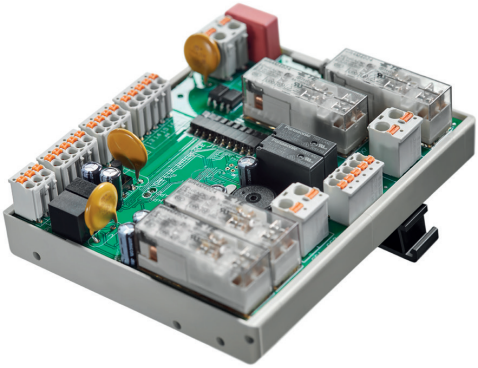
Kübler

Manual

PSU02 (Position Supervisor Unit)

english



SIL3 Functional Safety EN 81

CANopen LIFT © CiA

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1. Abbreviations used

Ants LES01	Linear Encoder Safe, 1. Generation, SIL3
Ants LES02	Linear Encoder Safe, 2. Generation, SIL3
PSU02	Auswerteeinheit / Position Supervisor Unit, SIL3
UCM	Unintended Car Movement
SC	Safety Circuit

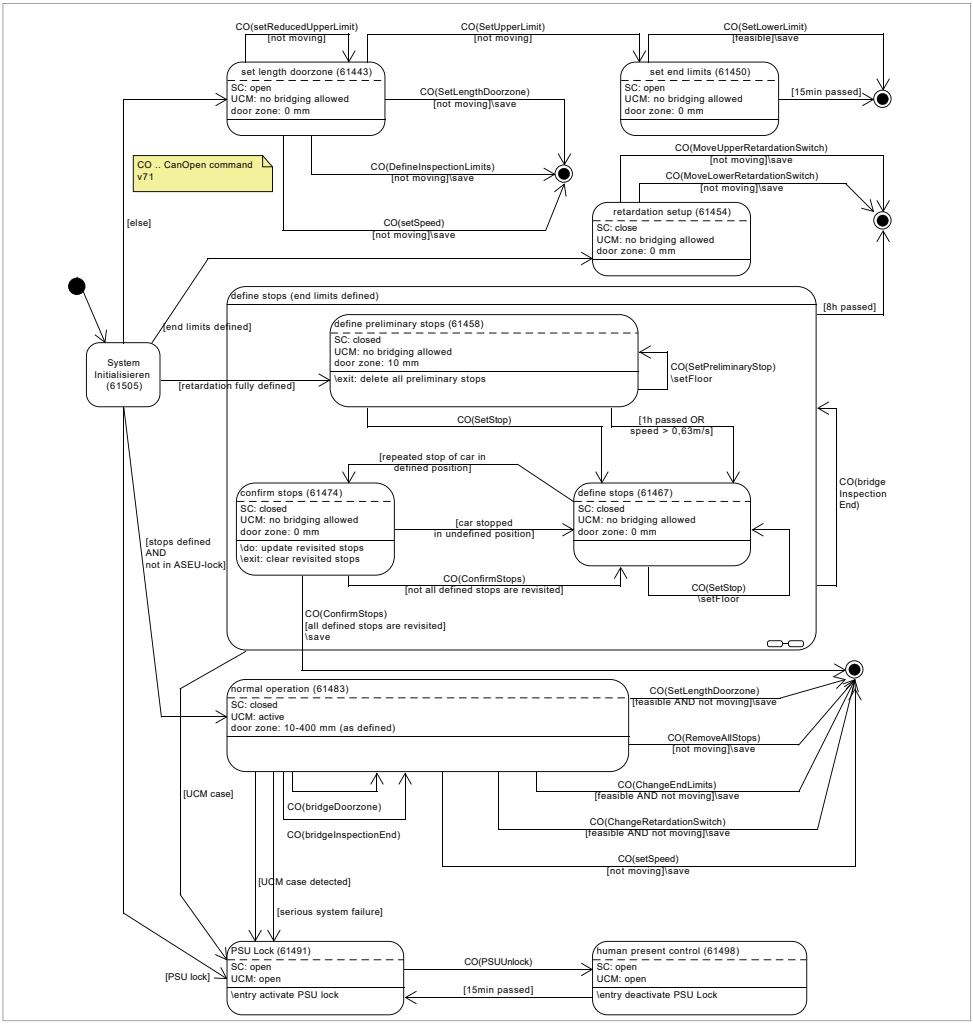
2. Symbols used / Warnings and safety information

Particularly important information in the manual are identified as follows:

DANGER	**Classification** This symbol, together with the signal word **DANGER**, warns against immediately imminent threat to life and health of persons. The non-compliance with this safety instruction will lead to death or severe adverse health effects.
WARNING	**Classification** This symbol, together with the signal word **WARNING**, warns against a potential danger to life and health of persons. The non-compliance with this safety instruction may lead to death or severe adverse health effects.
CAUTION	**Classification** This symbol, together with the signal word **CAUTION**, warns against a potential danger for the health of persons. The non-compliance with this safety instruction may lead to slight or minor adverse health effects.
ATTENTION	**Classification** The non-compliance with the **ATTENTION** note may lead to material damage.
NOTICE	**Classification** Additional information relating to the operation of the product, and hints and recommendations for efficient and trouble-free operation.

3. PSU02 State Diagram

This manual describes the parametrization workflow as well as other commands of PSU02. Communication must apply to CANopen Lift 417 or to the manufacturer specific protocol. The following state diagram gives you all information about the parametrization process. The entry point is on the left. The conditions of a state transition is written above the arrows. The black points at the end of a path indicates a restart.



NOTICE	You have to set upper and end limit switches within 15 min, otherwise already learned positions of limit switches will be lost. You have to confirm defined stops within 8 h, otherwise already learned positions will be lost. A power cycle will also delete already defined but not yet confirmed stops.

4. Parametrization

With PSU02 you have two possibilities for parametrization. There is the possibility to program PSU02 manufacturer specific CANopen parametrization or paramatrize according to CANopen Lift 417.
In either way a common knowledge of CANopen is required to use this document. The default node-id is 4 with a baud rate of 250kbit/s. Those values can be changed with manufacturer specific objects 2000h and 2001h. It is also possible to change them via CANopen LSS.
After each persistent writing of parameters indicated as “save”, the PSU02 restarts and performs consistency checks and is available for further parametrization after that. A Startup confirmation can be read from SDO 2004h. The PSU02 parameters can be read back from the Object 2005h and its subindices or also from CANopen Lift 417 defined objects. It may take however up to 500 ms for that object to be up to date. For a detailed description of all relevant SDOs we refer to table 7.
We highly recommend to study the state diagram figure 1 before reading any further.
After first boot up or after a factory reset PSU02 starts in state 61443. This is the state where one can set parameters for door zone, inspection mode and overspeed.

4.1 Set Door Zone Length

Sets door zone length. The entered value in object 2006h will be interpreted as the total door length for one floor + 1000. Door zone can be from 5 to 400 mm in total. Please be aware that the values differ depending on what type of parametrization you choose. The value of the door length can be set via CANopen Lift 417 by writing the value to index 1 or index 2. As defined in that protocol the value means floorlevel ± value. One value will be set for both leveling and re-leveling door zone sizes.

4.2 Configure Inspection Mode

There are four possible configurations concerning the inspection mode, that can be set by writing the value to object 2006h: no inspection limits (value 30), only upper inspection end limit (value 31), only lower inspection end limit (value 32), both inspection end limits (value 33), and no upper nor lower inspection end limit, but wiring of inspection is done - speed is monitored (34).
The configuration can only be set at the beginning of the teaching in state 61443. Default is set to both inspection end limits, ± 1200 mm to the reference point end limit switch. The current configuration can be read manufacturer specific via object 2005 index 10. Please see table 7 for more information.
It is also possible to check if inspection end limits are set via CANopen Lift 417 object 63E9h - Limit switch offsets.
If the PSU02 is used together with the evaluation unit for an electromechanical safety gear (SGT02), then the inspection limits are monitored in this control unit.
In PSU02, „no inspection limitation“ (value 30) must then be set at this point.

4.3 Set Overspeed (optional)

A once defined rated speed prevents trips over 115 % upwards as well as downwards by opening the SC. When overspeed is detected the status bit is set in object 2005h index 8 bit 15 and 63E1h index 1. You can write the speed via the SDO 0x2005-18 (setSpeed), if you are in the state „set length door zone“ and „normal operation“. The writing sets the rated speed of the elevator in mm/s.
The parameter range is from 100-8000 (0.1 ... 8.0 m/s). The set speed can be read out in the SDO at any time. The default value is set to 8 m/s and is thus ineffective. The rated speed can be changed continuously. Each change triggers a restart of the PSU02 (approx. 2-3 seconds).

If the evaluation unit for an electromechanical safety gear (SGT02) is used together with the PSU02, then the speed is monitored in this evaluation unit. The rated speed must then be set to 8 m/s in the PSU02 or left at this default value.

NOTICE	This function is not certified by the TÜV but rather a feature one can use.

4.4 Teaching End limit Switch Positions

PSU02 needs to learn the position of the upper end limit switch before the lower one. One can change the position also in normal operation but only by entering the offset in mm to the current end limit position. The shaft room can only be made smaller not larger.

4.4.1 Teaching End limit Switch Position with Low Shaft Head

With PSU02 it is possible to set an end limit switch position with low shaft head. Therefore you have to position the car exactly 1500 mm below the actual desired position of the end limit switch.
Then you send 19 to object 2006h. This command sets temporary the position of the end limit switch to the that current position plus 1500 mm. The position is saved permanently if the car is stopped above this position within 15 minutes.

NOTICE	PSU02 closes the safety circuit as soon as above steps are done, the elevator can now drive in rated speed for further installation purposes.

4.5 Define Retardation limit Switches

Moves the retardation switches towards each other. The number 13000 - 13999 moves the lower retardation switch by 13000 [cm] upwards (eg. 13176 means: 176 cm upwards). The switches can only be moved within end limit switch positions. On success the system restarts with the newly defined switches. Retardation switches must be set in retardation setup state and can be moved in normal operation. Moves the retardation switches towards each other. The number u = 14000 - 14999 moves the upper retardation switch by value - 14000 [cm] downwards (eg. 14077 means: 77 cm downwards). The switches can only be moved within end limit switch positions. On success the system restarts with the newly defined switches. Retardation switches must be set in retardation setup state and can be moved in normal operation.

4.6 Teaching Stops

With either the manufacturer specific command or the command according to CANopen Lift 417 a stop is set to the position the car currently has. Stops can be set in any desired order, PSU02 will sort them automatically by the value of the positions. It is not possible to adjust floor positions after teaching, so be sure that the position is final. Teaching stops shall be teached only after all floor positions are final, e.g. right before the lift control would go into normal operation.

With PSU02 one has the possibility to program short distance stops:

- Only two stops can make a short stop together, then at least 60 cm distance to the next one. Eg. 1000, 1070, 1120 are not legitimate floors, this is checked and it is not possible to create the floors. 1000, 1070, 2000, 2115, on the other hand, works.
- If the stops are under 10 cm you will get a common zone (should the zone be long enough to allow this, otherwise an asymmetric zone, as originally).
- Stops over 10 cm get an asymmetric (or if it goes out a normal symmetrical) door zone.

- Due to the common door zone, fast pre-opening and relevelling is not clear and is possible for both floors in the zone. However, fast start refers back to ± 20 mm from the fast start zone.

NOTICE	The PSU02 does not support blindfloors as described in CANopen Lift 417. The PSU02 can not support elevators with 3 doors and 3 short distance stops.

4.7 Revisit Stops

After teaching all floors the elevator has to stop once more on each floor. Each learned stop has to be hit within ± 5 mm. Upon the first revisited stop the state changes to 61474 and PSU02 beeps one time long. A second stop to an already visited stop would not be confirmed by a peep anymore.
The elevator must not stop at any other undefined position during that process, otherwise PSU02 changes back to state 61467.

NOTICE	For testing purposes Ants encoder is often used on the desktop in the office. In that case it is rather impossible to move the tape so smoothly to the stops and hit them as accurate as required without accidentally stopping inbetween. We recommend to test the system with only 2 stops and fixate both positions with 2 fingers for teaching the stops.

4.8 Enter Normal Operation

This step will tell PSU2 to finalize the definition of all stops. On success PSU02 changes to normal operation 61483 and beeps one long time. On failure PSU02 stays in the state 61474 and peeps 3 short times. The reason for failure could be, that not all defined stops are revisited. In that case the error code will be saved in object 2004h with at least one position of a stop which was not revisited yet. For detailed information please see section 6.

4.9 PSU02 Feedback

On success PSU02 restarts, changes the state or simply returns the feedback upon sending the command. What kind of feedback is given depends on the sent command and is shown in the installation process tables manufacturer specific or CANopen Lift 417.
It is possible at any time to read the current state of PSU02 by reading object 2006, but also PSU02 has implemented a MPDO with COB-ID 0x500 + nodeId where the object 2006 is sent upon change of the state. In case of error while parametrizing, e.g. a step can not be completed, we recommend to read chapter section 4, because confirmation codes are also saved permanently and can be read out in object 2004h. Position Feedback: PDO ID 18c (32 bit unsigned int)

4.10 Guideline CANopen Lift 417

Currently parametrization can be done according to CANopen Lift 417 (Version 2.3) as shown below. Some steps have to be done manufacturer specific because the protocol has not yet defined a solution (for more details see table 6).
The table shows the required steps in the necessary order. Every step is described with function, mode, action part and a description of what is happening and the feedback on success. Default values are also presented, as some steps are optional. Table below shows the different modes in CANopen Lift 417 with the equal state numbers.

Table 1: CANopen Lift modes and according PSU02 states

CANopen Lift mode	PSU02 state
pre-commissioning mode (PM)	61505
configuration mode (CM)	61443, 61450, 61454
teaching mode (TM)	61458, 61474
normal mode (NM)	61483

Table 2: Guideline CANopen Lift installation process

Step	Stepname	Mode	Action	Value	Default	Conf. Message (2004h)	PSU02 State
0	(optional) factory reset	CM	write value to 63E2 index 2	magic word	-	restart	61443
1	(optional) set Length Doorzone	CM	write value to object 63E8 index 1 or 2	between 5 and 200 (mm) - only a symmetric door zone is possible	20 mm	restart	61443
2	(optional) define inspection limit mode	CM	Manufacturer specific: write value to object 2006h	30, 31, 32, 33 and 34.	both activated (2005h[10] = 7)	restart	61443
3	(optional) set speed	CM	Manufacturer specific: write value to object 2005h index 18	between 100 and 8000 (mm/s)	8 m/s	restart	61443
4	set upper end limit switch	CM	write “SETL” (4C544553h) to object 63EA index 02	“SETL” (0x4C544553)	-	long peep	61450
5	set lower end limit switch	CM	write “SETL” (4C544553h) to object 63EA index 01	“SETL” (0x4C544553), position must be below upper end limit switch	-	restart	61454
6a	set offset for retardation limit switch top	CM	Manufacturer specific: write value to object 2006h	13001-13999, position of the retardation limit can not be below upper end limit switch position	-	restart	61458
6b	set offset for retardation limit switch bottom	CM	Manufacturer specific: write value to object 2006h	14001-14999, position of the retardation limit can not be above upper end limit switch position.	-	restart	61458
7	define stops	TM	write “SETF” (0x46544553) to object 63ED index 01-200 [1)]	Maximum number of stops is 200. Please be aware of short distanced stops	-	long peep	

8	revisit stops	TM	revisit stops	To confirm stops each defined stop has to be revisited at least once more and stand still for at least 1 sec.	-	71	61474
9	confirm stops	TM	enter normal mode via PSU02 safety control object 63E2 index 06	magic word (read object and send read value back)		restart	61483

[1)] Index number is irrelevant, PSU02 sets a new stop and sorts them according the absolute position.

4.11 Guideline Manufacturer Specific

The following table gives a quick overview of all necessary steps for teaching PSU02.

Table 3: Recommended manufacturer installation process

Step	Stepname	State	Command	Note	Default	PSU02 Feedback
0	(optional) factory reset	-	2006h: 1	PSU02 resets to factory settings	-	restart
1	(optional) set Length Door-zone	61443	2006h: value of the entire door length + 1000	Value must be between 1010 and 1400	4 cm in total (2+2)	restart
2	(optional) define inspection limit mode	61443	2006h: 30 or 31 or 32 or 33 or 34	Please see table 6 for detailed information.	both activated	restart
3	(optional) set speed	61443	2005h Index 18: value of rated speed	Please see table 6.	8 m/s	restart
4	set upper end limit switch	61443	2006h: 9	Sets the upper end-limit of the elevator to the current position.	-	state 61450
5	set lower end limit switch	61450	2006h: 8	Sets the lower end-limit of the elevator to the current position.	-	restart, state 61454
6	set retardation limit switches	61454	2006h: send value + 13000, send value + 14000	Set retardation limits to the value minus 13000 for the upper and minus 14000 for the lower switch. Please see table 6.	-	restart, state 61458
7	define stops	61458	2006h: 5	Sets a stop to the current position of the elevator. You may set stops in any order, PSU02 will sort them automatically according to the value of the position **.	-	

8	revisit stops	61458	revisit stops	To confirm stops each defined stop has to be revisited at least once more and stand still for at least 1 sec. (by stopping there) and the elevator must not stop on any other undefined stop. PSU02 changes to state 61474 as soon as one stop is revisited	-	state 61474
9	confirm stops	61474	2006h: 6	Tells PSU02 to finalize the definition of all stops. On success PSU02 changes to normal operation. For further information please see chapter table 6.		restart, state 61483

5. In Operation

5.1 Door Bridging

Door bridging can be requested for pull-in, catch-up, and quick start for a specific stop.
Entry door bridging can be requested outside or inside the door area of the stop. Within the door area, however, only until the cabin comes to a standstill. Door bridging becomes active when the car is in the door area of the stop and the speed is less than 0.8 m/s.
It is best to request door bridging outside of the door zone of the stop you are approaching.
This allows the door bridging relay to switch as soon as the door zone is reached, leaving the maximum possible time to operate the doors.
When the vehicle comes to a standstill, or as soon as the speed falls below 0.3 m/s, the PSU02 switches over to bridging the door to catch up. The door bridging thus remains active even when the vehicle is at a standstill.
Door bridging for catch-up is only possible at a speed of up to 0.3 m/s. This speed must not be exceeded during the movement. Otherwise UCM is reported.
For entry and catch-up door override, when door override is no longer needed, the controller must disable it or switch to quick start override. Otherwise, UCM is reported when leaving the door zone.
Door override for quick start is only possible in a range of 2 cm around the flush position.
It is not necessary to switch off this bridging explicitly. It is automatically deactivated when the car leaves the door area.
Entry door override can be requested at any time outside the door area at any position, even if the car is at a different landing at the time. The request remains stored until the car reaches the desired stop. However, the request to bypass the door when entering is canceled if the car then moves in the opposite direction, i.e. away from the requested destination stop.
The door bridging request can be made according to the CANOpen Lift 417 protocol with the SDO 63E0h Index 01 or the TPDO 387. A manufacturer-specific SDO 2005h Index 15 „DoorBridging“ is also available (see table 7).
If one of the SDOs is used, the PSU02 responds with an error code in the case of an invalid or impermissible request. With TPDO 387 there is no feedback.

5.2 Inspection Mode

Due to the fact, that PSU02 does not need wiring of the inspection direction, one must follow the process of moving out of inspection end limits as thoroughly described in the operation manual of the PSU02 in chapter 7.1.2.

Below is a quick overview with the necessary commands to implement that process and status information.

1. During the inspection the speed is limited to 0.6 m/s. If this speed is exceeded, „overspeed“ is triggered and the SC opens until the lift stops. This can be read out on bit 15 of the status object 0x2005-8 (see table 7).
2. If the elevator is under inspection and passes an inspection limit switch position plus a 10 cm reserve, the SC is opened and status bit 14 is set to 0x2005-8 (manufacturer specific) and 0x63E1 (CANopen Lift 417) to signal this to the lift controller.
3. It is the responsibility of the controller to allow only driving in the direction to exit the inspection limit switch. If such a drive is required, the lift control asks to close the SC by means of a CANopen command 12 („bridgeInspectionEnd“, only possible in the three „define-stops“ states and in the „normal operation“ state).
4. Exceeding the „hard“ position of the inspection limit switch by 1.2 m (see figure 3) always causes the SC to open (see point above), which is no longer bridged by the PSU02 on request. Here, the elevator can only be moved by the releveling control or by switching off the inspection.

5.3 PSU02 Lock

The device is locked if a critical error occurs (safety circuit is open). The lock state can be checked via reading upbeat 2006h. The state for the lock mode is 61491.

To switch PSU02 to normal operation, the “Unlock Command” must be sent. E.g. Writing value 7 to object 2006h or by the way described in CANopen Lift 417. This has to be confirmed additionally with a power cycle of the PSU02, to assure the presence of a person. On success PSU02 restarts to state normal operation otherwise it stays in the locked mode.

NOTICE	Upon receiving the unlock command the device state changes to 61498 and stays there for 15 min to wait for the power cycle. If the time passes by without a power cycle the device state switches back to Lock 61491.

6. Error Handling and Confirmation Messages

For simplification errors are categorized into classes. That class number is sent via Emergency Object (1001h) as defined in CANopen Lift 417.

Additional all error occurrences (repetitive errors only once per minute) as well as confirmation messages are permanently saved with all error details as described below.

Table 4: Error Classes

Class	Class Name	Description
2	HW PSU02	Please restart the device. If the error reoccurs, the device is defect.
3	SW PSU02	Please restart the device. If the error reoccurs, the device is defect.
4	Communication problem between encoder an Evalution Unit	Please check if Ants LES is connected correctly and restart the device.
5	Problems with the power supply 24 VDC	Please check the power supply.
20	UCM	An UCM-case was detected. Unlock necessary.
21	Elevator refuge space	Please move the elevator out of the refuge space (see chapter subsection 2.2) or enter normal operation.
23	Overspeed detected	After three occurrences PSU02 goes into Lock mode.
30	Encoder tape problems	Please check if the tape is ok and it is mounted correctly.
31	Encoder mounting problem	Please check if the Encoder is mounted correctly. It has to be in an upright and straight position.
32	HW encoder	Please restart the device. If the error reoccurs, the device is defect.
33	Acceleration problems	Please check the system installation.
34	Free fall	Encoder has detected free fall.

The object SDO 2004h offers a cyclic buffer for accessing all occurred errors / confirmations (i.e. events), which are saved permanently and can be read also after a power cycle. PSU02 increases the count number of the errors constantly but will overwrite older ones upon reaching an error count of more than 640 entries. PSU02 keeps track of an internal readout number of that buffer. Most recent events have higher numbers.
The number increases with every entry throughout the whole lifecycle. Upon reaching the maximum number of entries older entries will be overwritten.

The information corresponding to that internal error count can be accessed by reading from 2004h index 2-5. The internal readout number can be set by writing to 2004h index 1. Reading from that very same index has the side effect of setting the internal readout index to its most recent event. Repeated reading from 2004h index 2 has the side effect of decrementing the internal readout number to offer simple successive event extraction in LIFO semantics. We recommend to read once index 1 to gain the maximum count within the buffer and resetting to most recent event. After that cyclic read index 2 to gain the respective error / confirmation code (and after that corresponding informations stored in index 3-5 if required) until the stack is red. For a detailed description of all relevant SDOs we refer to table 7.
Writing DEL (in h) to the object 2004h index 1 erases all errors and sets the error count to zero.

Table 5: Error and confirmation codes

Error / Confirmation Number	Description
1	An UCM-case was detected.
3-7, 17, 18	Internal error. The device is defect.
10-11, 16	Internal error. Please restart PSU02. If the error reoccurs, the device is defect.
12	Timeout: no new position. Please check if PSU02 is connected correctly and restart PSU02.
13	24 VDC not correct.

19	Refuge space violation during inspection drive.
23 (from software version v216)	Position code is not valid. Error can only occur when booting / restarting through unlock.
24 (from software version v216)	Code tape is not clamped in the device.
26 (from software version v216)	Measurement of the clock track is not possible (small holes).
27 (from software version v216)	Measurements in the channel is not plausible.
28 (from software version v216)	Measurement of the code track is not possible (large holes).
29 (from software version v216)	The device is not level (on average more than 15 degrees inclined).
30 (from software version v216)	Difference between channels during operation.
31 (from software version v216)	Channel has failed.
32 (from software version v216)	BUS communication error.
33 (from software version v216)	Unauthorized communication on the BUS.
34 (from software version v216)	CRC checksum error via program code.
35 (from software version v216)	Acceleration values are not plausible.
37 (from software version v216)	Device is not upright. Error can only occur when booting / restarting through unlock.
38 (from software version v216)	Driving the device too fast detected (system limits 12 m/s).
39 (from software version v216)	Partial voltage drop in the device.
40 (from software version v216)	Incorrect measurement.
42 (from software version v216)	Logic defect.
43 (from software version v216)	Logic defect.
44 (from software version v216)	Free fall (1g).
45 (from software version v216)	Ants Safe encoder (Ants LES) in LOCK.
46 (from software version v216)	Ants Safe encoder (Ants LES) starts.
50	Lower end-limit not below upper end-limit.
51	Maximum number of possible stops reached. Error condition 1-2 indicate the maximum number of stops.
52	It is not possible to determine the stop because the elevator is moving.
53	Stop position not possible (e.g. overlapping with other stop or outside elevator limit).
54	Confirmation of all stops not possible, because not all stops were revisited. Error condition 1-2 indicates one position which had not been revisited.
55	Timeout within the state machine model. Error condition 1-2 tells which timeout: 1. ... from “set end limits”, 2. ... from “define stops”.
56	Door bridging on running-in not accepted (when approaching the stop, a door override was requested, but in the door zone the bridging relay was not activated).
70	A final stop or preliminary stop has been written. Confirmation condition 1-2 indicate the position which has been written.
71	A final stop or preliminary stop was approached again for confirmation. Confirmation condition 1-2 indicate the position which has been written.
80	Final limit switch position with shortened shaft head was fixed.
81	An unsafe error condition has been unlocked.
100	PSU02 restarted.
101	PSU02 restarts because it performs its periodic relays test.
102	PSU02 resets to factory settings.
2xx (up to software version 213a)	Errors reported from Ants Safe encoder (Ants LES).

7. Firmwareupdates

Firmwareupdates can now be done by the integrated CANopen bootloader. For that purpose please follow steps below.

1. Write value 0x50 to object 0x6005 index 1.
2. Do a NMT application reset according to CANopen 301.
3. PSU02 has now started in bootloader mode indicated by the node-id 126.
4. Send value 3 to object 1F51h index 1 to erase the current programmed firmware.
5. Download the new firmware to object 1F50h index 1.
6. On success do a NMT application reset again.

The new firmware is now running indicated by the devices specific nodeid (default 4).

8. CANopen Reference - Manufacturer Specific

8.1 Parametrization Commands

Table 6: Possible commands to program PSU02 using SDO 2006h

Command Name	Number	Description
Factory Reset (not in Figure)	1	This command can be issued at any time and resets the PSU02 to factory values. On success PSU02 resets values and restarts to state “set length door zone”.
Restart System (not in Figure)	2	This command can be issued at any state, except “human present control” and restarts the PSU02 and associated safety timers. This can be usefully to explicitly perform a diagnosis and relays check in full knowledge of the lift control. Otherwise these checks are performed after a predefined time delay automatically and the switching safety circuits might confuse the lift control.
SetPreliminaryStop	4	Sets a stop preliminarily at the current position. This means a 10 mm door zone is provided whilst in that state. This can be used by lift controls in teaching mode. It can be skipped by programming a final stop using the SetStop-command. On success PSU02 sends the respective confirmation (which can be read from 2004h) and beeps and stays in the state. Note, that this state is offered as help during teaching of the lift control unit. If the car moves faster than 0.63 m/s or after one hour, that state is automatically left and all preliminary stops are removed.
SetStop	5	Sets a final stop at the current position. This can only be undone through a power cycle which will delete all stops so far. So be sure that this position is final. On success PSU02 sends the respective confirmation (which can be read from 2004h) and beeps and switches to the respective state. Note that all preliminary stops are deleted once exiting state “define preliminary stops” and no door zones (via relays) are provided anymore.
ConfirmStops	6	Tells PSU02 to finalize the definition of all stops. This can only be achieved, after each defined stop (form command 5) is revisited at least once more (by stopping there) and the elevator did not stop on any other undefined stop. On failure it writes the respective error (which can be read from 2004h) and beeps and stays in the state. On success PSU02 saves the stops permanently and restarts to state “normal operation”.

PSU Unlock	7	Resets the PSU02 to normal mode once in state “PSU lock”. This has to be confirmed additionally with a power cycle of the PSU02, to assure the presence of a person. On success PSU02 restarts to state “normal operation” otherwise it stays in the locked mode.
SetLowerLimit	8	Sets the lower end-limit of the elevator to the current position. On success PSU02 saves and restarts to state “define preliminary stops”. On failure it writes the respective error (which can be read from 2004h) and beeps and stays in the state.
SetUpperLimit	9	Sets the upper end-limit of the elevator to the current position. On success PSU02 moves to state “set end limits”.
RemoveAllStops	10	This command removes all programmed stops und resets the PSU02 to state “define preliminary stops”, conserving end-limit positions only.
BridgeInspectionEnd	12	This command tells PSU02 to close the circuit, so the control will be able to move the car outside the inspection end limit.That is only possible during the states“define-stops“ and „normal operation“ and only if the car is only max. 10 cm beyond the inspection end limit switch.
SetReducedUpperLimit	19	Sets a temporary upper end limit switch exactly 1500 [mm] above the momentarily position (for lifts with reduced shaft-head) e.g. if the car is on position 10000 [mm] the upper end limit will be temporarily saved on position 11500 [mm]. The position is saved permanently if the car is stopped at the same position or above within 15 minutes.
DefineInspectionLimits	30-34	Tells PSU02 by sending the command: 30: no inspection end limits, 31: only upper inspection end limit, 32: only lower inspection end limit, 33: upper and lower inspection end limits 34: no upper nor lower inspection end limit, but wiring of inspection is done. Those commands are only possible when in state "set length doorzone".
SetLengthDoorzone	1010-1400	Sets the length of the door zone to the written value minus 1000. On success PSU02 saves and restarts to state “set length door zone”. The zone is centered around each stop.
ChangeEndLimits	9000-11000	Moves the end limit switches towards each other. The number l = 9000 − 10000 moves the lower end limit switch by l − 9000 [mm] upwards (eg. l = 9034 means: 34 mm upwards). The number u = 10000 − 11000 moves the upper end limit switch by u − 10000 [mm] downwards (eg.u = 10117 means: 117 mm downwards). See also Table 7, 2005h index 3-4). The switches cannot be moved over an existing stop. On success the system restarts with the newly defined end limit switches.
MoveRetardationSwitch upwards	13000 - 13999	Moves the retardation switches towards each other. The number l = 13000 − 13999 moves the lower retardation switch by l − 13000 [cm] upwards (eg. l = 13176 means: 176 cm upwards). The switches can only be moved within end limit switch positions. On success the system restarts with the newly defined switches. Retardation switches must be set in retardation setup state and can be moved in normal operation.
MoveRetardationSwitch downwards	14000 - 14999	Moves the retardation switches towards each other. The number u = 14000 − 14999 moves the upper retardation switch by u − 14000 [cm] downwards (eg. u = 14077 means: 77 cm downwards). The switches can only be moved within end limit switch positions. On success the system restarts with the newly defined switches. Retardation switches must be set in retardation setup state and can be moved in normal operation.
*setSpeed		Please see table relevant Manufacturer SDOs 2005 index 18

8.2 Relevant Manufacturer SDOs

Table 7: Relevant manufacturer SDOs and their meaning

SDO	Description
2000h	Reading: current node id.Writing: sets node id to the entered value.
2001h	Reading: current bitrate. Writing: sets bitrate to entered value.
2002h	0: PSU02 starts in NMT state pre-operational 1: PSU02 starts in NMT operational
2003h	Cyclic error and confirmation array (see table 5).
2004h	Cyclic error and confirmation array (see table 5).
2004h index 0	Object length set to 8. Do not alter.
2004h index 1	Reading: number of items in cyclic buffer (max: 1000). Resets the internal current error/confirmation readout number to the most recent. Writing: sets the internal current error/confirmation readout number to this value. Valid range [1-1000].
2004h index 2	Reading: returns the information of the internal current error/confirmation readout number whereas millions count the number itself, thus e.g.: 12000050 means 12th item in cyclic buffer with error number 50. Successive reading of that index reduces the internal current readout counter by one enabling iterative readout of all informations. Writing: no effect.
2004h Index 3	Reading: returns the time since power on in seconds when the current error/confirmation happened. Writing: no effect.
2004h index 4-5	Reading: returns the condition 1-2 and 3-4 respectively of the current error/confirmation (see table 6). Writing: no effect.
2004h index 6	Reading: overall count of errors/confirmations since power on. Writing: no effect.
2004h index 7-8	Reserved. Do not alter.
2005h	Read Only (except index 6). Returns the parameterization of the PSU02. Position values are always (raw) absolute without correction of the position value offered in SDO 2003h. The latter only affects the position value gained from SDO 6383h and its corresponding TPDO 263 (COB-ID 396). Note this SDO might have delayed values up to 500 ms.
2005h Index 0	Length of array.
2005h index 1	Release CRC of the software.
2005h index 2	Length of door zone in mm.
2005h index 3	Position of upper end limit.
2005h index 4	Position of lower end limit.
2005h index 5	Number of stops.
2005h index 6	Writing: indexes the stop required [1 – saved stops]. Reading: returns the position of the stop indexed by the previous write operation. Note: stops are in chronological order.
2005h index 7	reserved

2005h index 8	PSU02 status bits: bit 0: reserved bit 1: reserved bit 2: upper end limit bit 3: lower end limit bit 4: UCM bit 5: door zone bit 6: flush zone bit 7-11: reserved bit 12: door bridging active bit 13: in retardation switch bit 14: in inspection end limit bit 15: overspeed detected others: reserved
2005h index 9	Current time in seconds since power up.
2005h index10	Returns inspection limit configuration. bit 0: upper inspection end limit on/off bit 1: lower inspection end limit on/off bit 2: inspection wired yes/no
2005h index 11-14	Position of first 4 stops (development only).
2005h index 15	Writing: bit 0: door bridging on entry bit 1: door bridging re-leveling bit 2: door bridging fast start bit 3-15: number of stop Example: 9 = 00001001b requests a door bridging when entering stop number 1. • Bit 0 to bit 2 cannot be combined with each other otherwise the command is invalid. • If bit 0 to bit 2 are 0 (none of the bits is set) then an existing door bridging for this stop is deleted. • If the value 0 is written in this SDO, then every existing door bridging is deleted in every possible stop will be deleted. This also applies to SDO 63E0h/01 and TPDO 387.
2005h index 16	Reading: returns position of upper retardation switch
2005h index 17	Reading: returns position of lower retardation switch
2005h index 18	Writing: Sets the rated speed of the lift in mm/s. Possible parameter range is 100 − 8000. This can be done any time. On success PSU02 restarts.
2006h	Reading: current system state number of PSU02 (see figure 1) Writing: sending respective command to PSU02 (see table 6). Commands not applicable in the current state are ignored.

9. FAQ

1. PSU02 remains in state 61505 System initialize. This indicates that PSU02 is not getting any positions. Please check if the Ants encoder is proper installed (straight) and the tape is correctly inserted.
2. PSU02 is peeping 3 times while Ants is moving. This indicates that the tape is inserted upside down. Please be sure to mount the tape with the topside up.

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