

LiftOne Commissioning Guide V5

LS Automation Solutions

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Chapter 1. Elevator application

Application summary

Elevators (lifts) are integrated electrical/mechanical devices that carry people and cargo in buildings, buildings, airports, subways, and overpasses. Since elevators are human-ride systems, safety and reliability are very important. In recent years, due to the rise of high-rise buildings, excellent ride comfort, energy saving and synchronous motors that do not use a reducer are often used, replacing the induction motor driving method using a reducer. Accordingly, advanced technologies such as improved ride comfort and prevention of roll-back during start-up by driving the synchronous motor have been developed.

Motors applied to elevators are largely classified into induction motor starting method and synchronous motor driving method. Induction motors are mainly applied to places requiring high-rise and high-speed operation, and synchronous motors are applied to buildings that do not have space to install a separate machine room or lower floor.



[Fig.1. Classification according to an elevator installation space]

Chapter 2. LiftOne parameter

Function	Group (Class 1)	Group (Class 2)	Synchronous motor (MR_PM / MRL)		Asynchronous motor (MR_IM)	
Check option	C -> Driver Settings	DISPLAY	DIS-04_Opt. Board	Endat	DIS-04_Opt. Board	Incremental
Control		PARAMETER	PAR-07_Control Mode	Speed(PM)	PAR-07_Control Mode	Speed(IM)
Motor			PAR-09_Motor Select	User Define	PAR-09_Motor Select	User Define
			PAR-10_UserMotorSel	Name plate	PAR-10_UserMotorSel	Name plate
			PAR-11_Max Speed	Name plate	PAR-11_Max Speed	Name plate
			PAR-14_Sync Speed	Name plate	PAR-15_Rated Volt	Name plate
			PAR-15_Rated Volt	Name plate	PAR-16_Pole Number	Name plate
			PAR-16_Pole Number	Name plate	PAR-18_Rated-Slip	Max – RPM(Name plate)
			PAR-19_Rated Curr	Name plate	PAR-19_Rated Curr	Name plate
			PAR-20_AC In Volt	AC input voltage	PAR-20_AC In Volt	AC input voltage
Encoder			PAR-23_Enc Type	2 (Sin/Cos_All) 3 (Sin/Cos_1387)	PAR-23_Enc Type	0 (A/B Pulse) (Default)
			PAR-24_Enc Pulse	Encoder specification	PAR-24_Enc Pulse	Encoder specification
Autotuning			PAR-31_AutoTuneType	1(Standstill)	PAR-31_AutoTuneType	1(Standstill)
			PAR-51_PM AutoTune	1 (All)	PAR-41_IM AutoTune	1 (ALL1)
Car speed		ELEVATOR	E/L-01 Max. CarSpd	1m/s(Default)	E/L-01 Max. CarSpd	1m/s(Default)
			E/L-03_Car Speed	1m/s(Default)	E/L-03_Car Speed	1m/s(Default)
			E/L_04 Rated MotSpd	Name plate	E/L_04 Rated MotSpd	Name plate
Floor	W -> Wizard Settings	A06	A06 MAX FLOOR COUNT	Floor Number	A06 MAX FLOOR COUNT	Floor Number
UCM	G -> FUNCTIONAL SETTINGS	G01	G01 UCM Source	NONE(Default) OVER SPEED REG. MOTOR BRAKE	G01 UCM Source	NONE(Default) OVER SPEED REG. MOTOR BRAKE
Sensor type	D -> SHAFT SETTINGS	D05	D05 SHAFY COPY TYPE	ENCODER ML1-ML2		ENCODER ML1-ML2
				ENCODER LS-LADS		ENCODER LS-LADS
FHM	Q34 Shaft Copy Mode	-	Q34 Shaft Copy Mode	ACTIVE	Q34 Shaft Copy Mode	ACTIVE
Parameters for troubleshooting below						
Elevator input status	C -> Driver Settings	ELEVATOR	E/L-39_ELIO IN Neg	001111111111	E/L-39_ELIO IN Neg	001111111111
Motor direction		PARAMETER	PAR-25_Enc Dir Set	0 A Phase 1.B Phase(Default)	PAR-25_Enc Dir Set	0 A Phase 1.B Phase(Default)
Pole position estimation		PARAMETER	PAR-44_MagDet Volt	80(Default)	-	-
			PAR-45_MagDet Curr	70(Default)	-	-
Ride Performance		CONTROL	CON-71_ARF Time	0(Default)	-	-
			CON-72_ARF ASR P	1000(Default)	-	-
			CON-73_ARF ASR I	50(Default)	-	-
	CON-74_ARF APR P		200(Default)	-	-	

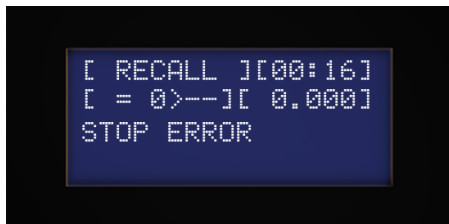
			CON-02_ASR PI Ratio	300(Default)	-	-
			CON-03_ASR P Gain1	500(Default)	CON-03_ASR P Gain1	500(Default)
			CON-04_ASR I Gain1	300(Default)	CON-04_ASR I Gain1	300(Default)
Initial Pole Position Estimation Test		DISPLAY	DIS-08_Init Theta	-	DIS-08_Init Theta	-
Door	F-> Door settings	F20	F20 DOOR OPEN TIME	3sec(Default)	F20 DOOR OPEN TIME	3sec(Default)
		F30	F30 DOOR CLOSE DELAY	1sec(Default)	F30 DOOR CLOSE DELAY	1sec(Default)

Chapter 3. Quick commissioning procedure

Machine Roomless(MRL) & Machine Room Synchronous (MR PM) & Machine Room Asynchronous (MR IM) parameter setting and start-up

Yellow shaded refer to Machine Room Asynchronous (MR IM)

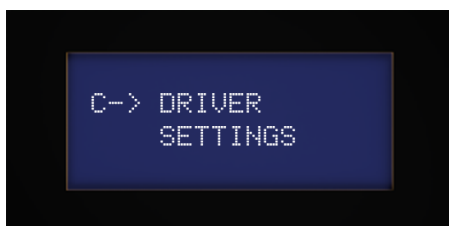
1. After power on, LCD will have message below.



2. In order to adjust drive parameters, please press ``Enter`` button for 2 seconds.



3. Please press ``Up`` key to navigate through settings pages and find ``C -> Driver Settings``.



4. Please press ``Enter`` key to get in group parameters selection.

By using ``Up`` and ``Down`` keys navigate through group parameter titles to select ``DIS Display Group``.

LiftOne



5. Please press ``Enter`` key to get in ``DIS Display Group`` parameters then go to ``DIS04`` by using ``Up`` key and check ``DIS04 Opt. Board`` parameters displays ``ENDAT`` (if it is MR IM, DIS04 Opt. Board parameter will be displayed ``A/B Pulse``).

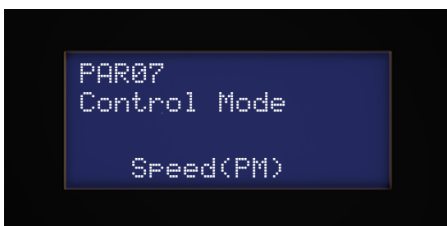


6. Please press `Escape` key to get back to parameter group selection list.

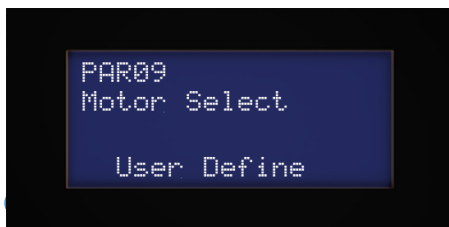
7. Go to `PAR Parameter [PAR] Group` press `Enter`.



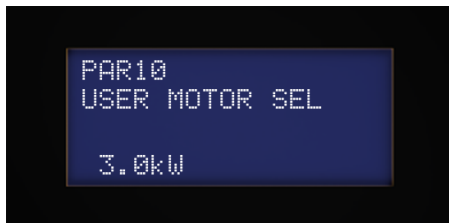
8. Then please select PAR07 Control Mode to `Speed(PM)` (if it is MR IM, PAR07 Control Mode ` parameter will be displayed `` Speed(IM)``).



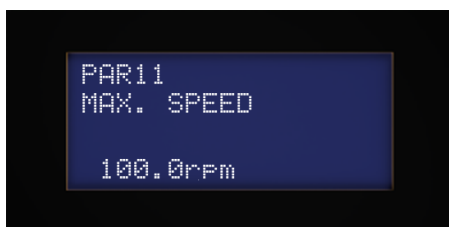
9. Please go to `PAR09` and select `User Define`.



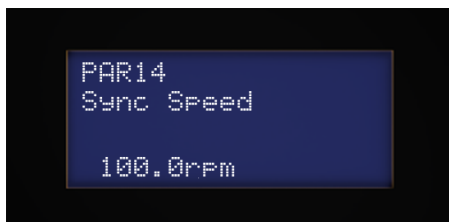
10. Go to `PAR10` and enter the exact motor capacity written on motor nameplate.



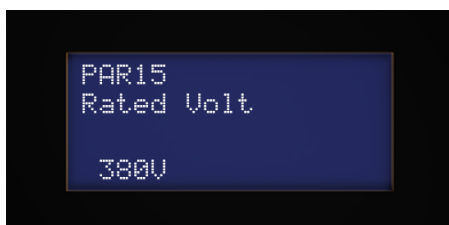
11. Go to `PAR11` and enter the exact motor speed written on motor nameplate.



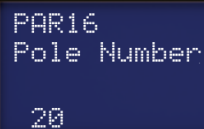
12. Go to `PAR14` and enter the exact sync speed (usually motor speed and sync speed is identical) written on motor nameplate (if it is MR IM, PAR18 Rated-Slip value should be changed according to Max RPM – rated RPM).



13. Go to `PAR15` and enter the exact motor voltage written on motor nameplate.



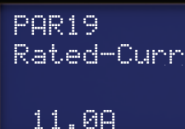
14. Go to `PAR16` and enter the exact motor pole number written on motor nameplate.



```

PAR16
Pole Number
20
    
```

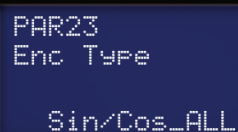
15. Go to `PAR19` and enter the exact motor current written on motor nameplate.



```

PAR19
Rated-Curr
11.0A
    
```

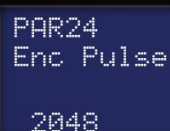
16. Go to `PAR23` and enter the type of encoder used (Sin/Cos or ENDAT) (if it is MR IM, PAR23 Enc Type should be selected to `` A/B Pulse``).



```

PAR23
Enc Type
Sin/Cos_ALL
    
```

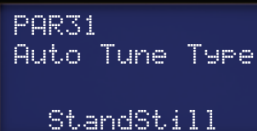
17. Go to `PAR24` and enter the pulse number written on encoder nameplate.



```

PAR24
Enc Pulse
2048
    
```

18. Go to `PAR31` and check that `Auto Tune Type` is `Standstill`.



```

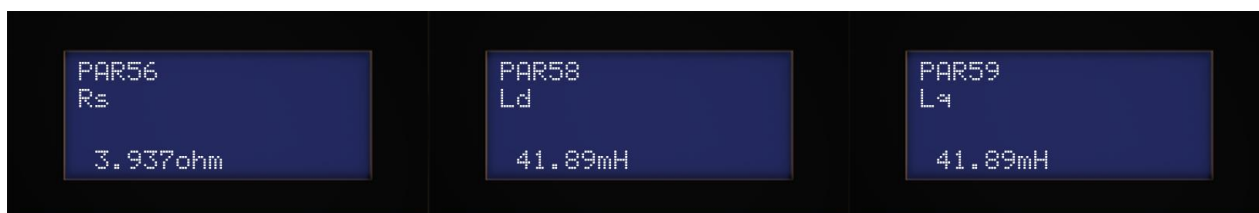
PAR31
Auto Tune Type
StandStill
    
```

19. Go to `PAR51` `PM Autotune` and press `Enter` select `ALL` by using `UP` key and press `Enter` to start AutoTuning process. (if it is MR IM, PAR51 IM AutoTune parameter should be selected).



20. Please wait until `Please wait` stops blinking on screen.

TIP: In order to get the best result from AutoTuning process. Take note of `PAR56`, `PAR58` and `PAR59` results after first AutoTuning, and do a second AutoTuning by following above step. After second AutoTuning has completed, compare results. If results are within $\pm 1\%$ of each other, AutoTuning results are good to use. (if it is MR IM, AutoTuning values are related to PAR52, PAR53, PAR54, PAR55, PAR56 results).



21. Please press `Escape` key to get back to parameter group selection list.

22. Go to `E/L ELEVATOR[E/L] Group` press `Enter` then you will see screen as below.

23. Please set Maximum car speed from motor nameplate. (Default : 1m/s)

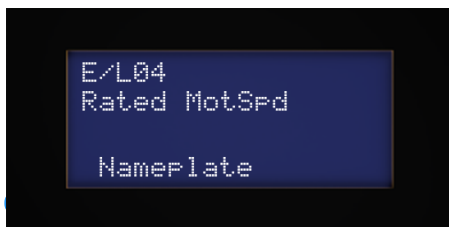


24. Go to `E/L03 Car Speed` parameter and select the desired speed for car in normal operation.

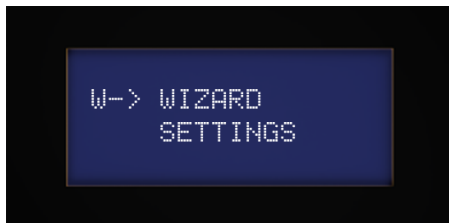
(Default : 1m/s)



25. Please set rated motor RPM from motor nameplate.



26. Press `Escape` twice and navigate to `W -> Wizard Settings` and press `Enter`



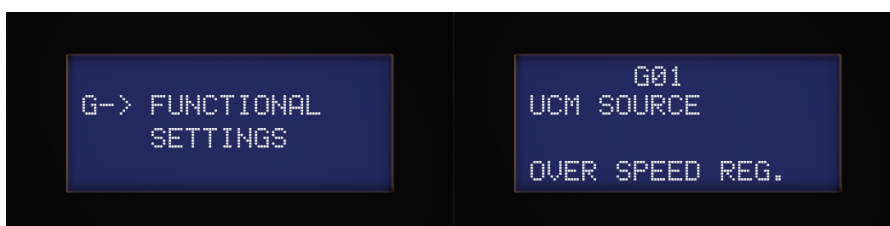
27. Go to `A06 MAX FLOOR COUNT` parameter and press `Enter` then select the total number of stops (Ex. If building consists of 5 stories and 1 entrance, select 6 stops)



28. Please press `Escape` once and go to main parameter group selection.

29. Go to `G -> FUNCTIONAL SETTINGS` press `Enter` and select `G01 UCM Source` if UCM source exists.

Press `Enter` and choose the appropriate UCM Source by using up or down keys. Press `Enter` and confirm selection.



30. Please exit menu by pressing `Escape` once and second time press for 2 seconds.

31. Please put switch in to `Re-call Operation` state.

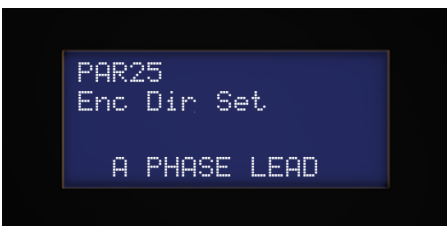
LiftOne



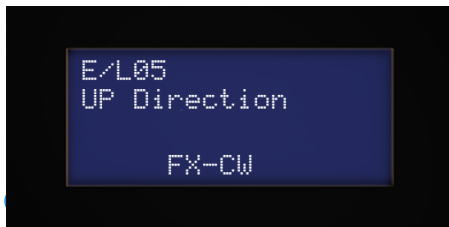
32. By using re-call buttons in LiftOne, test if car moves with intended speed, and direction.



If the car doesn't move and you hear a loud abrupt sound from motor please. In this case please go to `C – Drive Settings` and enter `PAR Group` and go to `PAR25` and change `Enc Dir Set` from `B Phase Lead` to `A Phase Lead`, in case it was `A Phase Lead` change to `B Phase Lead`.



If the car moves in the wrong direction, please go to `E/L Elevator Group` and go to `E/L05 UP Direction` press `Enter` and change value `FX-CCW` to `FX-CW` and try manual operation again.



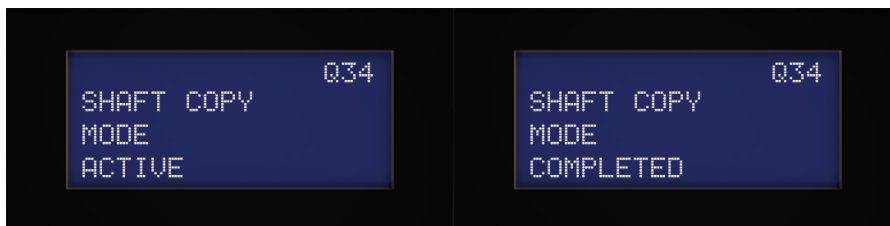
33. After elevator passes direction test, please proceed to do FHM(Floor Height Measurement).

Please put switch on the controller to `Normal Operation` state.



34. Press `Down` button navigate to `Q34 Shaft Copy Mode` and press `Enter` Select `ACTIVE` and press `Enter` again.

FHM operation will start, and you will see `Please wait`. During this time the car will manually move to bottom floor, starts FHM towards top floor. Then after successful completion, car will move down to top floor level, open and close door. Then move to bottom floor in normal operation mode and open then close gates once more and you will see `COMPLETED` on the keypad.



Chapter 4. Troubleshooting guide

LiftOne Q.C.G.

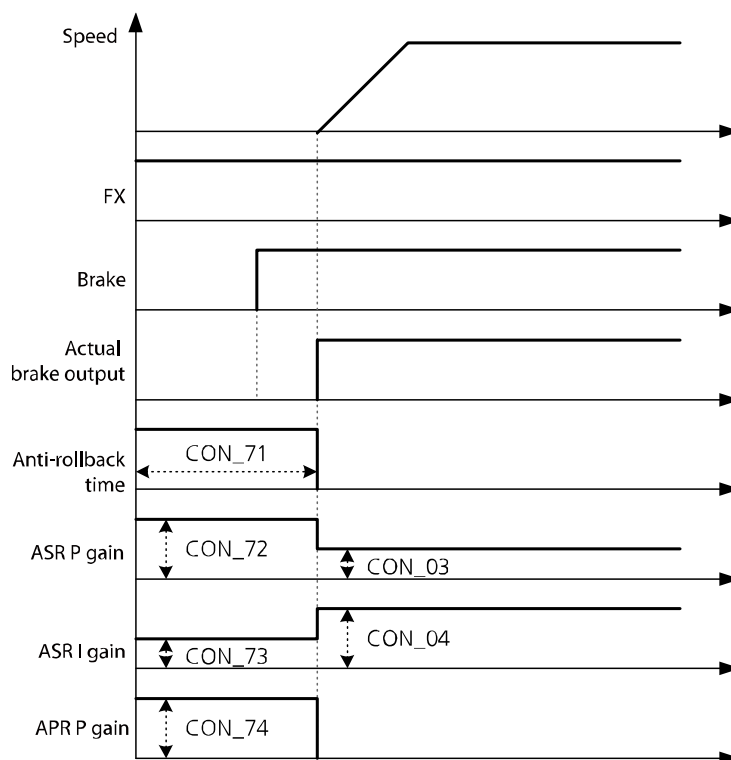
Fault	How to solve																																																																																																																																																												
2.C.G. Floor Leveling	In case there is a little offset between floor and car, please proceed to fix by manually adding offset to floor levels. To do this adjustment: Please press `Enter` for two seconds and enter parameter group selection. Go to `D -> Shaft Settings` press `Enter` and select `D20` press `Enter` once more. In `D20` parameter by using `up` or `down` key select the floor for adjustment. Once the desired floor has been selected press `Enter` to adjust `UPWRD` and `DNWRD` floor offsets. One press of `Enter` key lets user adjust `UPWRD` floor adjustment by using `UP` or `DOWN` keys. Second press to `Enter` will accept the adjustment to `UPWRD` and let user select the desired offset to `DNWRD` direction. Example: Elevator car starts moving from floor #2 to floor #3. Once car reaches floor and car is 3mm lower than the floor level. Please follow steps above and select Floor 3 in `D20` parameter and enter `3mm` to `UPWRD` direction offset. General rule of thumb is, if car is lower than the floor level, offset needs to be positive, and if car is higher than the floor level, offset must be negative number. If a value already exists in offsets, please consider already existing value and add or subtracts from existing value to determine the optimal value required.																																																																																																																																																												
Motor is not moving at recall mode	Go to `E/L44 ELIO In Neg`. If Inductor 1 and Inductor 2 is normally open, and Slow Down switches and limit switches are normally closed, value in E/L44 should be: "001111111111". Normally open sensors are configured with "0" and normally closed ones are configured as "1". Please refer to table below to check which sensor is which bit. <table><tr><th>I_D</th><th>I_U</th><th>DLS</th><th>ULS</th><th>RV1</th><th>RV2</th><th>SD1</th><th>SU1</th><th>SD2</th><th>SU2</th><th>DAC</th><th>RV3</th></tr><tr><td colspan="4">I_D</td><td colspan="8">Downside inductor signal</td></tr><tr><td colspan="4">I_U</td><td colspan="8">Upside inductor signal</td></tr><tr><td colspan="4">DLS</td><td colspan="8">Down Limit Switch</td></tr><tr><td colspan="4">ULS</td><td colspan="8">Up Limit Switch</td></tr><tr><td colspan="4">RV1</td><td colspan="8">Reserved</td></tr><tr><td colspan="4">RV2</td><td colspan="8">Reserved</td></tr><tr><td colspan="4">SD1</td><td colspan="8">Downside Deceleration Switch 1</td></tr><tr><td colspan="4">SU1</td><td colspan="8">Upside Deceleration Switch 1</td></tr><tr><td colspan="4">SD2</td><td colspan="8">Downside Deceleration Switch 2</td></tr><tr><td colspan="4">SU2</td><td colspan="8">Upside Deceleration Switch 2</td></tr><tr><td colspan="4">DAC</td><td colspan="8">Deceleration approval signal</td></tr><tr><td colspan="4">RV3</td><td colspan="8">Reserved</td></tr></table>	I_D	I_U	DLS	ULS	RV1	RV2	SD1	SU1	SD2	SU2	DAC	RV3	I_D				Downside inductor signal								I_U				Upside inductor signal								DLS				Down Limit Switch								ULS				Up Limit Switch								RV1				Reserved								RV2				Reserved								SD1				Downside Deceleration Switch 1								SU1				Upside Deceleration Switch 1								SD2				Downside Deceleration Switch 2								SU2				Upside Deceleration Switch 2								DAC				Deceleration approval signal								RV3				Reserved							
I_D	I_U	DLS	ULS	RV1	RV2	SD1	SU1	SD2	SU2	DAC	RV3																																																																																																																																																		
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Floor height measurement failure	The fault occurs if the number of shielded plates detected in the upper and lower inductors after floor height measurement doesn't match the number of stop floor (E/L-02). `Fcount` is displayed on the home screen (Also available on the DIS_05). If FHM before moving to top, and right after reaching bottom, please lower related manual speed and try again.																																																																																																																																																												

Floor height data error	If there is a negative numbered floor from the bottom to the top floor. If there is a floor with a floor height of less than 2000mm or with a floor height higher than that of the upper floor. It is displayed as 'Fdata' on the home screen (Also available on the DIS_05).
Floor height data check sum error	The fault occurs when there is a difference between the check sum of the floor height data and check sum stored in the EEPROM in the past. The fault could be detected before initializing or starting automatic operation. It is displayed as 'ChkSum' on the home screen (Also available on the DIS_05)
Deceleration error	The fault displayed when the operation command (FX/RX) is not released even after a certain amount of time has elapsed since the deceleration began. Only visible on the home screen.
Forced deceleration switch error	Both SDS-D1 and SDS-U1 are detected at the same time. (If the SDS2 used, the fault occurs when SDS2 is detected at the same time. If SDS-D1 (SDS-U1) input is not detected at the bottom floor (top floor), or SDS-U1 (SDS-D1) input is detected. The fault displayed when it is not the bottom floor (top floor) at the time SDS-D1 input is detected. 'SDS' is displayed on the home screen. (Also available on the DIS_05).
Vibration	Vibrations of the car could occur because of the characteristic of the machine. And reasons are like below. 1) If the motor constant differs from the actual value due to poor tuning 2) If the speed gain is inappropriate. 3) In the case of an induction motor, if you decreases the PAR-52(Flux-Curr) or after high speed automatic operation, set the PAR-52(Flux-Curr) as the recommended magnetizing current DIS-02(Flux Cur Ref). Adjustable parameters as below. CON-02 : It is related to the speed gain if there are vibrations after pole-position estimation and auto-tuning. CON-03 : The smaller the CON_02, the larger the CON_03, the smaller the CON_04, the more noise the motor may occurs. Decreasing the CON_03 and increasing the CON_04 without adjusting CON_02 may improve the vibrations if there are vibrations. CON-04 : If the CON_03 is too small or the CON_04 is too big, landing could be unstable because the speed response is too slow. So, they shall be set to an appropriate value. PAR-44 : Increase / Decrease Magnet Detection Voltage PAR-45 : Increase / Decrease Magnet Detection Current * The CON-02 is not displayed in MR IM.

LiftOne Q.C.G.

Roll-back

1. Set P&I gains in CON_03, 04
Optimal setting to minimize overshooting effect
 2. Set CON_71=ARF Time: Approx. 700 ~ 1000 [ms]
 3. Set CON_72=ARF ASR P: Set this higher than CON_03
If rollback occurs, increase the P-gain. If noise or vibration occurs, reduce the setting.
 4. Set CON_73=ARF ASR I: Set this smaller than CON_04
If rollback occurs, reduce the I-gain. If noise or vibration occurs, increase the setting.
 5. Setting for CON_74=ARF APR P: If rollback occurs at default value, increase the setting. If noise or vibration occurs, reduce the setting.
- *CON71~CON74 will not effect on MR IM.



Chapter 5. Functional Description

5.1 Option Boards and Encoder Check

LiftOne Q.C.G.

- The LED in the upper left corner of the option board flashes every 1 second when an encoder and options are the same with the settings. Otherwise, it flashes at an interval of 0.5 seconds (Abnormal).
- In case of abnormal operation, check out the option board type and encoder settings. If it is abnormal while DIS-04 is 'EnDat' and PAR-23 is 'EnDat', check out the wiring of the encoder and encoder type whether if it supports EnDat (ECN1313).
When DIS-04 is 'EnDat' or 'sin/cos', the used encoder is 'sincos' encoder, Sin+(A+), Sin-(A-), Cos+(B+), Cos-(B-) are normal, then the operation is possible.
But, every time power is turned on, the drive estimates the position of the poles.
Normal operation is possible if the encoder is ERN1387 and PAR-23 is set to 'Sin/Cos_All'.
However, LED flashes at an interval of 0.5 seconds and every time the power is turned on, the drive estimates the position of the poles.

***Notice: If the control mode (PAR-07) is IM (induction motor), only the A/B Pulse encoder could be used and PAR-23 is not visible.**

5.2 Motor Information Settings

Setting Items	Description
PAR09 Motor Select User Define	- Motor capacity selection - IM: Select the capacity of the motor from the menu. - PM: If there isn't the proper capacity from the menu, please set it to 'User Define'
PAR10 UserMotorSel 4.3 kW	User-defined capacity setting
PAR11 Max Speed 95.0 rpm PAR-12_Min. Speed(IM) PAR-13_Base Freq(IM) PAR-14_Sync Speed(PM) PAR-15_Rated Volt PAR-16_Pole number PAR-17_Efficiency PAR-18_Rated-Slip(IM) PAR-19_Rated Curr PAR-20_AC In Volt	- Input the information from the nameplate of the motor. - If there is no information on the nameplate of the motor such as efficiency, leave it as the initial value. - Parameters are separated for IM and PM.

5.3 Encoder Information Settings

LiftOne Q.C.G.

Setting Items	Setting Range	Description
PAR23 Enc Type Sin/Cos_1387	0: A/B Pulse 1: EnDat 2: Sin/Cos_All 3: Sin/Cos_1387	Encoder type
PAR24 Enc Pulse 2048	360~32768	The number of the encoder pulses
PAR25 EncDirset B Phase Lead	0: A Phase Lead 1: B Phase Lead	Direction of the encoder signal



'B Phase Lead'
Direction

- If the installed encoder is a 'sin/cos' encoder (ERN1387), Set PAR-23_Enc Type to 'Sin/Cos_1387'.
- When the HEIDENHAIN encoder signals are connected to the option board, PAR-25_EncDirSet is 'B Phase Lead' and PAR-26_Sc_EnDat Dir is 'CCW' (Displayed when MAK group is activated.), the counterclockwise direction is the forward direction.
- Conversely, in order to make clockwise direction as the forward direction, Set PAR-25_EncDirSet to 'A Phase Lead' and two of the U/V/W terminals need to be switched.

5.4 Motor Auto-tuning

Setting Items	Description
PAR31 AutoTuneType StandStill	• Select type of auto-tuning(Standstill/Rotational) • PM: Only 'Standstill' available • The default is 'Standstill' for elevator
PAR41 IM AutoTune All1	• IM auto-tuning
PAR51 PM AutoTune All1	• PM auto-tuning • Select 'All' to perform auto-tuning. ※ If there is a M/C on the output side, check the status before performing.

- If the manufacturer of motor provides the motor parameters, please input them into PAR-29_Ld, PAR-30_Lq, PAR-31_Rs.
 - ※ Please compare the parameters provided by the manufacturer of motor to auto-tuned values in some cases where the error is large.
- If there are no motor parameters provided by the manufacturer of motor, please auto-tune according to the procedure.
- If the Sin/Cos encoder or the control board of L100 is exchanged, please make sure to execute the initial pole position estimation and operate the motor.
 - 1) After setting PAR-23(Enc type) to 'A/B Pulse', press the 'Enter' key on the keypad and set

PAR-23 to the proper encoder or option board type again.

2) Please set MAK-54(Theta Offset) to 0.0000 → Displayed when MAK group is activated.

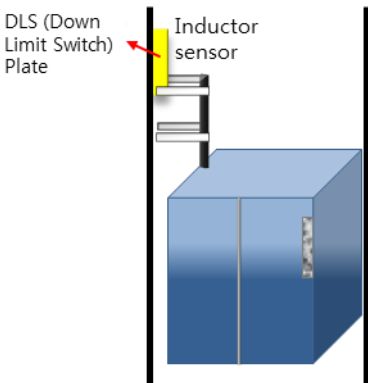
5.5 Initial pole position Estimation (PM only)

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Setting Items	Descriptions
PAR44 MagDet Volt 80V	- Default: 80V - DC voltage to estimate the position of the motor's pole.
PAR45 MagDet Curr 70%V	- Default: 70% - Current to estimate the position of the motor's pole.

- Set the default value for the first test and check the stability of the speed control during manual operation.
- Check the balance between the car and the counterweight. If the balance is good, the output current is maintained below the rated current while the elevator is moving downward under no-load conditions.
- If the output current is over the rated current while the elevator is moving downward under no-load conditions, fix the values throughout the process of initial pole position estimation.
- If the output current is over the rated current while the elevator is moving downward under no-load conditions, please adjust the values by the process of initial pole position estimation. (Test it by incrementally increasing the PAR-45 by 5 %.)
 - ※ The higher the setting value, the Bigger the noise when estimating of initial pole position.

5.6 Floor Height Measurement Operation (FHM)

Setting Item	Descriptions
	- Select the operating condition of the floor height measurement operation. ID-OFF/IU-ON: Operating condition of FHM in the condition that the inductor down signal is off and the inductor up signal is on. DLS ON/SD1-ON: Operating condition of FHM in the condition that the lowest level DLS signal is on and the slowdown 1 signal is on. LS-LADS : These are the starting conditions for floor height measurement exclusively for the LS-LADS sensor for elevator systems using the LS-LADS sensor. Move the elevator car downward from the lowest floor so that both the upper and lower inductor signals are ON. However, when measuring floor height in an elevator with two floors, the values of PAR_18 (Plate Length) and PAR_19 (InductorEdge) are fixed to 300 mm and 146 mm (MP-20 sensor specifications), respectively.

- After selecting a condition, perform FHM if the condition is met.
 - ※ The conditions of the FHM are linked with the operating condition of the high level controller, so be sure to check before setting them.

- The FHM operation measures the height of each floor and the average of the length of the shield and inductor edge installed on each floor. After FHM finished, you can check the changed value at E/L-18 and E/L-19.

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Q34 SHAFT COPY MODE ACTIVE	E/L18 Plate Length 199.5mm	E/L19 InductorEdge 19.8mm
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5.7 Ride Quality Tuning (Only for Synchronous motors)

If shock occurs when starting operation

Roll-back is that the car briefly rises or falls depending on the number of passengers (loads) when the brake is opened when an elevator start its operation,

When operating the sincos encoder installed synchronous motor, anti-rollback control is built-in to prevent roll-back without the use of a load detector when an elevator start its operation.

If the CON_71 (ARF Time) is not '0', anti-rollback control is unavailable. In order to improve the ride quality, properly tune the related parameters.

Setting Items	Descriptions
CON71 ARF Time 1000msec	- The elevators vary in weight and size depending on the specifications designed and require the gain turning for stable control depending on the characteristics of the instrument. - Anti-rollback is the function used to prevent the shock that occurs when an elevator start its operation. - Set P&I gains in CON_03, 04 Optimal setting to minimize overshooting effect - Set CON_71=ARF Time: Approx. 700 ~ 1000 [ms] - Set CON_72=ARF ASR P: Set this higher than CON_03 If rollback occurs, increase the P-gain. If noise or vibration occurs, reduce the setting. - Set CON_73=ARF ASR I: Set this smaller than CON_04 If rollback occurs, reduce the I-gain. If noise or vibration occurs, increase the setting. - Setting for CON_74=ARF APR P: If rollback occurs at default value, increase the setting. If noise or vibration occurs, reduce the setting. CAUTION: If the motor noise occurs when changing the setting, return it to the previous value, if possible, adjust CON_72, CON_74 and adjust CON_73 lastly. A small value of CON_73 may cause noise in the motor. If possible, please work at the top floor.
CON72 ARF ASR P 100%	
CON73 ARF ASR I 150msec	
CON74 ARF APR P 100%	

When vibrations of the car occurs during run

Vibrations of the car could occur because of the characteristic of the machine. And reasons are like below.

- If the motor constant differs from the actual value due to poor tuning
- If the speed gain is inappropriate.

Below are the gains that can be adjusted when the vibrations of the car occurs because the speed gain is appropriate.

- In the case of an induction motor, if you decreases the PAR-52(Flux-Curr) or after high speed automatic operation, set the PAR-52(Flux-Curr) as the recommended magnetizing current DIS-02(Flux Cur Ref).

NOTICE: The CON-02 is not displayed in the induction motor control mode.

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Setting Items	Descriptions
	It is related to the speed gain if there are vibrations after pole-position estimation and auto-tuning. ※ The smaller the CON_02, the larger the CON_03, the smaller the CON_04, the more noise the motor may occurs. Decreasing the CON_03 and increasing the CON_04 without adjusting CON_02 may improve the vibrations if there are vibrations. If the CON_03 is too small or the CON_04 is too big, landing could be unstable because the speed response is too slow. So, they shall be set to an appropriate value.

5.8 Encoder Type

In order to operate the elevator, the inverter option board must be selected according to the encoder specifications. The following is an inverter option board according to the encoder type, and the features of each option board are summarized.

	Option	Explanation
Incremental Option board		- Incremental or AB Pulse encoder (Line drive/Open collector/Complementary) - For Induction Motor/ Synchronous motor
SIN/COS Option board		- Sin/Cos Encoder(Heidenhain ERN1387, ERN487) - Motor position calculation – use 1cycle/rev of sine and cos signal - Apply Synchronous motor. need for initial pole position estimation
EnDat Option board		- EnDat Encoder(Heidenhain ECN1313, ECN413) - Motor position calculation – Serial communication between Control CPU and Encoder - Apply Synchronous motor, Initial pole position estimation

	Induction Motor	Synchronous motor		
Display (DIS-04)	A/B Pulse	A/B Pulse	Sin/Cos	EnDat
Enc Type (PAR-23)	No displayed	A/B Pulse	Sin/Cos_1387	Sin/Cos_All
No of Pulse	1024	8192	2048	2048
Communication	No	No	No	Yes
Pole position	Not need	necessary	Initially 1 time	Initially 1 time

estimation				
Load compensation	Use load cell	Use load cell	Anti-Rollback control	Anti-Rollback control
Control speed	~1800rpm	~680 rpm	~680 rpm	~680 rpm

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5.9 The Motor Initial Pole Position Estimation Test

NOTICE: it is executed only when there is a speed deviation fault during operation or when it is deemed that the current is excessive compared to the load during constant speed operation.

In the case of synchronous motor, accurately estimating the initial pole position is important in motor operation and performance.

Poor Estimation of the motor initial pole position may causes sudden rotation, speed deviation.

So, the motor initial pole position estimation should be made more accurately.

Safety Precautions

- If possible, for safety reasons, the elevator car should be located on the lowest floor and start the test with a 50% load on the car.
- To prevent the motor from rotating during the motor initial pole position estimation, make sure that the brake remains closed.
 - ⊗ Be sure to keep the brake closed because it may cause the elevator car to fall or sudden rotation.
 - ⊗ If a MC(Magnetic Contactor) is installed between the drive and the motor, MC should be turned on.

The way to do continuous motor initial pole position estimation

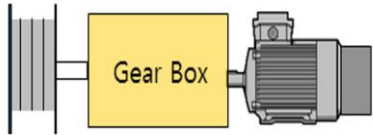
- ① Set 'PAR-23_Enc Type' to 'A/B Pulse'
- ② Change the command speed to 0.0 rpm and start operation.
- ③ Please write down what is displayed at the DIS-08_Init Theta
→ It is displayed when the MAK group is activated.
- ④ If there is no problem during operation after the initial pole position estimation, take a next step.
- ⑤ If the initial pole position estimation failed, please retry 5 times and if the error of the detected Init theta is over $\pm 10^\circ$, increase the PAR-45_MagDet Curr by 5% and please try again.
 - ⊗ The higher the PAR_44 MagDet Volt and PAR_45 MagDet Curr, the more noise of the motor.
- ⑥ Set the 'PAR-23_Enc Type' to 'A/B Pulse' again to repeat the motor initial pole position estimation with power on.
- ⑦ If the displayed error is within $\pm 10^\circ$, finish the test.
- ⑧ Set the 'PAR-23_Enc Type' as the installed encoder type.
- ⑨ Do the next step.

5.10 Induction/synchronous Motor elevator comparison

Induction Motor			Synchronous Motor (Permanent magnetic Motor)	
	0~3600 rpm	Speed	0~360 rpm	
	2, 4, 8 etc.	No. of Pole	20, 32, 40, 52 etc.	
	standard	Inverter	standard, MRL	
	Geared	Reducer	Gearless	
	No necessary	Initial Pole Position Estimation	necessary	
	Building	Applicable Place	Low building, Subway station, overpass etc.	

[Induction motor/Synchronous motor comparison for Elevator]

One of the most important elements in an elevator is an electric motor, and there are differences in control and mechanical aspects depending on the type of motor applied. The characteristics of induction motors and synchronous motors, which are representative motors applied to elevators, are as follows.

[Induction Motor traction machine]	[Synchronous motor traction machine]
 Sheave Motor - The motor rotates at high speed and the sheave rotates at low speed through the gearbox. - Number of encoder pulses: 1024p/rev - Motor speed: 0~1800rpm - Start Shock Prevention : Requires load detection device	- No Gear box(Gearless) - The structure of the motor is opposite to that of the induction machine. - Induction motor: Stator outside, rotor inside. - Synchronous motor: Stator inside, rotor outside. - The motor's rotor and sheave are directly connected, directly driven without a reducer - Motor low speed rotation: about 0~300rpm, - Encoder: 2048cycle/rev, Sincos Encoder - Start shock prevention: Without using a load detection device Roll-back prevention technology using high-resolution encoder

5.11
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UCM Selection

Setting Items	Descriptions
<i>G01</i> <i>UCM SOURCE</i> <i>OVER SPEED REG.</i>	NONE OVER SPEED REG MOTOR BRAKE Mechanism that would be used to Unintended Car Movement (UCM) is selected from this parameter. When "OVER SPEED REG." is selected, status of Speed Regulator is monitored from "KRO" input. When "MOTOR BRAKE" is selected, status of motor brake is monitored from FR1 and FR2 inputs. Monitoring will be performed before starting movement and during movement.