands have to be equipped with end sleeves!

Before switching on the device, connections and plug connectors have to be checked!

The device must be mounted in a way that it is protected against harmful environmental influences such as splashing water, solvents, vibration, shock and severe pollution and the operating temperature must not be exceeded.
10.2 Check of Safety Relevant Configuration

Before installing the LIMAX33 CP-00, the technician must ensure that the safety-relevant configuration specified on the info sheet belonging to the LIMAX33 CP-00 complies with the relevant lift conditions. If this is not the case, the LIMAX33 CP-00 must not be used for this lift. Instead, a LIMAX33 CP-00 with suitable configuration must be acquired, or an empty LIMAX33 CP-00 must be programmed with suitable configuration.

10.3 Mechanical Installation

PLEASE NOTE:
There is a separate mounting instruction for the installation of the magnetic tape and the LIMAX33 CP-00 which has to be observed (LIMAX33CP-00-MI).

The cables for the supply, inputs/outputs (PIO cable) as well as for the safety circuit and the actuators (SCA cable) must be laid with mechanical protection.

10.4 Electrical Installation

10.4.1 Basic Design

The complete system LIMAX33 CP-00 consists of:

- the LIMAX33 CP-00 sensor head
  (measuring system electronic, logic and safety relevant and not safety relevant interfaces)
- the magnetic tape AB20-80-10-1-R-D-15-BK80
- the mounting kit for the magnetic tape
- and the tape presence detector

The figure on the next page shows the top side and bottom side view of the LIMAX33 CP-00. There are two versions of LIMAX33 CP-00: One version with eSGC (refer to Figure 6) and one without eSGC. On the version without eSGC, the M12 connector is not fitted and the assignment of the LEDs is different.

“eSGC” is an abbreviation for “electronic Safety Gear Contact”. This actuator-contact is implemented by solid state switches (therefore “electronic”). The eSGC actuator (also referred as “SGC” in this manual) is intended to act an accordingly suitable safety gear, a blocking device of a speed governor or another braking element – except the brake handled via safety circuit – e.g. a rope gripper. The braking element for eSGC is electrically connected to the LIMAX33 CP-00 via a connector on the top side.

If an eSGC actuator is needed according to the safety functions, the system should fulfill (14.1.4), the version with eSGC must be used. If no eSGC actuator is needed according to the safety functions, the system should fulfill, it is arbitrary if a system with eSGC (eSGC actuator disabled in this case) or a system without eSGC is used.

Other actuator contacts are: OC, SR1 and SR2. They are implemented as dry contacts between each two wire ends of the SCA-cable (see below). They are intended to be wired in the safety circuit (10.4.3).
Figure 6: View on the top- and bottom-side of LIMAX33 CP-00 with eSGC

Remark: The top side view of the version without eSGC is slightly deviant: The eSGC-connector is not fitted and the LED assignment differs depending on the order.

Figure 7: Pin assignment eSGC connector (mechanical data according to IEC 61076-2-101)
NOTE!
Before the electrical installation can begin, the complete elevator unit has to be de-energized. The upper part of Figure 6 shows a view on the LIMAX33 CP-00 housing (including the definition of the cable assignment, connectors and earthing lug to the designations used in the following tables).

### Table 1: Connections PIO and SCA-Cable

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Function</th>
<th>Wire colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>0 V / GND</td>
<td>white</td>
</tr>
<tr>
<td>24V</td>
<td>+24 VDC</td>
<td>brown</td>
</tr>
<tr>
<td>CAN-H</td>
<td>CAN-HIGH</td>
<td>yellow</td>
</tr>
<tr>
<td>CAN-L</td>
<td>CAN-LOW</td>
<td>green</td>
</tr>
<tr>
<td>SHLD</td>
<td>shield</td>
<td>blank</td>
</tr>
<tr>
<td>CAN-G</td>
<td>CAN-GND</td>
<td>black</td>
</tr>
<tr>
<td>BAT_IN−</td>
<td>Battery supply −</td>
<td>blue</td>
</tr>
<tr>
<td>BAT_IN+</td>
<td>Battery supply +</td>
<td>red</td>
</tr>
<tr>
<td>DZO</td>
<td>Door zone output</td>
<td>pink</td>
</tr>
<tr>
<td>EN81-21</td>
<td>EN81-21-state</td>
<td>white/green</td>
</tr>
<tr>
<td>UP</td>
<td>Inspection direction “UP”</td>
<td>red/blue</td>
</tr>
<tr>
<td>DOWN</td>
<td>Inspection direction “DOWN”</td>
<td>grey/pink</td>
</tr>
<tr>
<td>RESET</td>
<td>RESET input</td>
<td>yellow/brown</td>
</tr>
<tr>
<td>WKP</td>
<td>Working Platform state</td>
<td>brown/green</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Function</th>
<th>Wire colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC-1</td>
<td>OC IN</td>
<td>white</td>
</tr>
<tr>
<td>OC-O</td>
<td>OC OUT</td>
<td>brown</td>
</tr>
<tr>
<td>SR1-1</td>
<td>SR1 IN</td>
<td>blue</td>
</tr>
<tr>
<td>SR1-O</td>
<td>SR1 OUT</td>
<td>red</td>
</tr>
<tr>
<td>SR2-1</td>
<td>SR2 IN</td>
<td>pink</td>
</tr>
<tr>
<td>SR2-O</td>
<td>SR2 OUT</td>
<td>grey</td>
</tr>
</tbody>
</table>

**Remark:** The PIO and SCA cable of the LIMAX33 CP-00 have open wire ends by default, so the function is defined by the wire color. Later LIMAX33 CP-00 cable ends may be equipped with plugs due to customer order. In this case this manual will be extended or a separate document will exist which defines the pin-assignment of the plugs.

### Table 2: eSGC-Connector (only for versions with eSGC)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Function</th>
<th>M12 Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>n. c.</td>
<td>not connected</td>
<td>1</td>
</tr>
<tr>
<td>SG_GND</td>
<td>Ground (reference potential) for External power supply for trip coil of eSGC-braking-element; to be connected to GND of external power supply as well as to the other side of the trip coil.</td>
<td>2</td>
</tr>
<tr>
<td>SG_OUT</td>
<td>Switched SG POW; will be switched on if lift movement can be released concerning to eSGC-actuator, switched off if safe state must be established. To be connected to one side of the trip coil of eSGC-braking-element.</td>
<td>3</td>
</tr>
<tr>
<td>SG_pow</td>
<td>To be connected to external power supply for trip coil of eSGC-braking-element; 24 V recommended; SELV/PELV supply required; 30 V must not be exceeded.</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 3: Floor Sensor plugs

<table>
<thead>
<tr>
<th>Number of Floor Sensors</th>
<th>Type of electrical Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No floor Sensor</td>
<td>No installation necessary</td>
</tr>
<tr>
<td>(max.) 2 floor Sensors</td>
<td>In case of LIMAX33 CP-00 with (optional) two floor sensors, there are circular connectors on the bottom side. Each of them is closed with a protective cap. The cap must only be removed immediately before the floor sensor is plugged. The person removing the cap and plugging the floor sensor must be grounded.</td>
</tr>
</tbody>
</table>

**Remark:** In case floor sensors are used, each floor level must be marked with a floor magnet.

Concerning mechanical installation of floor sensor(s) and magnets refer to the manual of the floor sensors.

Table 4: Earthing lug

The earthing lug on the LIMAX33 CP-00 must be connected to protection earth

### 10.4.2 Protection against Electrical Shock

For protection against electrical shock by direct contact, the housing of the LIMAX33 CP-00 has a protection class of IP54.

For protection against electrical shock by indirect contact, the housings of the LIMAX33 CP-00 are equipped with an earthing lug. This needs to be connected to the protection earth (refer to section 10.4.14).
10.4.3 Overview of the Integration in the Lift Installation

Figure 8 and Figure 9 on the next pages show the circuit diagrams to connect the single wires of the PIO and SCA cable due to their functions to the elevator system.

Figure 8: Installation circuit diagram of LIMAX33 CP-00 (maximum configuration)
Figure 9: Installation circuit diagram of LIMAX33 CP-00 (minimum configuration)

*) Only symbolic; actually the actuator consists of 2 relays
10.4.4 Integration of the bridgeable contact (OC)

The integration is placed in a way that assures that OC can be bridged by the recall panel (refer to Figure 8 and Figure 9).

10.4.5 Integration of the SR

In case of two SR’s, SR1 and SR2 should be connected following Figure 8.

In case of one SR, the SR1 should be wired due to Figure 10 (see below) if there is only one door side in the shaft (only front) and due to Figure 11 (see below) if there are front and rear doors.

Figure 10: One SR and one door side

Figure 11: One SR and two door sides
10.4.6 Integration of the Magnetic Tape Presence Detector

The magnetic tape presence detector is a contact which must open the safety circuit if the magnetic tape is not in the correct position. The contact has to be placed in non-bridgeable position within the safety circuit.

It is not allowed to place the presence detector in a spot where it can be bridged by the recall panel. Furthermore, it is not allowed to place it within the door circuit, since this circuit can be bridged by the door bridging functionality of SR-contacts.

10.4.7 Connection of the Power Supply and Emergency Power Supply

The 24 V supply for LIMAX33 CP-00 is powered by an external power supply.
A missing 24 V supply causes an opening of all actuators.

The 12 V emergency power supply should be switched to the BAT−/BAT+ inputs. LIMAX33 CP-00 will open all actuators if supplied with 12 V. LIMAX33 CP-00 can only serve position information if it is supplied with 12 V.

10.4.8 Connection of the eSGC

Alternatively, eSGC may be connected to the remote tripping coil of the speed governor (see Figure 12 below).

Figure 12: eSGC actuator connected to a blocking device on the speed governor (remote tripping)

The electromechanically tripped braking element (electronic safety gear or blocking device - remote tripping - on the speed governor) must be built in such a way, that the mechanical part is in the safe state if the electrical supply is disconnected.

In order to comply with the relevant standards, the entire electromechanical / mechanical functional chain connected to the eSGC actuator must be certified.
Attention: this is often not the case for the remote tripping device of the speed governor.

10.4.9 Connection of the Signals from Inspection Control

The 24 V level (circuit for information purpose) of the inspection control has to be connected to the LIMAX33 CP-00 as described in Figure 8.
The connection of the inspection control to the safety circuit remains unchanged. The 24 V level must be galvanically isolated from adjacent electric circuits, especially from the safety circuit.

### 10.4.10 Connection of the EN81-21-Input

The “EN81-21-input” must be connected to the “EN81-21-signal”. In normal lift operation this signal should be HIGH (24 V). This signal must be LOW (resp. open input) if a door giving access to the car roof or the shaft pit is opened by a key.

After this signal became LOW, it is only allowed to become HIGH level if EN81-21 §5.5.3.2.1 a.) – d.) are fulfilled. This demand must be fulfilled externally (not in scope of LIMAX33 CP-00).

### 10.4.11 Connection of the „Working Platform” Input

The Working Platform input must be connected by an external switch that is wired to 24 V on the other side. During normal lift operation this switch is closed (24 V on the input). A soon the user opens this switch, the LIMAX33 CP-00 opens all actuators and therefore each lift movement is prevented.

### 10.4.12 Connection of the „Reset“-Input

The “Reset”-Input may be connected by an external push-button, wired to 24 V on the other side (if the user may perform a system-reset by operating the push button).

**REMARK:**
A System Reset can also be done by CANopen; therefore connecting of the RESET-Input is optionally.

Over CANopen it is also possible to make a fault reset (safety functions only) instead of a complete system reset. The fault reset doesn’t restart the system. So, actuators which are closed, stay closed.

### 10.4.13 Connection of the CAN Bus

The LIMAX33 CP-00 CAN bus connections CAN HIGH and CAN LOW must be connected to the CAN bus of the control unit.

The shield for the CAN bus is connected on the device side via the housing to protection earth (see also section 10.4.14). If it can be ensured that there is a protection earth on the control side, in which no potential differences can occur to the contact point of the device-side protection earth, and thus no ground loops are formed, the shield must also be connected to the protection earth on the control side. This is an ideal solution for optimal interference suppression.

If the ground loops cannot be excluded with certainty, the shield must not be connected on the control side in order to avoid EMC-induced faults of the operation.

### 10.4.14 Earthing Connector

The LIMAX33 CP-00 housing is equipped with an earthing lug. This needs to be connected via a suitable earth cable with protection earth. The earth cable should be equipped with a suitable flat plug for connection to the earthing lug.

Ideally a cable with a recommended cross-section of 4 mm² is used. This is not included in the scope of delivery but can be ordered as an accessory.

To connect the earth cable to the earthing lug, the cable is provided on one side with a flat plug sleeve and on the other side with a ring cable lug for placing on the protection earth.
<table>
<thead>
<tr>
<th>NOTE!</th>
</tr>
</thead>
<tbody>
<tr>
<td>For protection against electrical shock, a cable with 0.75 mm² would be sufficient, but to optimize the immunity to interference, 4 mm² is recommended.</td>
</tr>
</tbody>
</table>
# 11 Operation modes and Commissioning

## 11.1 Operation Modes

The following operation modes are available:

- Pre-commissioning mode
- Teach mode
- Normal mode
- Test mode
- Settings mode

Teach mode and test mode provide additional sub-modes.

The figure on next page shows an overview of the operation modes and the transitions between them.
**Operation modes and Commissioning**

**Figure 13: Operation modes overview**

**NORMAL**
- Submodes:
  - MANUAL (default)
  - AUTO

**PRE-COMMISSIONING**
- Submodes:
  - IDLE (default)
  - ETSL UP
  - ETSL DOWN
  - TRIP

**TEST**
- Submodes:
  - IDLE (default)
  - ETSL UP
  - ETSL DOWN
  - TRIP
  - PRE TRIG

**SYSTEM ERROR**
- "diagnosis floor table"

**SETTINGS**
- Limit switch reference position learned
- At least one limit switch refer. dependent safety function enabled
- Valid floor table
- Door bridging/UCM Enabled
- Cond. "gotoNormal" fulfilled
- Cond. "startUpPreComm" fulfilled
- Cond. "startUpTeach" fulfilled
- Cond. "startUpNormal" fulfilled

<table>
<thead>
<tr>
<th>Situation</th>
<th>0</th>
<th>X</th>
<th>0</th>
<th>X</th>
<th>0</th>
<th>X</th>
<th>0</th>
<th>X</th>
<th>0</th>
<th>X</th>
<th>0</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit switch reference position learned</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>At least one limit switch refer. dependent safety function enabled</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Valid floor table</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Door bridging/UCM Enabled</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cond. &quot;gotoNormal&quot; fulfilled</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cond. &quot;startUpPreComm&quot; fulfilled</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cond. &quot;startUpTeach&quot; fulfilled</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cond. &quot;startUpNormal&quot; fulfilled</td>
<td>X</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

1) These situations cannot appear in teach mode; because of the configuration either learning of floor table or learning of reference position or even transition to teach mode would be refused.

2) These situations cannot appear at start up; same situations and same cause like footnote 1) above; only difference: situation that neither "limit switch dependent" nor "door dependent" safety functions are enabled can appear at power up => system will start directly in normal mode in this case.

**Power on or reset**
- "startUpTeach" in condition table fulfilled
- "startUpNormal" in condition table fulfilled
- "startUpPreComm" in condition table fulfilled

**Blue transitions are made with CANopen Lift State commands**

- **X** = limit switch references and floor table will be deleted
In Teach mode shaft information can be learned. There are two types of shaft information:

1. The floor table (total number of floors, positions of the single floors and possibly side of the floors)
2. The (limit switch) reference positions refer to \( \text{\textsection} \) 11.2.2

It depends on the enabled safety functions/features whether only the floor table, only the reference positions or both of them or none of them are needed, refer to section \( \text{\textsection} \) 14.1.3.

After start up (no matter if caused by power up or RESET) the LIMAX33 CP-00 goes into

- Normal mode, if all needed shaft information is available at start up
- Teach mode, if floor table as well as reference positions are needed, but only reference positions and no floor table are available.
- Pre-commissioning mode in all other cases

In case diagnostics of the floor table detected a corrupted floor table (CRC-check or comparison between the channels failed) the LIMAX33 CP-00 goes to pre-commissioning mode.

The transitions between the modes can be demanded by CANopen communication.

### 11.1.1 Pre-commissioning

After a correct physical installation of LIMAX33 CP-00, the device starts into pre-commissioning mode. Since there is no valid floor table stored, not all safety functions are active. The safety actuators (relays concerning OC, SR1 and SR2; solid state switches concerning SGC) have the following state:

<table>
<thead>
<tr>
<th>Safety output</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC</td>
<td>Open if a (pre-tripping-) overspeed-function trips*) or in EN81-21 state (provided inspection functions are not disabled). Otherwise closed</td>
</tr>
<tr>
<td>SR1</td>
<td>Always open</td>
</tr>
<tr>
<td>SR2</td>
<td>Always open</td>
</tr>
<tr>
<td>eSGC</td>
<td>Open if a (final-tripping-) overspeed-function trips*) or in EN81-21 state (provided inspection functions resp. pre-triggered stopping system are/is not disabled). Otherwise the (solid state-) contact is closed</td>
</tr>
</tbody>
</table>

*) provided these safety functions are not disabled \( \text{\textsection} \) 14.1.3

Pre-commissioning mode can be left by transition to teach mode \( \text{\textsection} \) 11.1.2.2.

---

1 If neither floor table nor reference positions are available, but also not needed the device starts also up in normal mode.
11.1.2 Teach Mode

11.1.2.1 General

In order to reach the normal mode (for normal lift operation), it is necessary to teach a valid floor table and/or reference positions using a commissioning process. This can only be done in teach mode.

There are two kinds of teach procedures: manually and automatically. Therefore, the teach mode provides two sub-modes:

- teach sub-mode manual, refer to \( \Rightarrow 11.1.2.2 \)
- and teach sub-mode auto, refer to \( \Rightarrow 11.1.2.3 \)

Concerning the safety output states both modes behave in the same way.

Reference positions can always be learned in teach mode regardless of the sub-mode.

If reference positions are needed but not available, the behavior of the safety outputs is the same as in pre-commissioning mode \( \Rightarrow 11.1.1 \).

If reference positions are available, the behavior of the safety outputs will have the following states:

Table 6: Safety output states in teach mode or teach auto mode when reference positions are available

<table>
<thead>
<tr>
<th>Safety output</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC</td>
<td>Open if a (pre-tripping-) overspeed-function trips* or in EN81-21 state outside of the range between the (direction dependent) inspection limit switches (provided inspection functions are not disabled). Otherwise closed.</td>
</tr>
<tr>
<td>SR1</td>
<td>Always open</td>
</tr>
<tr>
<td>SR2</td>
<td>Always open</td>
</tr>
<tr>
<td>eSGC</td>
<td>If a (final-tripping-) overspeed-function trips* or pre-triggered stopping system trips* or safety function “working platform” trips *, the (solid state-) contact is open. Otherwise closed.</td>
</tr>
</tbody>
</table>

*) provided these safety functions are not disabled \( \Rightarrow 14.1.3 \)

Teach mode (regardless of the sub-mode) can be left to normal mode by CANopen command, refer also to CANopen specifications.

If the teach process was not successful (e.g. because no floor or only one floor has been learned, or because floor positions are not in an increasing row according to their numbering), LIMAX33 CP-00 will refuse a demand to enter normal mode and will stay in teach mode. If the teach process was successful LIMAX33 CP-00 will accept the demand to enter normal mode and the floor table will be stored in a non-volatile way. Afterwards the mode changes to “normal”.

Teach mode (regardless of the sub-mode) can also be left to pre-commissioned mode by another CANopen command, refer also to CANopen specifications. In this case an existing floor table will be erased. Reference positions which may be available in teach mode, are also erased in this case.

If a power cycle occurs during teach mode or if a RESET command by CANopen was given all floors positions learned up to that moment will get lost.

In opposite to this, reference positions will be kept at power cycle or a RESET - provided both of them are available (they are stored in a non-volatile way as soon as both reference positions have been learned).

LIMAX33 CP-00 will restart in pre-commissioning mode after power cycle happened in teach mode when no – or only one reference position has been learned. If both reference position have been learned in teach mode, a power cycle in teach mode will cause immediate re-entering of teach mode or direct entering of normal mode if no floor table is needed due to the configured safety function.
Remarks:

1. If neither floor table nor reference positions are needed in order to fulfil the respective enabled subset of safety functions the LIMAX33 CP-00 will start directly in normal mode even after first installation. A demand to enter the teach mode will be refused.

2. If either floor table or reference positions are not needed in order to fulfil the respective enabled subset of safety functions (refer also to \( \triangleq 0 \)) the LIMAX33 CP-00 will refuse a demand to learn the each not needed information. For example, if “door safety functions” are disabled, LIMAX33 CP-00 will refuse to learn floor positions in teach mode. If inspection functions, ETSL and final limit switches are disabled, LIMAX33 CP-00 will refuse to learn reference positions in teach mode.

11.1.2.2 Entering Teach Mode, Sub-Mode “Manual”

- When LIMAX33 CP-00 is in pre-commissioned or in normal mode, the teach mode can be entered by the corresponding CANopen command.
- When teach mode is entered from pre-commissioned mode, no floor table is available after entering.
- When teach mode is entered from normal mode a valid floor table is already available after entering (floor table from normal mode will not be erased but kept).
- Teach mode is entered immediately after power up resp. system reset only if reference positions are already available but no floor table.
- Immediately after entering teach mode, the sub-mode is “manual”.
- In Sub-mode “manual” floors can be learned by a CANopen command \( \triangleq 11.2.3 \). Refer also to CANopen specifications.

11.1.2.3 Teach Mode, Sub-Mode “Auto”

- In teach mode, sub-mode auto, the floor table can be learned by using the floor sensor(s) \( \triangleq 11.3.2 \).
- Sub-mode auto can only be entered from teach mode (default: sub-mode manual) by demanding the sub mode change via CANopen-command. Refer also to CANopen specifications.

11.1.3 Normal Mode

After successful commissioning the LIMAX33 CP-00 is in normal mode:

- The lift is used in normal operations.
- The LIMAX33 CP-00 fulfils the specified safety functions \( \triangleq 13.2 \).

11.1.4 Settings Mode

Settings mode can only be entered from normal mode. This is done by the corresponding CANopen command. Refer also to CANopen specifications.

- In settings mode adjustments of floor positions by CANopen can be done \( \triangleq 11.6.1 \) and the parameters which are settable by CANopen, can be changed \( \triangleq 14.2 \).
- Settings mode can only be left with transition to normal mode. This is done by the corresponding CANopen command.
- Refer also to CANopen specifications.
11.1.5 Test Mode

Test mode can only be entered from normal mode. This is done by the corresponding CANopen command. The test mode provides the following sub modes:

- Idle
- Trip
- ETSL-UP
- ETSL-DOWN
- Pre-trig

Immediately after entering test mode the sub mode “idle” is activated. In sub mode idle, the behavior of the safety functions is the same like in normal mode. Concerning the other sub-modes, the behavior of each one safety function is changed for test purposes. For details refer to the next sub-chapters. Each of these sub modes can be entered by the CANopen demand to change to the corresponding sub-mode, provided the device is still in test mode.

Test mode can only be left with transition to normal mode. This is done by the corresponding CANopen command. This can be also done by a system RESET or power cycle.

11.1.5.1 Test Mode, Sub-Mode “Trip”

Sub mode trip can be entered by CANopen command to change the sub-mode to “trip”.

In sub-mode “trip” the final tripping speed for the safety function “Overspeed final tripping” is set to a reduced value. This value must be smaller than the normal final tripping speed. The value for the test final tripping speed is same as the rated speed by default. This value can be changed via CANopen in normal mode (before sub-mode “trip” is entered).

If the test final tripping speed has been set to a value bigger than the normal final tripping speed, the CANopen demand to enter sub-mode “trip” will be refused.

If the test final tripping speed is set to a value smaller than the normal final tripping speed, the CANopen demand to enter the sub-mode “trip” will be successful. In sub-mode “trip” the safety function overspeed final tripping already trips at this reduced test final tripping speed.

OC will open latest at the same speed than eSGC in sub-mode “trip”.

So, if test final tripping speed is below the normal pre-tripping speed, OC will open at the same speed as eSGC during the test.

If the value of test final tripping speed is between the normal pre-tripping speed and the normal final tripping speed, the opening of OC will take place at the normal pre-tripping speed.

The whole other functionality is identical to normal mode.

If test mode sub mode trip is entered, normally a test of over- speed final tripping will be performed. A lift travel e.g. with rated speed will be initiated and over- speed final tripping will trip due to the reduced tripping speed. After tripping of over-speed final tripping a RESET is necessary. After RESET the safety function will be reset and LIMAX33 CP-00 will restart in normal mode.

But this test-mode, sub-mode trip, can also be left explicitly transition to normal mode, initiated by CANopen command.
11.1.5.2 Test mode, sub-mode ETSL-UP

Test mode, sub-mode ETSL-UP can be entered by CANopen command to change the sub-mode to “ETSL-UP”. This can be only done if the device is in test mode.

The behavior of safety function deceleration control (ETSL) is different in this sub-mode:
- When moving up, distance “s” in the ETSL-formula is not calculated as the distance of the actual position to the position of the upper reference position minus upper ETSL-offset, but as the distance of the actual position to the “middle of the shaft”. For details see 13.2.3.
- The behavior of all other safety functions, including the behavior of ETSL when moving down, is identical to normal mode.
- The CANopen command to change the sub-mode to ETSL-UP (while the device is in test mode) is only accepted if the actual position is below the “middle of the shaft”.

Concerning calculation of position of “middle of the shaft” refer to Table 14.

11.1.5.3 Test mode, sub-mode ETSL-DOWN

Test mode, sub-mode ETSL-DOWN can be entered by CANopen command to change the sub-mode to “ETSL-DOWN”. This can only be done if the device is in test mode.

The behavior of safety function deceleration control (ETSL) is different in this sub-mode:
- When moving down, distance “s” in the ETSL-formula is not calculated as the distance of the actual position to the position of the lower reference position plus lower ETSL-offset, but as the distance of the actual position to the “middle of the shaft”. For details see 13.2.3.
- The behavior of all other safety functions, including the behavior of ETSL when moving up, is identical to normal mode.
- The CANopen command to change the sub-mode to ETSL-DOWN (while the device is in test mode) is only accepted if the actual position is above the “middle of the shaft”.

Concerning calculation of position of “middle of the shaft” refer to Table 14.

11.1.5.4 Test Mode, Sub Mode “Pre-Trig”

Sub mode “pre-trig” can be entered by CANopen command to change the sub-mode to “pre-trig”. This can only be done, if the device is already the test mode. The behavior of safety function pre-triggered stopping system is different in this mode:
- In normal mode the pre-triggered stopping system trips in case of EN81-21-state (13.2.6.1) and if the actual position is higher than the upper resp. lower than the lower stopping limit.
- In sub-mode pre-trig, the safety function trips if the actual position is higher than the upper resp. lower than the lower stopping limit – no matter if there is EN81-21-state or not.

But the behavior of the inspection limit switches depends on the EN81-21-state also in sub-mode pre-trig, (same behavior like in normal mode). So, if there is sub-mode pre-trig and no EN81-21-state, the pre-triggered stopping system is active, but the inspection limit switches are not active. That means, in this situation the pre-triggered stopping system can be tested:
1. It is possible to send the lift towards the shaft end from outside of the lift with activated the pre-triggered stopping system
2. When approaching the shaft ends, no inspection limit switches stop the car

When approaching the shaft ends, pre-triggered stopping system will trip, because the inspection limit switches will not prevent tripping of pre-triggered stopping system.

After tripping of pre-triggered stopping system, a RESET is necessary. After RESET the safety function will be reset and LIMAX33 CP-00 will restart in normal mode.

But this mode can also be left explicitly by the transition to normal mode, initiated by CANopen command.
11.2 Manual Learning of the Floor Table

**NOTE!**
This chapter gives a summary about the procedure when learning the floor table manually.

The following figure shows an overview of the flow of events in teach mode, sub mode manual. Details are described in the following subchapters.

![Flow of events in teach mode](image)

Figure 14: Flow of events in teach mode

*) refer to chapter „Operation Modes“
The order of learning is absolutely arbitrary - not only concerning the single floors, but also the order of learning of the reference positions and the floors. So, it is possible to save time by optimizing the order of events:

- first one reference positions is learned,
- after this one floor after the other on the way to the other side of the shaft is learned
- and then the other reference position is learned, the time for one travel through the whole shaft can be saved (flow of events similar to Figure 17).

### 11.2.1 Activation of Teach Mode, Sub Mode „Manual“

On delivery, there is no shaft information in the LIMAX33 CP-00 (neither a floor table nor reference positions) this is the pre-commissioning mode. LIMAX33 CP-00 must learn the floor table and/or the reference positions. In order to do this, the technician requests transition into teach mode via CANopen-command:

→ LIMAX33 CP-00 will transit to teach mode, the sub-mode will be “Manual” (default)

If the floor table of LIMAX33 CP-00 is not empty (normal mode) and the floor table should be corrected or extended for some reason (e.g. add, delete or shift the position of a floor), the technician carries out the transition into teach mode in an identical manner as from the pre-commissioning mode (described above). The existing floor table and the reference positions will be kept at the transition into teach mode.

In teach mode, there is an acoustic signaling by buzzer: there is a short acoustic signal every 2 second.

### 11.2.2 Learning of the (Limit Switch) References

(Limit switch) reference positions are used as references for calculation of the final- and inspection-limit-switch positions, the pre-triggered-stopping system limits and the distance to the assumptive buffer for ETSL-calculation, refer also to § 13.2.8.

The technician moves the car to the lowest possible position (normally this is the position where the car is on the buffer). He sends to the control that the current position has to be learned as the lower (limit switch-) reference position. For this purpose, the cabin must be in stand still. The control passes on this signal via CANopen to LIMAX33 CP-00

The technician moves the car to the highest possible position (normally this is the position where the counter-weight is on the buffer). He sends to the control that the current position has to be learned as the upper limit switch reference position. The control passes on this signal via CANopen to the LIMAX33 CP-00. For this purpose, the cabin must be in stand still.

If the technician tries to learn an upper reference on a position below the lower reference, this command will be refused. The same applies if he tries to learn a lower reference on a position higher than the upper reference.

If the technician gives a CANopen-command to learn an upper reference while an upper reference position is already available, the old upper reference will be overwritten. The same applies for the lower reference position.

Reference positions will be erased when teach mode is left to pre-commissioning mode, but they will be kept if teach mode is left to normal mode.

Reference positions will also be kept on power cycle starting from teach mode.

---

| 🔄 NOTE! | The lower reference can be learned before the upper reference or vice versa. It is also possible to learn one reference first, then learn the floor table and at last learn the 2nd reference. |
| 🔄 NOTE! | If a power cycle happens starting from teach mode and both reference positions have been learned, LIMAX33 CP-00 will restart in teach mode for the case that LIMAX33 CP-00 needs also a floor table, reference positions will be available, but floor positions may be learned up to that moment will be lost. The teach process can be directly continued with learning of the floor table. |
NOTE!
If a power cycle happens starting from teach mode and both reference positions have been learned, LIMAX33 CP-00 will restart in normal mode for the case that LIMAX33 CP-00 does not need a floor table, reference positions will be available. Learning process is finished.

11.2.3 Learning the Floor Table

After learning the reference positions, an inspection trip between the inspection limit switches is possible. In this phase, the technician can teach the lift control by performing an inspection trip.

After any necessary works to teach the lift control is finished, the elevator is set to normal (the LIMAX33 CP-00 remains in teach mode).

The elevator can now be moved by car call. The speed is limited to pre-tripping speed teach \( \mathcal{V} \) 14.1.

WARNING!
The technician must not be on the cabin roof or in the shaft if the elevator is not in inspection.

1. The technician now drives to one floor after the other.
2. At each floor, he opens the doors and checks if the door thresholds are level with the floor ground.
   - If not, he can adjust the position of the cabin by correcting the position of the floor in the lift control and then he induces the control to make a correction.
3. When the door thresholds are level with the floor ground, the technician signals to the lift control that this floor should now be learned by LIMAX33 CP-00.
   - The technician must not signal that LIMAX33 CP-00 should learn a floor position before the cabin is level to the floor ground.
   - When doing this, the number of the floor (index of the floor table, refer also to CANopen Specifications) must also be included in the signal (numbering from bottom to top, starting with number 1 for the lowest floor).
   - When doing this, the side of the floor (first side, second side or both sides) must also be included in the signal.
   - The cabin must be at standstill.
4. The control has to pass on this signal via CAN bus to LIMAX33 CP-00.
5. Repeat the last steps until all floors are learned.
Figure 15 and Table 7 illustrate the learning of double sided floors:

![Diagram showing learning process of double-sided floors](image)

**Table 7: Floor table as stored in CP in case of double sided floors**

<table>
<thead>
<tr>
<th>Floor No.</th>
<th>Position</th>
<th>First side</th>
<th>Second side</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1000</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>3000</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>#3</td>
<td>4000</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>7000</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>#5</td>
<td>10000</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Concerning Teach mode manual it is strictly prohibited to implement a fully automatic learn trip for LIMAX33 CP-00 in the lift control. The technician has to confirm manually at each floor that the floor level is correct. The lift control is only allowed to send the CAN command to teach this specific floor to the LIMAX33 CP-00 system in case the technician has confirmed.
11.2.4 Leaving the Teach Mode, Sub-Mode “Manual” to Normal Mode

When the limit switch reference positions and all floors have been learned (refer to chapter 11.2.3) the technician leaves the teach mode to normal mode by CANopen command. If the teaching is succeeded, LIMAX33 CP-00 will leave teach mode to normal mode. The commissioning is now finished.

If teaching was not successful, the LIMAX33 CP-00 refuses the demand to transit to normal mode and will stay in teach mode. This is the case if:

- The position of the single floors is not increasing with an increasing index
- There are no empty spaces in between the table (all entries in the table, starting from index 1 up to the highest floors must be filled => corresponding floors have been learned).
- No reference position or only one of them has been learned although they are needed due to the configuration

In this case the technician has the following possibilities:

- To stay in teach mode and correct the floor table by leaning, adding, or deleting floors, resp. learning the missing reference positions
- To leave the teach mode to pre-commissioning mode (≈ 11.2.5) and start over the teach process by re-entering of teach-mode, sub-mode manual again (≈ 11.2.1).
- To perform either a power cycle or a system reset. This may be advantageous if reference positions are already available: They will be kept and the system will restart directly in teach mode. In case no reference positions are available, the LIMAX33 CP-00 will re-start in pre-commissioned mode.

11.2.5 Leaving the Teach Mode, Sub-Mode “Manual” to Pre-Commissioning Mode

If a transit to pre-commissioning mode is demanded in teach mode, this will succeed, no matter if teach process has been successful or not. The floor table – possibly available – and reference positions - possibly available – will be erased.

11.3 Automatic Learning of the Floor Table

Figure 16 (see next page) shows an overview on the flow of events in teach mode auto. Details are described in the flowing subchapters. When teaching according to Figure 16 it will be necessary to move the car worst case two and a half-time through the whole shaft:

1. change to teach manual
2. move to the uppermost\(^1\) positions (through the half shaft)
3. teach upper reference,
4. move to the lowermost position (through the whole shaft)
5. teach lower reference
6. change to teach, sub-mode auto
7. move upward through the whole shaft, passing by all floor magnets (through the whole shaft)
8. leave teach mode to normal mode

\(^1\) In this example starting with uppermost position; if the car is in the lower half of the shaft at the beginning, the technician would normally start with the lowermost position
Figure 16: Flow of events in teach mode auto

Precommissioning or Normal Mode

Teach request

CANopen: Transition to TEACH

Teach Mode, submode Manual

Drive to top position

Teach upper reference

CANopen: Teaching reference position top

Drive to bottom position

Teach lower reference

CANopen: Teaching reference position bottom

Teach Sub-mode Auto request

CANopen: Transition to Teach, submode Auto

Teach Mode, Sub-mode Auto

Drive through the whole shaft

LIMAX Safe CP learns automatically when passing by the floor magnets

Exit teach mode

CANopen: Transition to NORMAL

Conditions to leave to normal mode fulfilled *)

Yes

Normal mode

No

*) refer to chapter „Operation Modes“

Only if references are needed (they are not needed if neither ETSL, nor final limit switches, nor safety functions dependent on EN81-21 are enabled)
The order of learning reference positions and floor positions by passing by the floor magnets is arbitrary; therefore it is also possibly to optimize the flow events in order to save time.

If the teaching process follows Figure 17 (see next page), it is only necessary to move one and a half time through the whole shaft:

1. change to teach manual
2. change to teach, sub mode auto
3. move to the uppermost positions (through the half shaft)
4. teach upper reference,
5. move to the lowermost position, passing by all floor magnets (through the whole shaft)
6. teach lower reference
7. leave teach mode to normal mode
Precommissioning or Normal Mode

Teach request

CANopen: Transition to TEACH

Teach Mode, Sub-mode manual

Teach Sub-mode Auto request

CANopen: Transition to TEACH, Sub-mode Auto

Teach Mode, Sub-mode Auto

Drive to bottom position

Teach lower reference

CANopen: Teaching reference position bottom

Drive through the whole shaft

LIMAX Safe CP learns automatically when passing by the floor magnets

Drive to top position

Teach upper reference

CANopen: Teaching reference position top

Exit teach mode

CANopen: Transition to NORMAL

Normal mode

*) refer to chapter „Operation Modes“
11.3.1 Activation of Teach Mode “Auto”

The technician first enters teach mode by CANopen command. The default sub mode is “Manual”. Optionally, he can teach the reference positions. Chapters 11.2.1 and 11.2.2 are here applicable as well.

Remark: reference positions can also be learned later, after change to sub mode “Auto”.

Now that the device is already in teach mode (sub-mode “Manual”), the sub-mode can be changed to “Auto”. This can be done by a CANopen command.

11.3.2 Learning of floors in Teach Mode, Sub-Mode “Auto”

The technician carries out a teach trip. The direction is arbitrary. It is only important that the car passes by all floor positions.

During this teach trip LIMAX33 CP-00 passes by the single floors and detects the positions of the floor magnets using the floor detection sensor(s).

Whenever a floor magnet is detected in teach mode auto, LIMAX33 CP-00 learns the new floor at the position.

In case of lift installations with double-sided entries normally two floor sensors are necessary: one of them detects the floor magnets on the first (front) side, the other on the second (rear side).

**NOTE!**

When the learning trip is carried out at a high speed, the individual floors are not learned with the same precision as during a slow learn trip.

Like in manual Teach 11.2.3 the floor table will be filled with the single floor positions. But in Teach, sub-mode “Auto”, the LIMAX33 CP-00 determines the respective index under which a certain floor is stored on its own (in such a way that floor positions are increasing with an increasing index).

The floor sensor (of first side or of second side), which detected the floor magnet, determines the side. The side information will also be stored in the floor table.

In case the first- and the second side sensor each detect a floor in between a distance of ± “Door minimum distance”, LIMAX33 CP-00 will store this as one floor with two sides; if the position where the first side is detected and the position where the second side is detected are not exactly the same, first side takes the leadership concerning the position entry in the floor table (by definition).

The same applies if e.g. a floor is already in the table on the first side and later a floor magnet is added on second side (may be because a new door is added). In order to learn this second side of the floor, teach mode Auto will be re-entered and LIMAX33 CP-00 will add the second side as soon as the second side floor magnet is detected in between a distance of ± “Door minimum distance” around the already existing first side floor. After this the floor will be double-sided (1st and 2nd side). In case the distance is bigger than ± “Door minimum distance” an own floor (only one side: on 2nd side) will be added.

Figure 18 and Table 8 (on next page) illustrate the learning of double sided floors.

1 “Door minimum distance” is a settings parameter, refer to Table 27
In case a floor which is already stored in the floor table is detected a second time during teach mode (within a tolerance of \( \pm \) “Door minimum distance”), the new detected position overwrites the position already available in the table. In case this happens at a double-sided floor (double side information already stored in the table), only the position detected on first side overwrites the position in the table. When the second side is detected, this information is ignored (first side takes the leadership by definition).

**Figure 18: Automatic learning of double sided floors**

**Table 8: Floor table as stored in CP in case of double sided floors learned automatically**

<table>
<thead>
<tr>
<th>Floor No.</th>
<th>Position</th>
<th>First side</th>
<th>Second side</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1000</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>3000</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>4000</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>7000</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>#5</td>
<td>10000</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE!**

When carrying out the learn trip by car call, it may happen that the highest floor is not detected: Because of tolerances it may happen the car stops a very small distance below the highest floor. In this case it would help to drive the cabin a small distance upwards by recall control. The same applies for the lowest floor.
11.3.3 Leaving the Teach Mode, Sub-Mode „Auto“ to Normal Mode

When all floors have been learned (refer to chapter 11.3.2) the technician can leave the teach mode, sub-mode “auto” to normal mode via CANopen command. If teaching succeeded, LIMAX33 CP-00 will leave teach mode to normal mode. Commissioning is finished now.

If teaching was not successful, the LIMAX33 CP-00 refuses demand to transit to normal mode and will stay in teach mode, sub-mode “auto”. This is the case if no reference positions have been learned although they are needed due to the configuration.

<table>
<thead>
<tr>
<th>NOTE!</th>
</tr>
</thead>
<tbody>
<tr>
<td>The situation “teach fail”, because of “no rising order of floor positions” or because of “empty spaces in the floor table” cannot occur because LIMAX33 CP-00 sorts the floor by its own in teach mode auto.</td>
</tr>
</tbody>
</table>

11.3.4 Leaving the Teach Mode, Sub-Mode „Auto“ to Pre-Commissioning Mode

A demanded “transit to pre-commissioning mode” in teach, sub-mode “auto” will be succeed, no matter if teach process has been successful or not. A floor table (possibly available) and reference positions (possibly available) will be erased.

11.4 Reentering of Teach Mode, Sub-Mode “Manual”

If teach mode is entered via CANopen-command from normal mode, the floor table will not be erased. Reference positions will also not be erased.

Entering Teach mode via CANopen-command from normal mode may be useful if:

- A floor position should be moved for a distance bigger than the adjustment distance permitted in settings mode (refer to 11.6.1). In this case this is a floor which is already in the table is taught a second time by the teach-command. The old positions of this floor will be overwritten. For moving the floor by a second teach-command the car must be on the position where the corrected floor positions should be taught. If the car is not on the position which should be taught as the new floor position the technician can use the “move”-command (see below).
- A floor position should be moved for a distance bigger than the adjustment distance permitted in settings mode. This can be done by the “move”-command. In this case it is not necessary to be on the new floor position. The floor can be moved by an offset, included in the “move”-command.¹
- A floor position should be added. If a floor is to be added as the new highest floor the floor can be learned in the known manner 11.2.3. If the position of the floor to be added is in between the floor table which is already present, this can be done by the command “ADD”.
- “A floor position should be deleted.” If the floor which is deleted is not the highest floor, the floor positions of the floors above are all shifted by one index down, so that there is again a continuous row of indexes. A floor can be deleted by the command “CLR”.
- When all operations concerning the floor table have been finished, teach mode can be left 11.2.4.

Further details concerning the commands mentioned above can be found in the CANopen specifications. All these commands can be used not only if teach-mode is re-entered but also when the LIMAX33 CP-00 is in teach mode for the first time.

¹ If floor position is changed by “move”-command or by teaching of an already known floor a second time on a corrected position, this affects always the “original” – floor- position, used for the limitation of adjustments 11.6.1.
11.5 Reentering of Teach Mode, Sub-Mode „Auto“

After re-entering teach mode \(\text{\textsuperscript{11.4}}\), sub-mode can be changed to “auto” by the corresponding CANopen command.

This may be useful if a new floor should be added. In this case it is sufficient to pass by only the new floor magnet. The position of this new floor will be added.

If the position of the new floor magnet is in between \(\pm \text{“Door minimum distance”}\) around the position of an already existing floor on the other side, the other side (side of the new floor magnet) is added to the already existing floor. This results in a double-sided floor. If position of 1\(^{st}\) (front-) and 2\(^{nd}\) (rear-) side are not exactly the same, the position of the 1\(^{st}\) (front-) side takes the leadership.

Remark: this corresponds to the situation that the first- and second side sensor each detects a floor in between a distance of \(\pm \text{“Door minimum distance”}\) during first teach-auto-process \(\text{\textsuperscript{11.3.2}}\).

After all floors have been added, teach mode (sub-mode auto), can be left to normal mode.

11.6 Adjustments

11.6.1 Adjustment by CANopen

Floor positions can be adjusted by CANopen in case five conditions do apply:

1. The actual mode is the settings mode
2. The new position (after adjustment) of the floor must be within \(\pm 100\) mm related to its original position\(^1\)
3. The cabin needs to be in the range of \(\pm 50\) mm of the actual position of the floor (before adjustment)
4. The cabin needs to be in the range of \(\pm 50\) mm of the new position of the floor (after adjustment)
5. The adjustment must not change the ascending floor ordering

There are two possibilities to adjust a floor by CANopen:

1. Firstly, an already known floor can be adjusted by a CANopen similar to the CANopen teach-message (\(\text{\textsuperscript{11.2.3}}\)). LIMAX33 CP-00 is commanded by this message to store the actual position as the new (adjusted) position of the floor (adjustment by actual position). The CANopen adjustment must contain the floor number.

   If all of the conditions above apply, the actual position will be stored as the new position of the floor.

2. The second possibility for adjustment (adjustment by offset) is quite similar: Another adjustment message (“adjustment by offset”) also must indicate floor number. Additionally, this adjustment message must contain an offset.

   LIMAX33 CP-00 will only accept the adjustment if the following conditions applies additional to the three conditions mentioned at the beginning of this subchapter.

   - The offset must be in a range between \(-50\) mm and \(+50\) mm

   If all of the conditions above apply, the new position of the floor will be calculated as old position (before adjustment) + (signed) offset.

---

\(^1\) The original position is the position where the floor has been initially learned. This is not necessarily the actual position (before adjustment)
11.6.2 Automatic Adjustment by Floor Sensors

While adjusting, using floor detection sensors, an already known floor in the floor table will be adjusted automatically under the following conditions:

- The actual speed is less than 1 m/s
- A floor sensor (first or second side) detects a floor which already exists in floor table. This means: The distance of the actual position to nearest floor position with a door existing on the side corresponding to the floor sensor is smaller than ±50 mm
- The new position (after adjustment) of the floor must be within ±100 mm related to its original position
- The distance of the actual position to nearest floor position in the floor table on the corresponding side is bigger than ±5 mm.
- In case of double side floors, the 1st side floor position takes the leadership: only the position of front side is taken into account concerning the adjustment.
- The adjustment must not change the ascending floor ordering.

If all conditions above apply, the actual position will be stored as the new position of the corresponding floor in the floor table. Otherwise the detected floor is ignored and floor table will not be changed.

Automatic adjustment by floor sensors will be carried out in normal-, settings-, test- and teach-mode (regardless of the sub-modes). Automatic adjustment by floor sensors will not be carried out if is not enabled in the configuration 14.1.6.
12.1 Triggering the Safety Functions

When an elevator fault, which is covered by the safety functions described in chapter 8, occurs, the actuator-contact specified for the respective safety function is opened \( \Rightarrow 13.2 \)

12.2 The Error Level and Error Codes

LIMAX33 CP-00 has a variety of self-diagnostic functions to ensure functional safety. When the self-diagnostic function detects a defect, a unique error code identifying the specific error is set in addition the error level defined for this specific error. The error-level determines the reaction of the LIMAX33 CP-00:

<table>
<thead>
<tr>
<th>Table 9: Error-level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No reaction, No error or error with level 0 (for information) is set.</td>
</tr>
<tr>
<td>1</td>
<td>If the cabin moves there is no reaction for the time being. As soon as standstill is reached, the error level is increased to level 2, and the LIMAX33 CP-00 reacts corresponding to level 2</td>
</tr>
<tr>
<td>2</td>
<td>OC open</td>
</tr>
<tr>
<td>3</td>
<td>Reserve (may be for later use)</td>
</tr>
<tr>
<td>4</td>
<td>eSGC, OC and SR1/(SR2) open</td>
</tr>
</tbody>
</table>

An error level can only be increased. That means that the corresponding actuators will be kept open even if the cause for the error disappeared – with exception of the undervoltage errors, they will disappear as soon as the undervoltage disappears.

But at power cycle or CO-reset the error level will get lost. Therefore, the corresponding actuators may close again if the cause for the error disappeared.

The error codes are also stored in the defect logs (A & B).

\[ \text{It's the task of the lift control to read all error codes from defect registers A and B which appear and to display them together with date and time.} \]

If an error occurs, the technician reads all error codes which appeared since last lift operation without error. The table below gives hints for troubleshooting. If the error affects the lift or the external wiring, LIMAX33 CP-00 is not defective and need not be replaced.

If the error affects LIMAX33 CP-00, the concerned component must be replaced. An error reset without replacing the component is then not allowed.

In case of an error-level \( >0 \) is set, LIMAX33 CP-00 does not accept teaching of floors or of reference positions.
<table>
<thead>
<tr>
<th>Error codes</th>
<th>Meaning of the code/group of codes</th>
<th>Meanings of special errors</th>
<th>Measures to fix the error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1xxh</td>
<td>Position errors</td>
<td>101h – 115h</td>
<td>The cause for these errors may be.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Incorrect mounting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. The magnetic tape</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. the LIMAX33 CP-00 (electronics)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failures in position</td>
<td>For troubleshooting 1º check the correct mounting of the tape, tape guiding and LIMAX33 CP-00 (correct up-direction, tape in the tape-guiding, and so on…)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If this is correct try to replace LIMAX33 CP-00 (electronics), if this does not help, replace the magnetic tape.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hint: if the error occurs always about at the same position, it is more likely that the cause is the tape. If it occurs everywhere over the whole reading distance it is more likely that the cause is the LIMAX33 CP-00 (electronics)</td>
</tr>
<tr>
<td>33Eh</td>
<td>Relays error</td>
<td>33Eh</td>
<td>Perform a power cycle or a reset (if order to maintain the defined test-intervals for some diagnostics it is mandatory to perform a power cycle or reset annually)</td>
</tr>
<tr>
<td>34xh</td>
<td>Relay failure</td>
<td>34xh</td>
<td>replace LIMAX33 CP-00</td>
</tr>
<tr>
<td>35ah</td>
<td>eSGC (solid state relay) error</td>
<td>350h</td>
<td>1. Check [external] supply voltage of SCG-actuator. If supply is not connected or voltage too low (&lt;18V), fix it.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Check for a short circuit between terminals SG POW and SG OUT (for example, a connected trip coil which is faulty). In this case, the self-resetting fuse becomes high-impedance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If this does not help, replace LIMAX33 CP-00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>351h</td>
<td>Check [external] supply voltage of SCG-actuator. If voltage is too high (&gt;30V), fix it. If this does not help, replace LIMAX33 CP-00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For older hardware versions (eSGC-HW 0.00) the following may help: Connect a load resistor between SG OUT and SG GND. The recommended value amounts to 4K7. Please take care of the maximum rating for power dissipation of the resistor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If this does not help replace LIMAX33 CP-00</td>
</tr>
<tr>
<td>37ah</td>
<td>Voltage error</td>
<td>370h</td>
<td>Check 24 V supply, a voltage of more than 30 V may cause this error. Rectification: use a supply voltage of 24 V.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If this does not help or supply voltage was not too high, replace LIMAX33 CP-00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37ah</td>
<td>replace LIMAX33 CP-00</td>
</tr>
<tr>
<td>64xh, 66yh</td>
<td>Nonvolatile data</td>
<td>64xh, x=3h..Eh, y=2h..Dh</td>
<td>These errors may appear if the system has been powered down, while storing of data in the EEPROM was in progress. For more detailed descriptions und measures to fix the error see Table 11</td>
</tr>
<tr>
<td>700h</td>
<td>Configuration</td>
<td>700h</td>
<td>Program the intended configuration to the device</td>
</tr>
<tr>
<td>72ah</td>
<td>Configuration</td>
<td>72ah</td>
<td>Check/correct the configuration to be programmed, try to program the configuration again.</td>
</tr>
<tr>
<td>71ah</td>
<td>Configuration</td>
<td>71ah</td>
<td>replace LIMAX33 CP-00</td>
</tr>
<tr>
<td>All other error codes</td>
<td>Only of interest for repair at ELGO-plant</td>
<td>All other error codes</td>
<td>replace LIMAX33 CP-00</td>
</tr>
</tbody>
</table>

**Table 10: Error codes**
Table 11: Errors concerning nonvolatile stored data

<table>
<thead>
<tr>
<th>Name</th>
<th>Error codes</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft parameter (offset final limit switch,</td>
<td>1. 0x643</td>
<td>▪ Go to settings or teach mode.</td>
</tr>
<tr>
<td>offset inspection limit switch)</td>
<td>2. 0x644</td>
<td>▪ Set new shaft parameter or set them to default.</td>
</tr>
<tr>
<td></td>
<td>3. 0x662</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. 0x663</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Go to settings or teach mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Set new shaft parameter or set them to default.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft references (reference position for the limit</td>
<td>1. 0x645</td>
<td>▪ Go to Pre-Commissioned mode.</td>
</tr>
<tr>
<td>switches)</td>
<td>2. 0x646</td>
<td>▪ Make a power cycle.</td>
</tr>
<tr>
<td></td>
<td>3. 0x664</td>
<td>▪ Redo the teach-process.</td>
</tr>
<tr>
<td></td>
<td>4. 0x665</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Go to Pre-Commissioned mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Make a power cycle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Redo the teach-process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor table</td>
<td>1. 0x647</td>
<td>▪ Go to Pre-Commissioned mode.</td>
</tr>
<tr>
<td></td>
<td>2. 0x648</td>
<td>▪ Make a power cycle.</td>
</tr>
<tr>
<td></td>
<td>3. 0x666</td>
<td>▪ Redo the teach-process.</td>
</tr>
<tr>
<td></td>
<td>4. 0x667</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Go to Pre-Commissioned mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Make a power cycle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Redo the teach-process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor parameter (number of floors, valid flag)</td>
<td>1. 0x649</td>
<td>▪ Go to Pre-Commissioned mode.</td>
</tr>
<tr>
<td></td>
<td>2. 0x64A</td>
<td>▪ Make a power cycle.</td>
</tr>
<tr>
<td></td>
<td>3. 0x668</td>
<td>▪ Redo the teach-process.</td>
</tr>
<tr>
<td></td>
<td>4. 0x669</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Go to Pre-Commissioned mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Make a power cycle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Redo the teach-process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door parameter (relevelling zone size, levelling zone</td>
<td>1. 0x64B</td>
<td>▪ Go to settings or teach mode.</td>
</tr>
<tr>
<td>size, minimum distance)</td>
<td>2. 0x64C</td>
<td>▪ Set new door parameters or set them to default.</td>
</tr>
<tr>
<td></td>
<td>3. 0x66A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. 0x66B</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Go to settings or teach mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Set new door parameters or set them to default.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Functions (state of the safety functions)</td>
<td>1. 0x64d</td>
<td>▪ Make two system resets.</td>
</tr>
<tr>
<td></td>
<td>2. 0x64e</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. 0x66C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. 0x66D</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Make two system resets.</td>
</tr>
</tbody>
</table>

Legend:

1. CRC mismatch to EEPROM (at initialization)
   ▪ This can happen,
     ▪ if the store was not successful, caused by power cycle
     ▪ or an EEPROM error

2. Channel CRC mismatch (at initialization)
   ▪ This can happen,
     ▪ if the store was not successful on one channel, caused by power cycle
     ▪ or an EEPROM error

3. CRC mismatch to EEPROM (at runtime)
   ▪ This can happen,
     ▪ if the store was not successful, caused by power cycle (consequence of 1.)
     ▪ or an EEPROM error or RAM error

4. Channel CRC mismatch (at runtime).
   ▪ if the store was not successful, caused by power cycle (consequence of 2.)
   ▪ or an RAM error
12.3 The Fault Register

The fault register contains the information if a safety function \( \neq_{13} \) tripped. A detailed description of the fault register can be found in the CANopen specifications.

12.4 Testing of the OC- Relays

When a relay is opened by LIMAX33 CP-00, it is checked by the feedback contacts whether the relay has really opened. OC is normally always closed during normal lift operation.

OC must be checked at least once per day that the OC-Relays are still able to open. This is done normally explicitly by a command of lift control, refer to CANopen Specification: If LIMAX33 CP-00 receives this command, it opens OC for a short period of time (approx. half a second), and then it closes OC again.

If LIMAX33 CP-00 did not open OC for longer than 24h (may be because the CAN-command was not received for some reason), LIMAX33 CP-00 opens OC at next stand still automatically for a short time (approx. half a second).

If LIMAX33 CP-00 is also not able to perform this test at next stand still for 12h more for some reason (OC stayed closed for more than 36h), LIMAX33 CP-00 sets the lift out of service by setting of error-level 4. This is done regardless of the actual movement state.

Remark: Normally it is always possible to open OC for a short time without disturbing normal lift operation when the car is in stand still.

12.5 Testing of the eSGC-actuator

The eSGC actuator is tested during operation: the eSGC-(solid state-) switch is opened very briefly and it is thereby tested whether the voltage at eSGC-OUT has dropped off.

The opening for test purposes is so short (\(<250 \mu s\)) that as a rule no disturbing influences on the normal operation are to be expected, provided that certain boundary conditions are respected (refer to chapter 8, topic 23 b).
12.6 LED Signals

The LEDs at the upper side of the sensor indicate the operating status or possible errors.

Figure 19: LED’s on the upper side of the sensor in case of eSGC – Version

Note: The view on the top side of version without eSGC is similar, but LED-assignment differs.

Table 12: Meaning of the LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE</td>
<td>Normal Mode</td>
</tr>
<tr>
<td></td>
<td>LED flashes once per second</td>
</tr>
<tr>
<td></td>
<td>Pre-commissioning Mode</td>
</tr>
<tr>
<td></td>
<td>LED flashes ten times per second</td>
</tr>
<tr>
<td></td>
<td>Teach Mode</td>
</tr>
<tr>
<td></td>
<td>LED lights permanently</td>
</tr>
<tr>
<td></td>
<td>Teach Mode Auto</td>
</tr>
<tr>
<td></td>
<td>LED lights permanently</td>
</tr>
<tr>
<td>ERROR</td>
<td>Flashes with a certain long/short pattern at an emergency error</td>
</tr>
<tr>
<td></td>
<td>Flashes with 10Hz if the CP is not configured</td>
</tr>
<tr>
<td></td>
<td>ON at a normal error</td>
</tr>
<tr>
<td>TAPE</td>
<td>ON, if no magnetic tape was detected</td>
</tr>
<tr>
<td>eSGC</td>
<td>ON, when eSGC-contact (solid state contact) is closed</td>
</tr>
<tr>
<td>OC</td>
<td>ON, when OC-relay is closed</td>
</tr>
<tr>
<td>SR1</td>
<td>ON, when SR1-relay is closed</td>
</tr>
<tr>
<td>SR2</td>
<td>ON, when SR2-relay is closed</td>
</tr>
<tr>
<td>CAN-ERR</td>
<td>Status CANopen</td>
</tr>
<tr>
<td>CAN-RUN</td>
<td>Status CANopen</td>
</tr>
</tbody>
</table>
13 Safety Functions

13.1 Safety Function Configuration

The safety functions LIMAX33 CP-00 can be adapted to the needs of the customer. The behavior of some safety functions can be changed by adapting configuration or settable parameter \( \text{\textsuperscript{14.1}} / \text{\textsuperscript{14.2}} \).

And most of the safety functions (\( \text{\textsuperscript{14.1.3}} \)) can be completely disabled because:

- The function is not required for the lift (e.g. ETSL is not needed if buffers are designed for nominal speed or pre-triggered stopping system is not needed in case of enough head/pit clearance).
- Or the customer wants to solve some safety functions externally (e.g. if the mechanical speed governor / mechanical tripping of safety gear is kept, a LIMAX33 CP-00 with safety function “overspeed final tripping” = disabled may be used).

13.2 Safety Functions after Commissioning

After correct installation and commissioning (LIMAX33 CP-00 is in Normal mode \( \text{\textsuperscript{11.1}} \)), the system fulfils the following safety functions:

<table>
<thead>
<tr>
<th>Name</th>
<th>Norm reference</th>
<th>SIL</th>
<th>OC</th>
<th>SR1</th>
<th>(SR2)</th>
<th>eSGC</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overspeed (pre-tripping)</td>
<td>EN81-20 §5.6.2.1.6.a.)</td>
<td>SIL 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overspeed (final-tripping)</td>
<td>EN81-20 §5.6.2.1.1a.)</td>
<td>SIL 3</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final limit switches</td>
<td>EN81-20 §5.12.2.3.1.b.)</td>
<td>SIL 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>deceleration control, synonym: ETSL</td>
<td>EN81-20 §5.12.1.3</td>
<td>SIL 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door bridging (monitoring the levelling and re-levelling)</td>
<td>EN81-20 §5.12.1.4</td>
<td>SIL 2</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unintended car movement</td>
<td>EN81-20 §5.6.7.7</td>
<td>SIL 2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspection limit switches</td>
<td>EN81-20 §5.12.1.5.2.1 e.)</td>
<td>SIL 2</td>
<td>X</td>
<td></td>
<td></td>
<td>In order to complete safety of direction dependency of “inspection limit switches”</td>
<td></td>
</tr>
<tr>
<td>Supervision on inspection direction</td>
<td>No norm reference</td>
<td>SIL2</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overspeed inspection (pre-tripping)</td>
<td>EN81-20 §5.12.1.5.2.1 e.)</td>
<td>No SIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please note the comment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overspeed inspection (final tripping)</td>
<td>No Norm reference</td>
<td>SIL3</td>
<td>X</td>
<td></td>
<td>X</td>
<td>This is in order to ensure the braking distance if “pre-triggered stopping system” trips. Therefore SIL3.</td>
<td></td>
</tr>
<tr>
<td>Pre-triggered stopping system</td>
<td>EN 81-21 §5.5.2.2 / §5.7.2.2</td>
<td>SIL 3</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working platform</td>
<td>EN81-20 §5.2.6.4.3.1 b.)</td>
<td>SIL 3</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks concerning the table above:
If the SGC triggers due to a safety function, the SR actuator(s) always opens. In the table this is only shown for the safety functions, where this is mandatory. This shows which actuators must be activated in the configuration and integrated to fulfill the corresponding safety function.

13.2.1 Overspeed Pre-Tripping / Final-Tripping

If the actual speed exceeds the pre-tripping speed, OC opens. OC is kept open even after stand still. This state is stored in a non-volatile way: OC will also be kept open after a power cycle. This state is cleared by manual reset by RESET (by CANopen). The pre-tripping speed depends on the Configuration, refer to chapter 14.1.

If the actual speed exceeds the final-tripping speed, eSGC opens additional to OC. eSGC is kept open even after stand still. This state is stored in a non-volatile way: eSGC will also remain open after a power cycle. This state is cleared by manual reset by RESET (by CANopen). The final-tripping speed depends on the configuration, refer to chapter 14.1.

Remark: SR1 and SR2 are normally already open in this situation due to the speed.

13.2.1.1 Actuator and Braking element for overspeed pre-tripping

- The OC is the actuator for “overspeed pre-tripping”.
- The OC is integrated in the safety circuit, refer to 10.4.4
- Therefore, the machine brake is normally the actuator for overspeed pre-tripping.

13.2.1.2 Actuator and Braking element for overspeed final-tripping

The eSGC is the actuator for “overspeed final-tripping”.

If LIMAX33 CP-00 is used as an electronic speed governor (as a substitute for the mechanical speed governor => EN81-20 §5.6.2.2.1.1a.) (overspeed final tripping) it is mandatory to use an electronic safety gear as the braking element connected to the eSGC-actuator.

13.2.2 Final Limit Switches

If car position is higher than upper final limit switch or car position is lower than lower final limit switch, OC opens due to safety function “final limit switches”. Safety function “final limit switches” is reset automatically and therefore OC closes if the car position is back in the area between upper and lower final limit switch.

The position of upper final limit switch is calculated as
“upper (limit switch-) reference positions − offset upper final limit switch”

The position of lower final limit switch is calculated as
“lower (limit switch-) reference positions + offset lower final limit switch”

Refer also to 13.2.8.

13.2.2.1 Actuator and Braking element for final limit switches

The OC is the actuator for “final limit switches”.

The OC is integrated in the safety circuit, refer to 10.4.4.

Therefore, the machine brake is normally the braking element for final limit switches.

13.2.3 Deceleration Control (ETSL)

“If the slowdown when approaching the terminal landings is not effective the machine brake shall cause the car speed to be reduced in such a way that if the car or the counterweight comes into contact with the buffers, the striking speed shall not exceed that for which the buffers are designed.” (Excerpt from EN81-20 §5.12.1.3)

The permitted ETSL-speed is a function of the distance “s” to the buffer, the car resp. the counterweight is approaching. The permitted ETSL-speed is decreasing when approaching the shaft end.
LIMAX33 CP-00 does know the position of the buffers by the lower resp. upper reference position, refer to \( \text{SR} \) 11.2.2.

Additional there may be set an offset in order to reduce the (assumed) distance to the buffer. There are two offsets, one of them for moving up and one for moving down. These two offsets are configuration parameter \( \text{SR} \) 14.1.2. Refer also to \( \text{SR} \) 13.2.8.

For decel test mode up when moving up the assumed distance to the buffer is calculated as the distance to the middle of the shaft. Distance of car to position of this assumptive buffer in the middle of the shaft will be valid for “decel test mode up” and moving up and for “decel test mode down” and moving down.

For “decel test mode up” and moving down and for “decel test mode down” and moving up, normal calculations are valid.

In “decel test mode” tripping of ETSL under real conditions can be tested without any risk for the material.

Furthermore, the ETSL-speed depends on fixed configuration parameter \( \text{SR} \) 14.1.2. These Parameters are:

- \( a \) = deceleration caused by the machine brake (it must be guaranteed that the average deceleration caused by the machine brake is bigger or at least equal than parameter “a”)
- \( t_{\text{del}} \) = delay from the moment the safety circuit is opened until the deceleration caused by the machine brake starts.
- \( V_{\text{Buffer}} \) = striking speed the buffers are designed for.
- \( \text{Offset}_{\text{ETSL_UP}} \) = offset for calculation of distance \( s \) in reference to upper reference position the refer to Table 14.
- \( \text{Offset}_{\text{ETSL_down}} \) = offset for calculation of distance \( s \) in reference to lower reference position the refer to Table 14 (meaning of \( \text{Offset}_{\text{ETSL_UP}} \) and \( \text{Offset}_{\text{ETSL_down}} \) already mentioned above).

The formula for the permitted ETSL-speed (absolute value) is:

\[
V_{\text{ETSL}} = \begin{cases} 
\text{MAX} \left( \sqrt{2 \cdot a \cdot s + V_{\text{Buffer}}^2 + a^2 \cdot t_{\text{del}}^2} \right) - a \cdot t_{\text{del}} \cdot V_{\text{Buffer}} & \text{for } s \geq 0 \\
V_{\text{Buffer}} & \text{for } s < 0 
\end{cases}
\]

Table 14 defines how the distance “s” in the formula above is determined.

<table>
<thead>
<tr>
<th>Table 14: Distance to assumptive buffer dependent on moving direction and mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal mode</td>
</tr>
<tr>
<td>Moving UP</td>
</tr>
<tr>
<td>Moving DOWN</td>
</tr>
</tbody>
</table>
Figure 20 shows the functional graphs of the ETSL-Formula for normal mode, moving up; normal mode, moving down; and “decel test mode up”, moving up as examples.

When the permitted ETSL-speed is exceeded, OC opens. OC will be kept open until stand still is reached and held for 1s. After this the ETSL-safety function resets automatically and OC close.

13.2.3.1 Actuator and Braking element for ETSL

- The OC is the actuator for ETSL.
- The OC is integrated in the safety circuit \( \Box 10.4.4 \)
- Therefore, the machine brake is normally the braking element for ETSL.

13.2.4 Door Bridging

There are two kinds of door bridging: “door bridging levelling” and “door bridging re-levelling”.

If the conditions for “door bridging levelling” or for “door bridging re-levelling” are fulfilled, SR(1/2) closes (door circuit is bridged). Otherwise if neither the conditions for “door bridging levelling” nor for “door bridging re-levelling” are fulfilled SR(1/2) opens (door circuit is not bridged any longer).
13.2.4.1 Door bridging levelling

The conditions for door bridging levelling are:

1. Door bridging command for levelling has been given by CANopen.
2. Actual position is in the door zone for levelling of that floor, the door bridging levelling has been enabled for \(\pm\) 13.2.4.3. The door zone extends from the flush position of the relevant floor (due to CANopen-command) \(\text{MINUS}\) door zone size for levelling to flush position of the relevant floor (due to CANopen-command) \(\text{PLUS}\) door zone size for levelling. Concerning door zone size for levelling see \(\pm\) 14.2.
3. Actual speed < 0.8 m/s

If all three conditions listed above are fulfilled, SR(1/2) closes due to door bridging levelling.

13.2.4.2 Door bridging re-levelling

The conditions for door bridging re-levelling are:

1. Door bridging command for re-levelling has been given by CANopen.
2. Actual position is in the door zone for re-levelling of that floor, the door bridging re-levelling has been enabled for \(\pm\) 13.2.4.3. The door zone extends from the flush position of the relevant floor (due to CANopen-command) \(\text{MINUS}\) door zone size for re-levelling to flush position of the relevant floor (due to CANopen-command) \(\text{PLUS}\) door zone size for re-levelling. Concerning door zone size for re-levelling refers to \(\pm\) 14.2.
3. Actual speed < 0.3m/s

If all three conditions listed above are fulfilled, SR(1/2) closes due to door bridging re-leveelling.

13.2.4.3 Door bridging Command by CANopen

Door bridging is enabled by CANopen-command. This Command contains

1. Information if door bridging should be enabled for levelling or for re-levelling
2. Number and position of that floor, the door bridging should be enabled for
3. (entry-) side (1\(^{st}\) side, 2\(^{nd}\) side or both sides) of the floor.

If one of the conditions mentioned above does not fit, LIMAX33 CP-00 will not accept the door bridging-command and neither SR1 nor SR2 will close.

In case the three conditions mentioned above do apply and the additional conditions concerning speed and zone do apply, SR1 or/and SR2 will close. Concerning the details about the dependency SR1/SR2 from 1\(^{st}\) side/2\(^{nd}\) side / both side floor and bridge command 1\(^{st}\) side/2\(^{nd}\) side / both sides refer to the table in the Appendix “bridging operations for double sided floors” in the CANopen Specification. In this table it can be also found, how LIMAX33 CP-00 deals with the situation that there is only one SR, but a double-sided door.

The following list specifies for accepting/not accepting a CANopen door bridging command.

- Door bridging cannot be enabled for more than one floor at the same time.
- It is possible to switch directly from door bridging levelling to bridging re-levelling (concerning one and the same floor)
- It is not possible to switch directly from door bridging re-levelling to bridging levelling
- It is not possible to switch directly from door bridging re-levelling or levelling to door bridging re-levelling or levelling of another floor
- In case of a double-sided floor it is possible to switch directly from one side to the other, from one single side to both sides or from both sides to one single side.
- door bridging (levelling or re-levelling) will stay enabled until it is:
  a.) disabled by CANopen-command or
  b.) until an invalid CANopen-levelling/re-levelling command is received (e.g. wrong floor position) or
  c.) until CANopen-levelling/re-levelling command is received which is indeed valid, but for another floor than a CANopen-levelling/re-levelling which is already pending

For more details refer to the CANopen specification.
13.2.5 Unintended Car Movement (UCM)

Three conditions must be fulfilled for causing door over-bridging (SR1/SR2 close) 13.2.4:

1. Door over-bridging (for levelling or re-levelling) must be enabled by CAN: “CAN-condition”
2. Speed must be below 0.8 m/s for levelling resp. 0.3 m/s for re-levelling: “speed-condition”
3. Position must be in the levelling resp. re-levelling zone of the correct floor: “zone-condition”

Otherwise SR1/SR2 opens.

If “CAN-condition”, “speed-condition” and “zone-condition” are all fulfilled (and therefore SR1/2 is/ are closed) and then “speed-condition” or “zone-condition” is hurt (levelling resp. re-levelling speed exceeded or levelling resp. re-levelling zone is left) unintended car movement (UCM) is triggered.

If UCM is triggered, all SR1/2 and OC will open. Whether eSGC opens depends on the concerning configuration and on the direction of the movement which caused UCM to trip 14.1.5.

If UCM is triggered, this state is stored in a non-volatile way: The corresponding relays will also be kept open after a power cycle. This state is cleared by manual reset by RESET (by CANopen).

If the car is on a floor level with doors bridged (SR1 or/and SR2 closed) lift control must always disable door bridging by CANopen, before a new travel can start. Otherwise UCM would be triggered.

Refer also to Figure 21.
Figure 21: Conditions for door bridging and UCM
13.2.5.1 Actuator and Braking element for UCM
If the machine brake built due to EN81-20 §5.9.2.2.2, the machine brake may be the braking element for UCM. Therefore, the eSGC-actuator is not necessarily needed with regard to UCM.

If the machine brake is not built due to EN81-20 §5.9.2.2.2, a brake, which is not needed for controlling the speed in normal lift operation, must be the braking element for UCM. This may be

- An electronic trigger-able safety gear
- A conventional safety gear tripped by speed governor. This speed governor again is tripped by a blocking device (remote tripping) connected to eSGC.
- A rope gripper

The tripping coil of this braking element must be connected to the eSGC-actuator.

13.2.6 Safety Functions in EN81-21 State

13.2.6.1 Activation of EN 81-21 State
LIMAX33 CP-00 fulfills safety functions in order to protect a man in the pit on the car roof or elsewhere in the shaft for maintenance work.

These safety functions are activated in case of EN81-21-state. EN81-21 state is activated if the EN81-21-signal (input) is active. An open input or LOW level means “active”, 24 V on the input means “not active”.

The following subchapters define those safety functions which depend on the EN81-21-state.

13.2.6.2 Overspeed Inspection (Pre-Tripping)
OC opens, if there is actual EN81-21-state and speed exceeds “pre-tripping speed inspection”. “Pre-tripping speed inspection” is a fixed configuration parameter \( \varphi \ 14.1 \)

This safety function is reset (and therefore OC closes) in case standstill is reached and hold for 1s.

13.2.6.3 Overspeed Inspection (Final Tripping)
eSGC opens additional to OC, if there is actual EN81-21-state and speed exceeds “final-tripping speed inspection”. “final-tripping speed inspection” is a fixed configuration parameter \( \varphi \ 14.1 \)

After tripping of this safety function, eSGC and OC are kept open even after stand still. This state is stored in a non-volatile way: eSGC and OC will also kept open after a power cycle. This state is cleared by manual reset (by CANopen).
SR1 and SR2 are already open due to EN81-21-state.

13.2.6.4 Actuator and Braking element for Overspeed Inspection (Final Tripping)
The braking element for Overspeed inspection (final tripping) may be:

- An electronic trigger-able safety gear
- A conventional safety gear tripped by speed governor. This speed governor again is tripped by a blocking device (remote tripping) connected to eSGC.
- A rope gripper

The tripping coil of this braking element must be connected to the eSGC-actuator.
13.2.6.5 Positions of “inspection limit switches” and “pre-triggered stopping system limit switches”

In EN81-21-state additional limit switches are activated:

1. Upper/lower stopping system limit switch => opening eSGC and therefore acting safety gear when the corresponding stopping system limit switch positions are over-traveled. These switches are only active if the corresponding safety function (upper/lower pre-triggered stopping system) is enabled (☞ 14.1.3), they are calculated with reference to the upper/lower limit switch references as they have been learned in teach mode (☞ 11.2.2), refer also to ☞ 13.2.8.

2. Upper/lower inspection limit switch => opening OC and therefore stopping the car by machine brake the corresponding inspection limit switch positions are over-traveled. They are calculated with reference to the upper/lower stopping system limit switch positions (see above and refer also to ☞ 13.2.8).

Before the position of the stopping system limit switch is reached, the OC opens (inspection limit switch) opens. So normally the car will stop before the stopping system limit switch is reached.

In case of “upper/lower pre-triggered stopping system” is disabled, there is no pre-triggered stopping system limit switch. In this case the position of the upper/lower inspection limit switch is calculated as an offset to the upper/lower limit switch references as it has been learned in teach mode ☞ 11.2.2.

Conditions in case of short head and short pit:

Conditions in case of sufficient head and pit clearance due to EN81-20§5.2.5.7/§5.5.5.8

Figure 22: Positions of inspection and stopping system limits in case of short head/pit and in case of head/pit-clearance
13.2.6.6 Pre-triggered Stopping System

There is an upper pre-triggered stopping system for the shaft head and a lower pre-triggered stopping for the shaft pit:

- The upper pre-triggered stopping system trips if “there is EN81-21-state” AND “actual position is higher than the upper stopping system limit”.
- The lower pre-triggered stopping system trips if “there is EN81-21-state” AND “actual position is lower than the lower stopping system limit”.

These safety functions are only active if they are “enabled”. They may be “disabled” in case there is no short head/pit.

For closer explanation short head/head clearance resp. short pit/pit clearance and for calculation of positions of upper/lower stopping system limits refer to Table 23 & Table 24 in chapter 14.1. Refer also to 13.2.8.

If upper or lower pre-triggered stopping system trips, eSGC and OC will open (SR1/2 are already open due to EN81-21-state). After tripping of pre-triggered stopping system, the actuators are kept open – even after power cycle - until the safety function is reset by CANopen-reset. So, it is not possible to move the car with the inspection pod after the pre-triggered stopping system has tripped.

In order to avoid the situation that a man on the roof or in the pit is trapped when approaching the shaft end in inspection travel, the upper/lower inspection limit switches should be able to stop the car before the upper/lower pre-triggered stopping system is trips. The user should take this into account when setting the offsets of the inspection limit switches by CANopen 14.2.

If upper or lower pre-triggered stopping system is enabled (or both enabled), eSGC must be available, enabled and installed due to 10.4.8. Concerning this safety function, it is arbitrary if eSGC drives directly an electronic safety gear, or the blocking device of a speed governor (remote triggering of speed governor).

13.2.6.7 Actuator and Braking element for pre-triggered stopping system

The braking element for pre-triggered stopping system may be:

- An electronic trigger-able safety gear
- A conventional safety gear tripped by speed governor. This speed governor again is tripped by a blocking device (remote tripping) connected to eSGC.

The tripping coil of this braking element must be connected to the eSGC-actuator.

13.2.6.8 Inspection Limit Switches

Inspection limit switches operate the OC-contact. They are only active in EN81-21-state and they are direction dependent:

- The upper inspection limit switch (OC) opens, if there is an “EN81-21-state” AND “actual position is higher than the upper inspection limit”, AND “there is actual no demand of a travel in DOWN-direction” (by inspection direction buttons). Refer also to Table 15 (see next page).
- The lower inspection limit switch (OC) opens if there is an “EN81-21-state” AND “actual position is lower than the lower inspection limit”, AND “there is actual no demand of a travel in UP-direction” (by inspection direction buttons). Refer also to Table 16 on the next page.
The direction dependency of the inspection limit switches means, that it is possible to drive the car into the safe direction with the inspection pod even after OC has opened due to over-travelling of the inspection limit switch. Therefore, a man e.g. on the roof is no trapped, but he can release himself by moving the car downwards.

13.2.6.9 Supervision on inspection direction

LIMAX33 CP-00 supervises also the consistency of direction button and real moving direction:

- If the UP Button is pushed and the car travels DOWN, OC will open
- If the DOWN Button is pushed and the car travels UP, OC will open

The roll-back (at start of movement) effect is taken into account.

If OC opened due to a contradiction of direction button state and real movement, they will close again after stand still and both buttons released. The connections of LIMAX33 CP-00 with the inspection panel should be checked in this case.

13.2.7 Safety function „Working Platform“

LIMAX33 CP-00 fulfills the safety functions “working platform” in order to prevent a movement of the car under all conditions.

- Safety concerning “Working Platform” is activated if the “Working Platform”-signal (input) is active.
- An open input “Working Platform” or Low-level means “active”, 24 V on the input means “not active”.
- In case safety concerning “Working Platform” is activated, all actuators will open.
- They will close again if input “Working Platform” is deactivated (24 V on the input).

NOTE!
If this functionality is used in conjunction with safety gear which does not reset itself, there is a danger that the technician will lock himself in using this function (for example, on the roof of the car above the uppermost floor). Electronically triggered safety gears often have the characteristic, for example, that they do not reset themselves when the voltage returns, even if they have triggered at standstill.
13.2.8 Relations limit switches/Offsets/ETSL and reference positions (summary)

Figure 23 (below) illustrates the lower final limit switch, the lower pre-triggered stopping limit, the lower inspection limit and the distance $s$ for ETSL-calculation when moving down related to the lower (limit switch-) reference position.

Relations to the upper reference positions see Figure 24 on next page.
Figure 24 (below) illustrates the upper final limit switch, the upper pre-triggered stopping limit, the upper inspection limit and the distance s for ETSL-calculation when moving up related to the upper (limit switch-) reference position.

Figure 24: Relations to the upper reference positions
13.3 Safety Functions during Commissioning

During commissioning (LIMAX33 CP-00 is in Teach mode 11.1) the system fulfils the safety functions listed in the table below:

Table 17: Safety functions during commissioning

<table>
<thead>
<tr>
<th>Name</th>
<th>Norm reference</th>
<th>SIL</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overspeed (pre-tripping)</td>
<td>EN81-20 §5.6.2.2.1.6.a.)</td>
<td>SIL 2</td>
<td>Same as in normal mode</td>
</tr>
<tr>
<td>Overspeed (final-tripping)</td>
<td>EN81-20 §5.6.2.2.1.1.a.)</td>
<td>SIL 3</td>
<td>Same as in normal mode;</td>
</tr>
<tr>
<td>Final limit switches</td>
<td>EN81-20 §5.12.2.3.1.b.)</td>
<td>SIL1</td>
<td>Always closed</td>
</tr>
<tr>
<td>Inspection limit switches</td>
<td>EN81-21 §5.5.3.4 / § 5.7.3.4</td>
<td>SIL2</td>
<td>If reference positions are available: same as in normal mode. Always opens if reference positions are not available.</td>
</tr>
<tr>
<td>Supervision on inspection direction</td>
<td>no norm reference</td>
<td>SIL2</td>
<td>Same as in normal mode</td>
</tr>
<tr>
<td>Pre-triggered stopping system</td>
<td>EN 81-21 §5.5.2.2 / §5.7.2.2</td>
<td>SIL3</td>
<td>If reference positions are available: Same behavior as in normal mode. If reference positions are not available: pre-triggered stopping system will always trip in EN81-21-state.</td>
</tr>
<tr>
<td>Overspeed inspection (pre-tripping)</td>
<td>EN81-20 §5.12.1.5.2.1 e.)</td>
<td>No SIL</td>
<td>Same as in normal mode</td>
</tr>
<tr>
<td>Overspeed inspection (final tripping)</td>
<td>no norm reference</td>
<td>SIL3</td>
<td>Same as in normal mode</td>
</tr>
<tr>
<td>Overspeed teach (pre-tripping)</td>
<td>Additional function, no norm reference</td>
<td>SIL3</td>
<td>Protection in teach mode. Substitute for ETSL, which is not carried out in teach mode. OC opens if speed exceeds pre-tripping speed teach. “Pre-tripping speed teach” is a fixed configuration parameter 14.1. This safety function is reset (and therefore OC closes) in case standstill is reached and hold for 1s.</td>
</tr>
<tr>
<td>Overspeed teach (final-tripping)</td>
<td>Additional function, no norm reference</td>
<td>No SIL</td>
<td>Protection in teach mode. eSGC opens additionally to the OC if the speed exceeds final-tripping speed teach. Final-tripping speed teach is a fixed configuration parameter 14.1. After tripping of this safety function, eSGC is kept open even after stand still. This state is stored in a non-volatile way: eSGC will also remain open after a power cycle. This state is cleared by manual reset by RESET (by CANopen).</td>
</tr>
<tr>
<td>Working platform</td>
<td>EN81-20 §5.2.6.4.3.1 b.)</td>
<td>SIL 3</td>
<td>Same as in normal mode</td>
</tr>
</tbody>
</table>

No door bridging and no UCM are active in teach mode.

SR1 and SR2 are always open in teach mode.
### 13.4 Safety Functions before Commissioning

The behavior of the safety functions in pre-commissioning mode \( \mathcal{M} \) 11.1 is the same as in teach mode \( \mathcal{M} \) 13.3.

**Remark:** Reference positions are never available in pre-commissioning mode.

In pre-commissioning mode \( \mathcal{M} \) 11.1, only the following safety functions are active:

<table>
<thead>
<tr>
<th>Name</th>
<th>Norm reference</th>
<th>SIL</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overspeed (pre-tripping)</td>
<td>EN81-20 §5.6.2.2.1.6.a.)</td>
<td>SIL2</td>
<td>Same as in normal mode</td>
</tr>
<tr>
<td>Overspeed (final-tripping)</td>
<td>EN81-20 §5.6.2.2.1.1a.)</td>
<td>SIL 3</td>
<td>Same as in normal mode</td>
</tr>
<tr>
<td>Overspeed teach (pre-tripping)</td>
<td>Additional function, no norm reference</td>
<td>SIL3</td>
<td>Same as in teach mode</td>
</tr>
<tr>
<td>Overspeed teach (final-tripping)</td>
<td>Additional function, no norm reference</td>
<td>No SIL</td>
<td>Same as in teach mode</td>
</tr>
<tr>
<td>Inspection limit switches</td>
<td>EN81-21 §5.5.3.4./§ 5.7.3.4</td>
<td>SIL2</td>
<td>Always open (because no references available in pre-comm. mode) =&gt; OC opens as soon as EN 81-21 state is active.</td>
</tr>
<tr>
<td>Supervision on inspection direction</td>
<td>no norm reference</td>
<td>SIL2</td>
<td>Same as in Normal mode</td>
</tr>
<tr>
<td>Pre-triggered stopping system</td>
<td>EN 81-21 §5.5.2.2 / §5.7.2.2</td>
<td>SIL3</td>
<td>pre-triggered stopping system will always trip in EN81-21-state</td>
</tr>
<tr>
<td>Working platform</td>
<td>EN81-20 §5.2.6.4.3.1 b.)</td>
<td>SIL 3</td>
<td>Same as in normal mode</td>
</tr>
</tbody>
</table>

No door bridging and no UCM are active in pre-commissioning mode.

\( \Rightarrow \) SR1 and SR2 are always open in pre-commissioning mode.
14 Configured/settable Parameter and Features

Most of the safety functions depend on parameters/features, which are either configured in the LIMAX33 CP-00 or settable/changeable by CANopen during operation.

ATTENTION!
It obligates the user to ensure that the configuration of the device fits the lift, where it will be installed. The hints given in this chapter must be observed.

14.1 Configuration

14.1.1 Procedure of Configuration

14.1.1.1 Configuration for a new installation

After the customer has fixed all necessary configuration parameters and features for a lift installation where LIMAX33 CP-00 should be installed for first time, he can download the configuration via CAN-bus on a blank device (device which contains no configuration).

In addition to the actual configuration information, the CRC must be sent to the device. Refer also to CANopen specification. The LIMAX33 CP-00 will accept the configuration only if the CRC fits. This prevents configuration errors due incorrect transmission. After successful download of the configuration the correct configuration CRC must be attached to the info label (refer to section 7.1.2). Faulty configurations due to incorrect input are not prevented by this method. For this reason, it is highly recommended that the downloaded configuration will be checked by a method independent of the programming procedure. The customer is responsible for checking the programmed configuration. The following info-box gives hints about methods which may be suitable.

NOTE!
Read back the single configuration parameters and features and the CRC, display them and check them. It is highly recommended to use a tool independent from the tool for download of the configuration, because normally neither the tool for download of the configuration nor the tool for upload and display are qualified.

NOTE!
A PC or notebook with a special software may be suitable for download of the configuration. The lift control may be suitable for upload and display. The special PC-software will calculate the configuration-CRC for download. The lift control should not calculate the CRC. It should always display the uploaded CRC. Section 14.1.1.5 should be observed.

NOTE!
The checks of the safety functions (refer also to section 15.7) gives an additional confirmation that the configuration is correct.

14.1.1.2 Configuration in case of repairs (exchange on of an existing device)

Configuration in case of repairs is similar to configuration in case of new installation, but in this case it is highly recommended to use a tool which is not able to calculate the CRC on its own. Instead of this, the CRC from the
info sheet should be used and entered manually additional to the configuration data. Only if the user proceeds like this, it can be assured that an incorrect input can be detected. This is important, because in case of repairs normally no examination by the notified body will follow. After a successful download of the configuration, the correct configuration CRC must by attached to the info label (refer to section 7.1.2)

14.1.1.3 Configuration at ELGO
It is possible to order a configured device at ELGO on own expense. In this case, the info sheet will be provided and the CRC-info-sticker will already be attached on the info label at delivery.

14.1.1.4 Reconfiguration
For newer devices (firmware 2.3 and – if so – higher) the following applies:
The configuration can be erased. However, this is only possible in pre-commissioning mode. It takes effect after a restart of the system or a system reset. Once the configuration has been erased, the device behaves like a blank device: the configuration can be rewritten and all actuators are open.

Erasure of the configuration and the subsequent rewriting with a configuration is the sole responsibility of the user. The user also bears the responsibility for everything related to this, especially for the exchange of the stickers, labels, and info sheet and other documentation fitting the old configuration against those fitting the new configuration (refer also to section 7.1.2).

For devices with firmware older than 2.3 the following two sentences are valid:
The configuration of a LIMAX33 CP-00 cannot be changed after it has been set. It is programmable only once.

14.1.1.5 Summarization of suitable tools
Table 19 shows an overview how suitable tools in order to manage (download/ upload /erase) of the configuration may look like. Concerning the concrete implementation of the features in the lift control please refer to the CANopen-specification.

<table>
<thead>
<tr>
<th>NOTE!</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you need help concerning hard- and software for the PC-tool please contact ELGO.</td>
</tr>
</tbody>
</table>
Table 19: proposal for tools which may be used for configuration

<table>
<thead>
<tr>
<th>Feature</th>
<th>PC (notebook) with special software and CAN-adapter</th>
<th>Lift control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to download parameter / features / CRC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Able to calculate CRC</td>
<td>Yes</td>
<td>No (CRC must be manually entered)</td>
</tr>
<tr>
<td>Able to upload and display parameter / features / CRC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Able to send command to erase the actual configuration</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 20: tools for the different purposes

<table>
<thead>
<tr>
<th>Purpose</th>
<th>PC (notebook) with special software and hardware (CAN-adapter)</th>
<th>Lift control</th>
</tr>
</thead>
<tbody>
<tr>
<td>First installation in a lift</td>
<td>used for download, CRC calculated by the software</td>
<td>not for download, only for check (upload and display)</td>
</tr>
<tr>
<td>Exchange (repairs)</td>
<td>-</td>
<td>used for download, CRC entered manually</td>
</tr>
<tr>
<td>Reconfiguration</td>
<td>used for erasure and download, CRC calculated by the software</td>
<td>not for download, only for check (upload and display)</td>
</tr>
<tr>
<td>Initial and annual examination</td>
<td>-</td>
<td>used for check (upload and display)</td>
</tr>
</tbody>
</table>

1 It is also possible to use lift control for download, but in this case the CRC must be acquired on a different way: one possibility is to use the special software for the PC (if used only for CRC-calculation no extra hardware – CAN-adapter- is needed). Another possibility is to use an online configurator tool.
14.1.2 Configuration Parameters

The configuration parameters concerning speeds are listed in the following table.

Table 21: configuration parameter concerning speeds

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Unit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated speed</td>
<td>0 … 13000</td>
<td>mm/s</td>
<td>Rated speed of the lift, the device is installed in. This parameter has no direct influence on the safety functions.</td>
</tr>
<tr>
<td>Pre-tripping speed</td>
<td>0 … 13000</td>
<td>mm/s</td>
<td>Tripping speed for safety function over-speed (pre-tripping)</td>
</tr>
<tr>
<td>Final-tripping speed</td>
<td>0 … 13000</td>
<td>mm/s</td>
<td>Tripping speed for safety function over-speed (final-tripping)</td>
</tr>
<tr>
<td>Pre-tripping speed teach</td>
<td>0 … 3000</td>
<td>mm/s</td>
<td>Tripping speed for safety function over-speed teach (pre-tripping). Refer to the hints on next page.</td>
</tr>
<tr>
<td>Final-tripping speed teach</td>
<td>0 … 3000</td>
<td>mm/s</td>
<td>Tripping speed for safety function over-speed teach (final-tripping)</td>
</tr>
<tr>
<td>Pre-tripping speed inspection</td>
<td>0 … 1000</td>
<td>mm/s</td>
<td>Tripping speed for safety function over-speed inspection (pre-tripping)</td>
</tr>
<tr>
<td>Final-tripping speed inspection</td>
<td>0 … 1000</td>
<td>mm/s</td>
<td>Tripping speed for safety function over-speed inspection (final-tripping). Refer to the hints on next page.</td>
</tr>
</tbody>
</table>

Hint for definition of pre-tripping speed teach:

In teach mode safety function ETSL is not active. The safety function “overspeed pre-tripping teach” is a substitute for ETSL in teach mode. The function protects a technician in the cabin during teach mode. It prevents hitting the buffers with a speed higher than the speed the buffers are designed for. This speed must therefore be at most as great as the speed for which the buffers are designed. This condition may only be hurt in case:

- No ETSL-functionality is needed in normal operation (buffers designed for nominal speed)
- The customer either ensures safety of a person travelling in the car by other means or prohibits travelling in the car during commissioning.

Hint for definition of final-tripping speed inspection:

When the customer defines the offsets for the pre-triggered stopping system limits (see Table 23) he has to take the braking distance of the car after the safety gear tripped into account. The breaking distance again depends on the speed. The final tripping speed inspection must be at most as great as the speed assumed when determining the braking distance.

The speed configuration is only valid, when all of the following rules are met. All of the speeds must be in the allowed range (defined in the table above):

- If $V_{\text{rated}} \leq 1 \text{ m/s}$ than the $V_{\text{finaltrip}}$ must be $< 1.5 \text{ m/s}$
- If $V_{\text{rated}} > 1 \text{ m/s}$ than the $V_{\text{finaltrip}}$ must be $< (1.25 \times V_{\text{rated}} + 0.25 / V_{\text{rated}})$
- If $V_{\text{rated}} \leq 1 \text{ m/s}$ than the $V_{\text{pretrip}}$ must be $\leq V_{\text{finaltrip}}$
- If $V_{\text{rated}} > 1 \text{ m/s}$ than the $V_{\text{pretrip}}$ must be $< V_{\text{finaltrip}}$
- $V_{\text{pretrip, teach}}$ must be $\leq V_{\text{finaltrip, teach}}$
- $V_{\text{pretrip, inspection}}$ must be $\leq V_{\text{finaltrip, inspection}}$

Furthermore, there are configuration parameters concerning the ETSL-Curve:

Table 22: configuration parameter for ETSL-Curve

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Unit</th>
<th>Explanation</th>
</tr>
</thead>
</table>

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Configured/settable Parameter and Features

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Unit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>100 ... 10000</td>
<td>mm/s²</td>
<td>Deceleration a</td>
</tr>
<tr>
<td>( \text{f}_{\text{del}} )</td>
<td>20 ... 500</td>
<td>ms</td>
<td>Delay of the functional chain: from detecting ETSL-event by LIMAX33 CP-00 until start of deceleration of the car.</td>
</tr>
<tr>
<td>( V_{\text{Buf}} )</td>
<td>0 ... 2500</td>
<td>mm/s</td>
<td>It is sufficient to reduce the speed to that speed the buffers are designed for. This Value gives the remaining speed when the car hits the buffers provided the car retards due to deceleration curve defined in the concerning chapter.</td>
</tr>
<tr>
<td>Offset(_{\text{ETSL_UP}})</td>
<td>0 ... 1000 mm</td>
<td>mm</td>
<td>The distance ( s ) to the assumptive buffer when moving up is reduced by this offset</td>
</tr>
<tr>
<td>Offset(_{\text{ETSL_down}})</td>
<td>0 ... 1000 mm</td>
<td>mm</td>
<td>The distance ( s ) to the assumptive buffer when moving down is reduced by this offset</td>
</tr>
</tbody>
</table>

Furthermore, there are configuration parameters concerning the offsets of the stopping system limits:

**Table 23: configuration parameter for offsets of stopping system limits**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Unit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset upper pre-triggered stopping system limit</td>
<td>0 ... 2500 mm</td>
<td>mm</td>
<td>Determines the position of the upper stopping system limit as an offset to the highest reference position: ( \text{Pos}<em>{\text{upper_stopping_system_limit}} = \text{Pos}</em>{\text{upper_reference}} - \text{Offset}_{\text{upper_stopping_system_limit}} )</td>
</tr>
<tr>
<td>Offset lower pre-triggered stopping system limit</td>
<td>0 ... 2500 mm</td>
<td>mm</td>
<td>Determines the position of the lower stopping system limit as an offset to the lowest reference position: ( \text{Pos}<em>{\text{lower_stopping_system_limit}} = \text{Pos}</em>{\text{lower_reference}} + \text{Offset}_{\text{lower_stopping_system_limit}} )</td>
</tr>
</tbody>
</table>
14.1.3 Configured Safety Functions

There are configuration features concerning if single safety functions are enabled/disabled:

Table 24: configuration features for Safety functions

<table>
<thead>
<tr>
<th>Feature</th>
<th>Selection</th>
<th>Group*)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>All “Inspection-safety functions”</td>
<td>disabled/enabled</td>
<td>-</td>
<td>If the user wants to care about safe in inspection/EN81-21-state on his own, a LIMAX33 CP-00 with “inspection safety functions disabled” = YES may be used. In this case the safety functions “inspection limit switches”, “supervision on inspection direction”, “overspeed inspection (pre- and final tripping)” and (upper and lower) pre-triggered stopping system are disabled at the same time.</td>
</tr>
<tr>
<td>Upper pre-triggered stopping system</td>
<td>enable/disable</td>
<td>REFERENCE (fulfilled in case of “enabled”)</td>
<td>If there is sufficient head clearance due to EN81-20§5.2.5.8., an upper pre-triggered stopping system is not necessary. In this case a LIMAX33 CP-00 with disabled safety function “upper pre-triggered stopping system” can be used. In this case the other “inspection safety functions” are still active.</td>
</tr>
<tr>
<td>Lower pre-triggered stopping system</td>
<td>enable/disable</td>
<td>REFERENCE (fulfilled in case of “enabled”)</td>
<td>If there is sufficient pit clearance due to EN81-20§5.2.5.8., a lower pre-triggered stopping system is not necessary. In this case a LIMAX33 CP-00 with disabled safety function “lower pre-triggered stopping system” can be used. In this case the other “inspection safety functions” are still active.</td>
</tr>
<tr>
<td>Overspeed Inspection (final tripping)</td>
<td>enable/disable</td>
<td>-</td>
<td>This function ensures that the car is not going to fast when pre-triggered stopping system limits are over traveled, so that a worst-case braking distance can always be guaranteed. Please observe also the hint for definition of final-tripping speed inspection.</td>
</tr>
<tr>
<td>ETSL</td>
<td>enable/disable</td>
<td>REFERENCE (fulfilled in case of “enabled”)</td>
<td>If the lift installation has no reduced buffers ETSL is not needed. In this case or if the user wants to take care about ETSL on his own, a LIMAX33 CP-00 with disabled safety function “ETSL” can be used.</td>
</tr>
<tr>
<td>Final Limit switch</td>
<td>enable/disable</td>
<td>REFERENCE (fulfilled in case of “enabled”)</td>
<td>In case the user wants to take care about the final limit switches on his own, a LIMAX33 CP-00 with disabled safety function “final limit switches” can be used.</td>
</tr>
<tr>
<td>Overspeed (pre-tripping)</td>
<td>enable/disable</td>
<td>-</td>
<td>If the user wants to take care about overspeed (pre-tripping) on his own, a LIMAX33 CP-00 with disabled safety function “overspeed (pre-tripping)” can be used.</td>
</tr>
<tr>
<td>Overspeed (final tripping)</td>
<td>enable/disable</td>
<td>-</td>
<td>If the LIMAX33 CP-00 should be used as an electronic speed governor this safety function must be enabled. In this case the eSGC must be available and connected to an electronic safety gear. If the user wants to keep the mechanical speed governor this safety function may be disabled.</td>
</tr>
<tr>
<td>Overspeed Teach (pre-tripping)</td>
<td>enable/disable</td>
<td>-</td>
<td>Overspeed teach (pre-tripping) is a substitute for ETSL in teach mode. It may be disabled for example if no ETSL is needed. Please observe also the hint for definition of pre-tripping speed above.</td>
</tr>
<tr>
<td>Overspeed Teach (final tripping)</td>
<td>enable/disable</td>
<td>-</td>
<td>Only for additional safety</td>
</tr>
<tr>
<td>Doors</td>
<td>enable/disable</td>
<td>DOORS (fulfilled in case of “enabled”)</td>
<td>In case the user does not need any door bridging for his lift installation, he may set the value “disables”. In this case also UCM is disabled. So, the feature doors enables/disables always door bridging and UCM together.</td>
</tr>
</tbody>
</table>

*) in this column it is noted if the group REFERENCE or DOOR is fulfilled in case the certain feature is enabled resp. has the value “NO” (for “all inspection functions disabled”). If the value of at least one feature fulfills the group REFERENCE, LIMAX33 CP-00 needs the information about the reference positions. They must be learned in teach mode. If feature “doors” is enabled, the group DOORS is fulfilled, otherwise the group DOORS is not fulfilled. If the group “DOORS” is fulfilled, LIMAX33 CP-00 needs the information about the floor table, which must be learned in the teach mode.

From a certain configuring of the safety function, it results, which actuators must be available on the LIMAX33 CP-00. They must be installed according to section 10.4.
14.1.4 Configuration of enabled actuators

General remarks concerning the relationship between “relay-contacts”, “relays” and “actuators”:
An actuator which appears to the outside when the device is regarded as a black box is the either a dry-contact (concerning OC, SR1 and SR2) or a solid state switch (concerning SGC)

Enabling/disabling of actuators are also configuration features. Additional to the safety functions the needed actuators must be enabled. An actuators which is physical available on the device but not enabled will always stay open.

Table 25: dependency “enabled safety functions” => needed actuators/relay contacts

<table>
<thead>
<tr>
<th>Feature</th>
<th>OC **)</th>
<th>eSGC</th>
<th>SR1</th>
<th>SR2(*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All “inspection” functions disabled *)</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Upper pre-triggered stopping system</td>
<td>enabled</td>
<td>enabled(1)</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>lower pre-triggered stopping system</td>
<td>enabled</td>
<td>enabled(1)</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Overspeed Inspection (final tripping)</td>
<td>enabled</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>ETSL</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Final Limit switch</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Overspeed (pre tripping)</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Overspeed (final tripping)</td>
<td>enabled</td>
<td>enabled(4)</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Overspeed Teach (pre tripping)</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Overspeed Teach (final tripping)</td>
<td>enabled</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
<tr>
<td>Doors (door-bridging + UCM)</td>
<td>enabled</td>
<td>enabled</td>
<td>don’t care</td>
<td>don’t care</td>
</tr>
</tbody>
</table>

*) all safety-functions activated by an activated “EN81-21”-input: overspeed inspection pre- and final-tripping, upper/lower inspection limit switch, upper/lower pre-triggered stopping system.

**) OC must always be enabled.

1) “Inspection-safety functions disabled” = NO is a prerequisite for upper or lower pre-triggered stopping system enabled
2) If UCM is solved by opening safety circuit. Solving UCM only by opening safety circuit is only permitted if the machine brake is a certified safety brake.
3) If UCM is solved by safety gear.
4) In this case eSGC must be connected to an electronic safety gear.
5) SR2 may be optimally enabled and wired additional to SR1 in case of a lift installation with two entry sides. In lift installations with only one entry side SR1 is used. But also in lift installations with two entry sides, devices with only SR1 may be used. The software of LIMAX33 CP-00 adapts its behavior due to CANopen – door bridging message by its own in case of only one SR and double-sided entries, refer to Appendix “Bridging operations for double sided floors” in the CANopen Specification.
6) In case of feature “Safety gear trip direction” = “only down”, the upper pre-triggered stopping system must be disabled ** 14.1.5
14.1.5 Configuration of actuators and Safety Function Behavior

There are two configuration features influencing the behavior of UCM and overspeed final tripping:

1. **Safety gear trip direction:**
   In case LIMAX33 CP-00 will be used in a lift installation with a unidirectional acting safety gear, the feature “safety gear trip direction” may be configured to “Only Down”. In this case the tripping of a safety function acting the eSGC will cause opening the eSGC only in downwards direction, in upward direction only OC will open in this case. This applies to Overspeed final tripping (for normal, teach and inspection) and for UCM. In this case the safety function is either not necessary in upwards direction, the user cares for safety in upwards direction on his own or opening OC is sufficient for safety in upwards direction. Indeed, also the pre-triggered stopping system acts eSGC, but in case of “trip direction of the safety gear” is “only down”, LIMAX33 CP-00 cannot care for safety in case of the upper pre-triggered stopping system. So, in this case the safety function “upper pre-triggered stopping system” must be disabled. The same applies to the safety function “working platform”.

2. **UCM only OC:**
   Under special prerequisites it is possible to fulfill the UCM-function by opening the safety circuit. In this case and if it is undesirable that the safety gear trips in UCM-case, the feature “UCM only OC” can be configured to “YES”. In this case only OC will open in case of UCM. This applies to upwards and downwards direction as well.

Each combination of setting “safety gear trip” direction and “UCM only OC” is possible. Table 26 shows the influence of the combination on the affected safety functions.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Safety gear trip direction</th>
<th>UCM only OC</th>
<th>Behavior of safety functions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only Down</td>
<td>Yes</td>
<td>If UCM trips downwards, the contacts listed below open</td>
</tr>
<tr>
<td>Both</td>
<td>Yes</td>
<td>OC</td>
<td>OC</td>
</tr>
<tr>
<td>Both</td>
<td>No</td>
<td>eSGC and OC</td>
<td>eSGC and OC</td>
</tr>
<tr>
<td>Only Down</td>
<td>Yes</td>
<td>OC</td>
<td>OC</td>
</tr>
<tr>
<td>Only Down</td>
<td>No</td>
<td>eSGC and OC</td>
<td>OC</td>
</tr>
</tbody>
</table>

14.1.6 Configuration concerning Behavior of Adjustment and Teach

It is a configuration feature if adjustment by floor sensors will be done. If this feature is not enabled, no adjustment by floor sensors will be carried out.
### 14.2 Settable Parameters

Some parameters can be changed by CANopen always and as often. But this is only possible within a defined range in compliance with the EN81-20.

#### Table 27: Settable parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Default</th>
<th>Unit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset upper final limit switch</td>
<td>10 … 30000*</td>
<td>500</td>
<td>mm</td>
<td>Determines the position of the upper final limit switch as an offset to the upper reference position: ( \text{Pos}<em>{\text{upper.final.limit}} = \text{Pos}</em>{\text{upper.reference}} - \text{Offset}_{\text{upper.final.limit}} )</td>
</tr>
<tr>
<td>Offset lower final limit switch</td>
<td>10 … 30000*</td>
<td>500</td>
<td>mm</td>
<td>Determines the position of lower final limit switch as an offset to the lower reference position: ( \text{Pos}<em>{\text{lower.final.limit}} = \text{Pos}</em>{\text{lower.reference}} + \text{Offset}_{\text{lower.final.limit}} )</td>
</tr>
<tr>
<td>Door zone size levelling</td>
<td>20 … 350</td>
<td>200</td>
<td>mm</td>
<td>Determines the area of the door zone for levelling around the flush floor position. The door zone for levelling reaches from: ( \text{flush.floor.position} - \text{door.zone.size.levelling} ) to ( \text{flush.floor.position} + \text{door.zone.size.levelling} )</td>
</tr>
<tr>
<td>Door zone size re-levelling</td>
<td>20 … 200</td>
<td>140</td>
<td>mm</td>
<td>Determines the area of the door zone for re-levelling around the flush floor position. The door zone for re-levelling reaches from: ( \text{flush.floor.position} - \text{door.zone.size.relevelling} ) to ( \text{flush.floor.position} + \text{door.zone.size.relevelling} )</td>
</tr>
<tr>
<td>Offset upper inspection limit switch</td>
<td>20 … 30000*</td>
<td>200</td>
<td>mm</td>
<td>Determines the position of the upper inspection limit as an offset to the upper stopping system limit: ( \text{Pos}<em>{\text{upper.inspection.limit}} = \text{Pos}</em>{\text{upper.stopping.system.limit}} + \text{Offset}<em>{\text{upper.inspection.limit}} ) (This is equivalent to): ( \text{Pos}</em>{\text{upper.inspection.limit}} = \text{Pos}<em>{\text{upper.reference}} + \text{Offset}</em>{\text{upper.stopping.system.limit}} + \text{Offset}_{\text{upper.inspection.limit}} )</td>
</tr>
<tr>
<td>Offset lower inspection limit switch</td>
<td>20 … 30000*</td>
<td>200</td>
<td>mm</td>
<td>Determines the position of the lower inspection limit as an offset to the lower stopping system limit: ( \text{Pos}<em>{\text{lower.inspection.limit}} = \text{Pos}</em>{\text{lower.stopping.system.limit}} + \text{Offset}<em>{\text{lower.inspection.limit}} ) (This is equivalent to): ( \text{Pos}</em>{\text{lower.inspection.limit}} = \text{Pos}<em>{\text{lower.reference}} + \text{Offset}</em>{\text{lower.stopping.system.limit}} + \text{Offset}_{\text{lower.inspection.limit}} )</td>
</tr>
<tr>
<td>Door minimum distance</td>
<td>0 … 100</td>
<td>50</td>
<td>mm</td>
<td>Floors with a distance smaller than “Door minimum distance” will be evaluated as one floor during automatic teach. Behavior of teach mode manual and adjustments are not affected. - If a floor is detected a second time during automatic teach (on the same side as a floor that has already been learned) the floor position that has already been learned will be overwritten with the newly detected floor position, provided that the new and existing floor positions are at a distance smaller than “Door-Minimum-Distance”, otherwise the new detected floor position will be “sorted” as a new floor. - If during automatic teach a floor is detected on the other side like an already known floor, it will be complemented “second side” to the already learned floor position and this now counts as a double-sided floor, provided the new and the already existing floor position have a distance smaller than “Door-Minimum-Distance”, otherwise the new detected floor position will be “sorted” as another floor.</td>
</tr>
</tbody>
</table>

**Remark:** Changing of the settable parameters is only possible in a special mode, the “settings mode” (refer also to CO-Specs). The LIMAX33 CP-00 will keep changes of these parameters even after power cycle.
*: In software versions prior to v2.2, the maximum values of the offsets (inspection and the final limit switch) were limited to 5000 mm.
15 Initial and Annual Examination

In this chapter is described how the auditor can check LIMAX33 CP-00 at initial and annual examination. The existing local accident prevention regulations and additional especially the rules of the EN81 must be observed when carrying out the tests for examination.

15.1 System Restart

Some checks concerning self-diagnostics of LIMAX33 CP-00 are only performed at start-up of the system. Therefore, it is mandatory to restart the LIMAX33 CP-00 at annual examination. This can either be done by RESET-button, by reset-command given by CAN or by disconnection/reconnection the main power supply.

15.2 Magnetic Tape

Concerning the magnetic tape, the tape guiding and the tape presence sensor the maintenance-hints of the manual for the magnetic tape should be followed.

15.3 Software Identification

It is possible to read the ROM-CRC of the LIMAX33 CP-00 software by CANopen. Refer to CANopen specification.

Display the ROM-CRC of LIMAX33 CP-00 software and compare it with the respective CRC noted in the certificate in order to verify the correctness of the software version.

15.4 Set of Configuration

The configurable parameter/features/CRC of LIMAX33 CP-00 are noted on the info-sheet (normally in the documentation of the lift). They must fit the conditions of the lift. The CRC must fit with the CRC noted on the sticker on the info-label (see section \( \approx \) 7.1.2).

The configuration data (parameter/ features / CRC) of the LIMAX33 CP-00 can be read out via CANopen ( refer to CANopen specification). They must also fit with the data on the info sheet.

Display the configuration information and compare it with the info sheet.

15.5 Interference Suppression Measures

It must be checked that the interference suppression measures (refer to "constraints for use, topic \( \approx \) 15) are present and still effective.
15.6 Verification of the Floor Table

The floor table as it is stored in LIMAX33 CP-00 must be verified. For example, this is possible by the following procedure:

- Send the car from one floor to the other. Normally this will be done by car call. All floors stored in the control have to be approached. Lift control should perform pre-opening of the doors approaching the single floors. For pre-opening of the doors, door bridging must be enabled. Otherwise the open door-circuit would cause an emergency stop. So if pre-opening of the doors works without emergency stop it is proved that the floor number and the position of the floor, where the lift control wants to land the car, is the same as in LIMAX33 CP-00: position and number of the target floor are communicated via CANopen to LIMAX33 CP-00. The device will only close SR1 resp. SR2 if these information’s fit.
- Check if the car and landing thresholds are flush at each floor.
- Read the total number of floors stored in LIMAX33 CP-00 and compare it with the number of floors stored in the lift control. This is done in order to ensure, that LIMAX33 CP-00 has not stored any additional floor at a position where actually is no floor.

Remark: this procedure is only possible if door bridging is performed. But that is no restriction because for a lift without door bridging it is not necessary to learn the floor table.

Further Remark: if lift control does not support pre-opening it is also possible to carry out the check with the re-levelling functionally: Load/unload the cabin at a floor and watch if the cabin relevals.

15.7 Check of Safety Functions

ATTENTION!

It obligates the user to ensure the safety for persons during check of the safety functions.
It is possible, to carry out all of the following tests without the presence of a person in the car, on the car roof or in the pit.

It obligates to the notified body to judge, if it is necessary to carry out all of the following tests concerning the safety functions annually or if it is sufficient to carry out some of them only at initial examination. The concrete proceeding concerning the tests should be locked at as a proposal. The user and/or notified body may find other ways to test the safety functions.

15.7.1 Final Limit Switches

The correct position of the final limit switches should be tested.

- The auditor calculates the position of the lower and upper final limit switches from the reference positions and the offsets of the final limit switches (refer also to 13.2.8).
- Now, the auditor takes the elevator to the top floor by car call. From here, he begins to move the cabin slowly upwards (generally this will be done by using the recall panel) until a point just under the top final limit switch.
- Then he switches off “recall” so that by measuring the voltage behind OC he can determine if the contact is open. Here, the normal safety circuit voltage must exist (OC closed).
- The auditor now over travels the position of the upper final limit switch (by recall panel) by the shortest possible distance and switches off recall.
- Now he checks the voltage behind OC. There must not be any voltage as OC must be open. The auditor measures the voltage before OC as to crosscheck. The normal safety circuit voltage must exist.

The lower final limit switch can be tested by the corresponding procedure.
15.7.2 Pre-Triggered Stopping System

The upper resp. lower pre-triggered stopping system must be tested, if the corresponding safety function is enabled in order to perform safety for a man on the roof resp. in the pit in case of a short shaft head resp. pit.

There must be no person in the shaft or on the car roof when carrying out this test.

The test can be done in test mode, sub mode “pre-trig”, refer to section \( \sigma \) 11.1.5.4. In this test mode, sub mode pre-trig a travel toward the upper resp. lower shaft end should be performed.

- The travel speed should be equal to the final tripping speed inspection (in order to get a realistic result for the braking distance).
- After the car has been stopped by safety gear (triggered by safety function upper resp. lower pre-triggered stopping system), the auditor checks if there is ample survival space left in the shaft head resp. the shaft pit.

15.7.3 Inspection Direction

The auditor switches the lift to inspection. By using an inspection direction button, the auditor drives the lift for half a meter in up and down directions in order to check that the lift moves in the correct direction.

In case of discrepancies in this test, the wiring of the inspection control is checked and corrected if necessary.

In case the lift starts to move in the correct direction, but is stopped by an open OC, wiring of the signals UP and DOWN to the LIMAX33 CP-00 is wrong.

15.7.4 Inspection Limit Switches

When approaching the inspection limit switches with the normal inspection speed, the car should come to stand still – due to open OC - before the pre-triggered stopping system trips. Otherwise a man would be trapped on the roof or in the pit.

The auditor performs an inspection travel with normal inspection travel speed in upwards direction. OC opens when the upper inspection limit switch position is over-travelled and car comes to stand still. Check: stand still is reached before the position of the limit for pre-triggered stopping system is over travelled (safety gear did not trip)

The same is done in downwards direction. After the car came to standstill it should possible to move the car into the safe direction by pushing the correct direction button.

Remark: in case that upper and/or lower pre-triggered stopping system is/are disabled, it should be checked, that the car stops before the corresponding final limit switch is over travelled. This is verified in a simple way: if it is possible to move the car into the safe direction with the corresponding direction button, the final limit switch remained closed.

Hint: If pre-triggered stopping system tripped or final limit switch has been over travelled during this test, the offset for the corresponding inspection limit switch should be increased (refer to \( \sigma \) 14.2).

15.7.5 ETSL

ETSL in upwards rep. downwards direction can be tested in test mode, sub mode “ETSL up” (\( \sigma \) 11.1.5.2), resp. ETSL up” (\( \sigma \) 11.1.5.3):

Starting a trip from the bottom of the shaft upwards in sub mode “ETSL up”, resp. from the top of the shaft downwards in sub mode “ETSL down”, will cause an (intended) emergency stop cause by the (test-) tripping of ETSL. The car will come to standstill somewhere near the position of the “assumptive buffer” in the middle of the shaft. From the position the car came to standstill, it is possible to judge if the reaction of the functional chain (LIMAX33 CP-00 => Safety circuit => motor / brake) fulfills EN81-20 §5.12.1.3.
**15.7.6 Overspeed (Pre-Tripping)**

The auditor adjusts lift control/inverter in such a way that overspeed can be reached. He performs a travel, each in upwards and in downwards direction and with a speed just above the pre-tripping speed.

**Check:** OC opens when pre-tripping speed is reached and the machine brake stops the lift.

**15.7.7 Overspeed (Final Tripping)**

Overspeed (final tripping) can be performed in the corresponding sub mode of the test mode. The procedure is done is already described in the corresponding section 11.1.5.1.

The test in downwards direction is always performed, in upwards direction only if feature setting “trip direction” is “both”.

**15.7.8 Overspeed Inspection**

The auditor performs an inspection travel with inspection travel speed higher than the pre-tripping speed inspection of the LIMAX33 CP-00.

**Check:** OC opens when “inspection pre-tripping speed” is reached and the machine brake stops the lift.

**Remark:** if it is not possible to adjust inspection speed in lift control to a value big enough, so that Safety function “overspeed inspection” trips leave the lift in normal operation (neither in EN81-21-state, nor in inspection state) and simulate the EN81-21-state to LIMAX33 CP-00 by disconnecting the EN81-21-signal from the corresponding input of LIMAX33 CP-00.

Test of “overspeed inspection (final tripping)” will be more difficult in most cases because the machine brake (triped due to “overspeed inspection (pre-tripping)”) may decelerate the cabin before “inspection final -tripping speed” is reached,

If it is nevertheless possible to test the safety function “overspeed inspection (final tripping)” in a safe way, check: eSGC opens when “inspection final-tripping speed” is reached and the safety gear stops the lift.

**15.7.9 Door Bridging**

Door bridging has been already checked in combination with the verification of the floor table.

**15.7.10 UCM**

The car is on a floor, door circuit is bridged. Now start a travel without disabling the door bridging. UCM must trip latest as soon as the door zone is left.

**Remark:** Starting a travel without disabling the door bridging is normally only possible if this is implemented as a special (test-) feature in the lift control. If this is not the case, the car may be moved by recall control while door bridging is enabled. Alternatively, the car may be moved by hand wheel.

**15.7.11 Working Platform**

The auditor enables safety for “working platform” by opening the corresponding (external) contact. He checks that all available actuators (OC, eSGC, SRS1 and SR2) are open.
### 16 Functional Safety

#### 16.1 Safety Parameters

<table>
<thead>
<tr>
<th>Safety function</th>
<th>Norm reference</th>
<th>Required SIL due to EN81 (or due to risk analysis, refer to comments)</th>
<th>Achieved SIL due to PFHD and SFF</th>
<th>PFHD [FIT] (acc. to FMEDA)</th>
<th>Percentage of required SIL</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overspeed (pre-tipping)</td>
<td>EN81-20 § 5.6.2.2.1.6 a.)</td>
<td>SIL2</td>
<td>SIL3</td>
<td>40 FIT</td>
<td>4 %</td>
<td></td>
</tr>
<tr>
<td>Overspeed (final tripping)</td>
<td>EN81-20 §5.6.2.2.1.1 a.)</td>
<td>SIL3</td>
<td>SIL3</td>
<td>28 FIT</td>
<td>28 %</td>
<td></td>
</tr>
<tr>
<td>Overspeed Inspection (pre-tripping)</td>
<td>EN81-20 §5.12.1.5.2.1 e.)</td>
<td>No SIL</td>
<td>SIL3</td>
<td>40 FIT</td>
<td>n.a.</td>
<td>This function is named in the EN81 but without any demand for a SIL</td>
</tr>
<tr>
<td>Overspeed Inspection (final-tripping)</td>
<td>Not named in EN81</td>
<td>SIL 3</td>
<td>SIL3</td>
<td>29 FIT</td>
<td>29 %</td>
<td>Not named in the EN81 secures braking distance for pre-triggered stopping system, therefore SIL3</td>
</tr>
<tr>
<td>Overspeed Teach (pre-tipping)</td>
<td>Not named in EN81</td>
<td>SIL3</td>
<td>SIL3</td>
<td>40 FIT</td>
<td>40 %</td>
<td>The safety function “over-speed teach (pre-tripping)” is a substitute for ETSL, which cannot be carried out in teach mode. Because ETSL is SIL 3 according to EN81-20, Annex A, “overspeed teach (pre-tripping)” is also SIL3.</td>
</tr>
<tr>
<td>Overspeed Teach (final-tipping)</td>
<td>Not named in EN81</td>
<td>No SIL</td>
<td>SIL3</td>
<td>28FIT</td>
<td>n. a.</td>
<td>Cares for additional safety before and during commissioning</td>
</tr>
<tr>
<td>Final limit switches</td>
<td>EN81-20 §5.12.2.3.1 b.)</td>
<td>SIL1</td>
<td>SIL3</td>
<td>40 FIT</td>
<td>0.40 %</td>
<td></td>
</tr>
<tr>
<td>Inspection limit switches</td>
<td>EN81-21 §5.5.3.4, §5.7.3.4 (under constraints)</td>
<td>SIL2</td>
<td>SIL3</td>
<td>41 FIT</td>
<td>4.1%</td>
<td></td>
</tr>
<tr>
<td>Supervision on inspection direction</td>
<td>Not named in EN81</td>
<td>SIL2</td>
<td>SIL3</td>
<td>41 FIT</td>
<td>4.1%</td>
<td>In order to complete safety of “Inspection limit switches”, therefore this is SIL2</td>
</tr>
<tr>
<td>Pre-triggered stopping system</td>
<td>EN 81-21 §5.5.2.2 / §5.7.2.2 (under constraints)</td>
<td>SIL3</td>
<td>SIL3</td>
<td>29 FIT</td>
<td>29 %</td>
<td>When the positions where the pre-triggered stopping system trips are defined, a certain stopping distance must be taken. The stopping distance depends directly from the velocity. Therefore, a worst-case value for the velocity must be assumed. The safety function “overspeed inspection (final tripping)” supervises that this worst-case velocity is not exceeded. Therefore, it is the same SIL like pre-triggered stopping system: SIL 3.</td>
</tr>
<tr>
<td>ETSL</td>
<td>EN81-20 §5.12.1.3</td>
<td>SIL3</td>
<td>SIL3</td>
<td>47 FIT/28FIT</td>
<td>47 % / 28 %</td>
<td>In case the eSGC-actuator is enabled and connected with a suitable</td>
</tr>
<tr>
<td>Safety function</td>
<td>Norm reference</td>
<td>Required SIL due to EN81 (or due to risk analysis, refer to comments)</td>
<td>Achieved SIL due to PFHD and SFF</td>
<td>PFHD [FIT] (acc. to FMEDA)</td>
<td>Percentage of required SIL</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------</td>
<td>--------------------------------</td>
<td>----------------------------</td>
<td>---------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>door bridging</td>
<td>EN81-20 §5.12.1.4</td>
<td>SIL2 SIL3 56 FIT 5.6 %</td>
<td></td>
<td></td>
<td></td>
<td>braking system, the better values are valid (eSGC would secure a failure of OC in this case).</td>
</tr>
<tr>
<td>UCM</td>
<td>EN81-20 §5.6.7.7</td>
<td>SIL2 SIL3 76 FIT 7.6 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Platform</td>
<td>EN81-20 §5.2.6.4.3.1 b.</td>
<td>SIL3 SIL3 27 FIT 27 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 29: Safe failure fraction, HFT and Type of the subsystems

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>HFT</th>
<th>Type</th>
<th>Required SFF for SIL3</th>
<th>Achieved SFF</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic (µ-controller in the broad sense)</td>
<td>1</td>
<td>B</td>
<td>90 %</td>
<td>99.4 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Digital Inputs</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>99.9 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Diagnostics for digital inputs</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>99.6 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Position</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>99.9 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>OC</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>75.8 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>eSGC</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>98.5 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>SR1 and SR2</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>75.8 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>3.3 V and 2 V supply voltage</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>99.5 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>12V Relay supply voltage</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>99.0 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>EMC of main supply</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>97.3 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>EMC of battery Supply</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>97.3 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Voltage supervision (diagnostics)</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>99.5 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>External watchdog (diagnostics)</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>96.9 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>CAN</td>
<td>0</td>
<td>B</td>
<td>90 %</td>
<td>99.1 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Floor Sensors</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>99.7 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Door Zone Output</td>
<td>0</td>
<td>A</td>
<td>90 %</td>
<td>99.0 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>A</td>
<td>60 %</td>
<td>97.7 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
<tr>
<td>µ-controller-PINs</td>
<td>1</td>
<td>B</td>
<td>90 %</td>
<td>92.8 %</td>
<td>Required SFF for SIL3 achieved</td>
</tr>
</tbody>
</table>

Table 30: Diagnostics Test Interval (DTI) of the subsystems

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Diagnostic Measurement</th>
<th>DTI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Comparison of the two channels</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analogue value range</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plausibility of pattern of the analog values</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plausibility of succession of positions</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dynamic check of analogue branch</td>
<td>90 ms</td>
<td></td>
</tr>
<tr>
<td>Logic (processing)</td>
<td>RAM Test</td>
<td>41 h : 56 min : 35 s</td>
<td>Also 1 x complete at startup before relays close</td>
</tr>
<tr>
<td></td>
<td>ROM Test</td>
<td>17 min : 29 s</td>
<td>Also 1 x complete at startup before relays close</td>
</tr>
<tr>
<td></td>
<td>Self-test of CPU</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comparison with other channel</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program flow</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check of timing</td>
<td>10 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(hardware) watchdog</td>
<td>15 ms</td>
<td></td>
</tr>
</tbody>
</table>

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### Functional Safety

#### Subsystem Diagnostic Measurement DTI Comments

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Diagnostic Measurement</th>
<th>DTI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital inputs (INSP., UP, DOWN)</td>
<td>Pulses are added to the input-signal (in case of High-level of input-signal)</td>
<td>10 ms</td>
<td>Diagnostics only possible (and necessary) when inputs are actuated</td>
</tr>
<tr>
<td>Digital inputs (RESET)</td>
<td>Defined operation pattern</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>OC</td>
<td>Check of the force guided feedback contacts</td>
<td>24 h</td>
<td>If OC has not been opened regular by CANopen-commend from lift control (for the purpose or relay test), the LIMAX33 CP-00 will open the OC compulsorily latest at next stand still after 24h for a short time (for purpose of relay test)</td>
</tr>
<tr>
<td>SR1/SR2</td>
<td>Check of the force guided feedback contacts</td>
<td>n.a.</td>
<td>SR1 and SR2 must open before next lift travel, otherwise UCM would appear. If opening fails, OC opens and lift travel will be prevented. Therefore SR1 and SR2 are tested before each lift travel</td>
</tr>
<tr>
<td>eSGC</td>
<td>Open eSGC for a short time and check if the voltage on SG_OUT goes down.</td>
<td>10 s</td>
<td>The duration of the opening of eSGC is very short (&lt;1ms), so that the connected braking element would not trip. The test is. The test is carried out alternately in the A-channel and B-channel: A-channel test, 5s later B-channel test, another 5s later B-channel test and so on…</td>
</tr>
<tr>
<td>Voltages</td>
<td>Overvoltage / EMC protection</td>
<td>(continuous)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voltage supervision</td>
<td>10 ms</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 31: Demands of 61508-2, Annex D2

<table>
<thead>
<tr>
<th>Ref. 61508</th>
<th>EN 61508 demand</th>
<th>Value, description of references to other chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2.1 a.)</td>
<td>Functional description</td>
<td>11, 12, 13</td>
</tr>
<tr>
<td>D2.1 b.)</td>
<td>Identification of configuration</td>
<td>7.1</td>
</tr>
<tr>
<td>D2.1 c.)</td>
<td>Constraints for use</td>
<td>8</td>
</tr>
<tr>
<td>D2.2 a.)</td>
<td>Kinds of undetected failures</td>
<td>Safe failures (relays open by fail)</td>
</tr>
<tr>
<td>D2.2 b.)</td>
<td>Rate of failures dependent on the kind (refer to a.)</td>
<td>Safe failures λ_s, see footnote 1, dangerous failures λ_d, corresponds to PFHD, refer to Table 28</td>
</tr>
<tr>
<td>D2.2 c.)</td>
<td>Kinds of failures detected by diagnostics</td>
<td>Safe failure (relays open by fail)</td>
</tr>
<tr>
<td>D2.2 d.)</td>
<td>Kinds of failures of diagnostics</td>
<td>Safe failure (relays open by fail)</td>
</tr>
<tr>
<td>D2.2 e.)</td>
<td>Rate of failures concerning c.) and d.)</td>
<td>Summarized to one value λ_dd (because reaction of the system is the same): λ_dd = λ_o - λ_dd, the value is mainly determined by the subsystems “position” (2 times), “logic” (2 times) and “relay OC resp. eSGC” (6 times). Because the high diagnostic coverage λ_dd is approximately equal to λ_o and therefore the value amounts to 12927FIT (λ_o values of the single subsystems added, ref Table 32).</td>
</tr>
<tr>
<td>D2.2 f.)</td>
<td>Diagnostic test interval</td>
<td>Refer to Table 30</td>
</tr>
<tr>
<td>D2.2 g.)</td>
<td>Initiated outputs</td>
<td>12.2</td>
</tr>
</tbody>
</table>

1 Rate of undetected safe failures λ_s (relay open by fail) is mainly determined by λ_s of the relay and therefore amounts to about 18000 FIT (8 times λ_s of one relay).
### Functional Safety

Ref. 61508 | EN 61508 demand | Value, description of references to other chapters
--- | --- | ---
D2.2 h.) | Regular test and maintenance | 18, 15
D2.2 i.) | External diagnostics | not applicable
D2.2 j.) | Hardware failure tolerance | Refer to Table 29
D2.2 k.) | Type A / Type B classification | Refer to Table 29

#### Table 32: Calculation of \( \lambda_0 \) for the entire system

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>X -times</th>
<th>( \lambda_0 ) per systems</th>
<th>( \lambda_0 ) (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic (µ-controller in the broad sense)</td>
<td>2</td>
<td>575</td>
<td>1150</td>
</tr>
<tr>
<td>Digital Inputs</td>
<td>6 (3 * 2)</td>
<td>17</td>
<td>102</td>
</tr>
<tr>
<td>Diagnostics for digital inputs</td>
<td>3</td>
<td>33</td>
<td>99</td>
</tr>
<tr>
<td>Position</td>
<td>2</td>
<td>3297</td>
<td>6594</td>
</tr>
<tr>
<td>Relays (OC SR1 and SR2)</td>
<td>6</td>
<td>615</td>
<td>3690</td>
</tr>
<tr>
<td>Solid State actuator (eSGC)</td>
<td>2</td>
<td>158</td>
<td>316</td>
</tr>
<tr>
<td>3.3 V and 2 V supply voltage</td>
<td>2</td>
<td>113</td>
<td>226</td>
</tr>
<tr>
<td>12V Relay supply voltage</td>
<td>1</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>EMC of main supply</td>
<td>1</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>EMC of battery Supply</td>
<td>1</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>Voltage supervision (diagnostics)</td>
<td>2</td>
<td>51</td>
<td>102</td>
</tr>
<tr>
<td>External watchdog (diagnostics)</td>
<td>1</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>CAN</td>
<td>1</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Floor Sensors</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Door Zone Output</td>
<td>1</td>
<td>(approx.) 0</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>µ-Controller-PINs</td>
<td>2</td>
<td>212</td>
<td>424</td>
</tr>
</tbody>
</table>

\( \sum_{\text{total}} \) | 12927

### 16.3 Safety Requirements for the Integration of the System

Refer to 8 Constraints for Use (Safety requirements for integration).
### 17 Disturbances

This chapter describes possible causes for disturbances and measures for their removal. In case of increased disturbances, please follow the measures for fault clearance (17.1). In case of disturbances that cannot be eliminated by following the advice and the fault clearance measures given here, please contact the manufacturer (see second page).

### 17.1 Fault Clearance

**CAUTION!**
The device, the connection line and the signal cable must not be installed next to sources of interference that emit strong inductive or capacitive interference or strong electrostatic fields.

External perturbations can be avoided through suitable cable routing.

Signal cables always have to be routed separately from the load power line. A safety distance of at least 0.5 m has to be kept from inductive and capacitive sources of interference such as contactors, relays, motors, switching power supplies, clocked controllers etc.!

Concerning connection of the shield please refer to 10.4.13

If interferences occur in spite of all the items stated above being observed, please proceed as follows:

1. Installation of RC-circuits via contactor coils of AC-contactors
   (e.g. 0.1 µF / 100 Ω)
2. Installation of recovery diodes via DC-inductors
3. Installation of RC-circuits via the different motor phases
   (in the terminal box of the motor)
4. Do not connect protective earth and ground
5. Connect a mains filter ahead of the external power pack
Re-Start after Fault Clearance

After the fault clearance:

1. Reset the emergency stop mechanism if necessary
2. Reset the error report at the super-ordinate system if necessary
3. Ensure that there are no persons in the danger area
4. Follow the instructions of chapters § 10 and § 11 as far as necessary

**WARNING!**

**Danger of injury through non-conventional fault clearance!**

Non-conventional fault clearance can lead to severe injuries and damage of property.

Therefore:

- Any work to clear the faults may only be performed by sufficiently qualified staff
- Arrange enough space before starting the works
- Make sure that the mounting area is clean and tidy. Loose components and tools are sources of accidents.

If components need to be replaced:

- Pay attention to a correct installation of the spare parts.
- Reinstall all the fixing elements properly
- Before turning on the device, ensure that all covers and safety equipment is installed correctly and works properly

**18 Repairs / Maintenance**

- The LIMAX33 CP-00 device is maintenance free.
- The magnetic tape is maintenance free.
- Repairs by the user are not allowed.
- If necessary, repairs are carried out by the manufacturer.
- In case of irreparable damages or the end of maximum product life; the LIMAX33 CP-00 and magnetic tape must be disposed in accordance to the statutory applicable regulations.
19 Replacing Components

19.1 Replacing Magnetic Tapes

When the magnetic tape is replaced, it is absolutely necessary to erase the floor table and the reference positions in LIMAX33 CP-00. The floor table and the reference positions stored in LIMAX33 CP-00 are not valid anymore in combination with the new tape. As soon the new magnetic tape is installed, a learn trip is necessary (☞ 11.2 and ☞ 11.3).

![WARNING]

Do not replace the magnetic tape without erasing the floor table and the reference positions.

19.2 Replacing the LIMAX33 CP-00

19.2.1 Replacing a defective LIMAX33 CP-00

The complete lift system must be switched off before disconnecting the LIMAX33 CP-00. The power down of LIMAX33 CP-00 must include the supply voltage of LIMAX33 CP-00 and the emergency supply if there is one.

Subsequently, the electrical connections have to be disconnected. The LIMAX33 CP-00 is dismounted from the fixture and then the replacement device is fixed to the same fixture.

![WARNING]

Take care the configuration of the replacement device fits the lift (see info label on the housing, resp. in the lift)!

Now reconnect the electrical connections. These installations are usually carried out on the cabin roof. The technician then leaves the cabin roof in order to switch the lift system back on.

It is mandatory to follow the appropriate safety measures during installation. All further procedures correspond to the learn trip described under ☞ 11.2 and ☞ 11.3. The proper work of the safety functions should be checked.

19.2.2 Dismantling an intact LIMAX33 CP-00

If an intact LIMAX33 CP-00 is dismounted, it is not allowed to use the device in another lift without careful check that:

- The configuration of the LIMAX33 CP-00 fits the lift where the device is intended to be reused concerning all parameters and features
- The LIMAX33 CP-00 has been set to the Pre-Commissioned mode. This can be done by entering Teach mode/leaving Teach mode to pre-commissioned mode without Successful reset to Pre-Commissioned mode should be checked, e.g. by watching the Mode-LED (refer to Table 12)

In case a re-configuration of the parameters/features is necessary, the LIMAX33 CP-00 must be sent back to the manufacturer.
20 Cleaning

**WARNING!**
The device can only be cleaned with a damp cloth, do not use aggressive cleanser!

21 Accessories

Table 33: Accessories

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIMAX S-RMS</td>
<td>Magnetic tape mounting kit for rail mounting</td>
</tr>
<tr>
<td>AB20-80-10-1-R-D-15-BK80</td>
<td>Magnetic tape</td>
</tr>
<tr>
<td>LIMAX33 CP MW</td>
<td>Mounting angle</td>
</tr>
</tbody>
</table>
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