MAKING MODERN LIVING POSSIBLE

Quick Guide

VLT® Lift Drive LD 302

Version 3.5

www.danfoss.com/drives

THE REAL DRIVE

VLT®

Classified as Business

Contents

1 Introduction

This manual is a guideline for using Danfoss frequency converter series, Lift Drive LD 302, Automation Drive FC 302 regarding design, installation, wiring and parameterization. Fundamental knowledge about elevators and frequency converters are essential. Fundamental knowledge is not a part of the manual. For elevators and the use of frequency converter, the national and local regulations and safety requirements must be complied. Regarding handling and use of frequency converters it is recommended additional to read and understand the available literature for Automation Drive FC 300 and Lift Drive LD 302 to be able to work with the system safely and professionally, particularly observe the hints and cautionary remarks.

1.1 Qualified Personnel

Only qualified personnel should carry out Installation, commissioning and maintenance of the frequency converter. Qualified personnel are trained personnel who are authorized to fit, install, commission, ground and label equipment, systems, and circuits in accordance with the standards for safety technology and who are familiar with the safety concepts of automation engineering. Additionally, the personnel must be familiar with all the instructions and safety measures described in supplemental publications and manuals are available from Danfoss. They must have suitable safety equipment and be trained in first aid.

1.2 Additional Resources

Other resources are available to understand advanced frequency converter functions and programming.

Supplemental publications and manuals are available from Danfoss:

Operating Instructions VLT® Automation Drive
Design Guide, VLT® Automation Drive
Programming Guide VLT® Automation Drive
Operating Instructions VLT® Lift Drive LD 302
See for listings:
http://www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/VLT+Technical+Documentation.htm

1.3 Symbols used in this document

DANGER

Indicates a potentially dangerous situation which could result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which may result in minor injury. The marking may also serve as a warning against unsafe practices. Also indicates a situation which may result in accidents involving equipment or property damage.

NOTICE

Indicates highlighted information that should be carefully observed to avoid errors or affect the performance of the equipment.

1.4 Used Terms

Inspection or Revisions Mode

All references in this documentation to inspection, inspection mode, revision mode control, and control panel mode refer to motion control (travel up or down) from the car / cabin roof or from the control panel at the elevator controller. For the operation of the frequency inverter, this distinction is not relevant.
Please refer to Chapter 7.6: Control during retrieval and inspection.

Inspection Mode

In Inspection Mode the drive is controlled from topside the car by an educated technician. The drive features a dedicated inspection mode, which can be activated by using the Speed (Vi). Inspection mode enabled for higher load capabilities and shall be used for any operation during commissioning under manual operation and for test load operation during the initial inspection of the lift. Further inspection mode enables for maximum available motor torque to remove the car from mechanical block (safety catch). In Inspection mode, the switching frequency for the inverter is reduced. Acoustic noise (Switching noise) during inspection mode can be expected. Running inspection mode on the lift without controlling Speed (Vi) can lead to a reduced lifetime of the drive!

Revision Mode

Revision Mode is the control of the lift by an operator from the control panel. For the drive it makes no difference to Inspection Mode. Same rules apply and it is important to control the drive with the Speed (Vi) in that operating mode. Running revision mode on the lift without controlling Speed (Vi) can lead to a reduced lifetime of the drive!

2 Safety

⚠ WARNUNG ⚠

2.1 High voltage

Frequency converters are connected to hazardous mains voltages. Extreme care should be taken to protect against shock. Only trained personnel familiar with electronic equipment should install, start, or maintain this equipment.

2.2 Unintended start

When the frequency converter is connected to the AC mains, the motor may be started by means of an external switch, a serial bus command, an input reference signal, or a cleared fault condition. Use appropriate cautions to guard against an unintended start.

2.3 Discharge time

Frequency converters contain DC-link capacitors that can remain charged even when the frequency converter is not powered. To avoid electrical hazards, disconnect AC mains, any permanent magnet type motors, and any remote DC link power supplies, including battery backups, UPS and DC-link connections to other frequency converters. Wait for the capacitors to fully discharge before performing any service or repair work. The amount of wait time is listed in the Discharge Timetable. Failure to wait the specified time after power has been removed before doing service or repair could result in death or serious injury.

Discharge Time	
Power range [kW]	Minimum waiting time [min]
0,37–7,5	4
11–90	15
High voltage may be present even when the warning LED indicator lights are off.	

2.4 Derating

Frequency converters in lift applications are subjected to higher stresses due to high switching frequencies. As a result, special instructions apply to operation. Deviations from the specified environmental conditions (chapter mechanical installation) can result in a different lifetime or the output power is reduced due to oversizing. This also applies to operation with very low output frequencies (fnom <20 Hz). A derating for the Frequency converter is necessary. Please contact Danfoss or your technical advisor.

2.5 Mechanical Holding Brake

A mechanical holding brake mounted directly on the motor shaft normally performs static braking. In some applications, the static holding torque is working as static holding of the motor shaft (usually synchronous permanent motors). A holding brake is either controlled by a PLC or directly by a digital output from the frequency converter (relay or solid state).

NOTICE

When the holding brake is included in a safety chain:
The frequency converter cannot provide a safe control of a mechanical brake.
A redundancy circuitry for the brake control must be included in the total installation.

2.6 Crane, Lifts and Hoists

The controlling of external brakes must always have a redundant system. The frequency converter can in no circumstances be the primary safety circuit. Comply with relevant standards. It is recommended to disable protection mode in hoisting applications.

2.7 Motor-generated Over-voltage

The voltage in the intermediate circuit is increased when the motor acts as a generator.

2.8 Back-EMF from PM motor operation

If coasted at high rpm the PM motor back-EMF may potentially exceed the maximum voltage tolerance of the frequency converter and cause damage. If it is possible that the motor may overspeed then it is recommended to equip a brake resistor.

2.9 Safe Stop

After installation and before first operation, perform a commissioning test of an installation or application, using Safe Stop. Perform the test again after each modification of the installation or application involving the Safe Stop.

NOTICE

A passed commissioning test is mandatory after first installation and after each change to the safety installation. The Safe Stop function can be used for asynchronous, synchronous and permanent magnet motors. Two faults can occur in the power semiconductor of the frequency converter. When using synchronous or permanent magnet motors a residual rotation can result from the faults. The rotation can be calculated to Angle = 360/ (Number of Poles). The application using synchronous or permanent magnet motors must take this residual rotation into consideration and ensure that it does not pose a safety risk. This situation is not relevant for asynchronous motors.

3 Installation

Installation Site Check List

- The frequency converter relies on the ambient air for cooling. Observe the limitations on ambient air temperature for optimal operation.
- Ensure that the installation location has sufficient support strength to mount the frequency converter.
- Keep the manual, drawings, and diagrams accessible for detailed installation and operation instructions. It is important that the manual is available for equipment operators.
- Locate equipment as near to the motor as possible. Keep motor cables as short as possible.
- Check the motor characteristics for actual tolerances.
- Ensure that the ingress protection rating of the frequency converter is suitable for the installation environment. IP55 (NEMA 12) or IP66 (NEMA 4) enclosures may be necessary.

⚠ WARNING ⚠

3.1 Ingress protection

IP54, IP55 and IP66 ratings can only be guaranteed if the unit is properly closed.

- Ensure that all cable glands and unused holes for glands are properly sealed
- Ensure that the unit cover is properly closed.

⚠ WARNING ⚠

Device damage through contamination. Do not leave the frequency converter uncovered. For "spark-free" installations according to European Agreement concerning International Carriage of Dangerous Goods by Inland Waterways (ADN_2011 ###), refer to VLT® Automation Drive FC 300 Design Guide.

3.2 Frequency Converter and motor pre-installation check list

- Compare the model number of unit on the nameplate to what was ordered to verify the proper equipment.
- Ensure each of the following are rated for same voltage:
  Mains (power), Frequency converter and Motor
- Ensure that the frequency converter output current rating is equal to or greater than motor full load current for peak motor performance. Motor size and frequency converter power must match for proper overload protection. If frequency converter rating is less than motor, full motor output cannot be achieved.

3.3 Mechanical Installation Cooling

- To provide cooling airflow, mount the unit to a solid flat surface or to the optional back plate.
- Top and bottom clearance for air cooling must be provided. Generally, 100-225 mm (4-10 in) is required.
  See specification for clearance requirements.
- Improper mounting can result in overheating and reduced performance.
- Derating for temperatures starting between 40 °C (104 °F) and 50 °C (122 °F) and elevation 1000 m (3300 ft) above sea level must be considered. See the equipment Design Guide for detailed information.

3.4 Lifting

- Check the weight of the unit to determine a safe lifting method.
- Ensure that the lifting device is suitable for the task.
- If necessary, plan for a hoist, crane, or forklift with the appropriate rating to move the unit.
- For lifting, use hoist rings on the unit, when provided.

3.5 Mounting

- Mount the unit vertically.
- The frequency converter allows side by side Installation.
- Ensure that the strength of the mounting location will support the unit weight.
- Mount the unit to a solid flat surface or to the optional back plate to provide cooling airflow.
- Improper mounting can result in overheating and reduced performance.
- Use the slotted mounting holes on the unit for wall mounting, when provided.

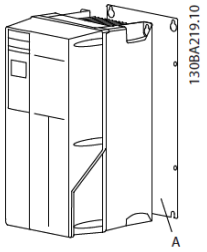


Illustration: Proper Mounting with Back Plate

Item A is a back plate properly installed for required airflow to cool the unit.

NOTICE

Back plate is needed when mounted on railings.

3.6 Tightening Torques

Connection Tightening Torques for proper tightening must be complied with specification.

3.7 Electrical Installation

Requirements

WARNING

EQUIPMENT HAZARD!

Rotating shafts and electrical equipment can be hazardous. All electrical work must conform to national and local electrical codes. It is strongly recommended that installation, start up, and maintenance be performed only by trained and qualified personnel. Failure to follow these guidelines could result in death or serious injury.

WARNING

Wiring isolation

Lay input power, motor wiring and control wiring in three separate metallic conduits or use separated shielded cable for high frequency noise isolation. Failure to isolate power, motor and control wiring could result in less than optimum frequency converter and associated equipment performance.

- For your safety, comply with the following requirements. Electronic controls equipment is connected to hazardous mains voltage. Extreme care should be taken to protect against electrical hazards when applying power to the unit.
- Run motor cables from multiple frequency converters separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out. Overload and Equipment Protection.
- An electronically activated function within the frequency converter provides overload protection for the motor. The overload calculates the level of increase to activate timing for the trip (controller output stop) function. The higher the current draw, the quicker the trip response. The overload provides Class 20 motor protection. See *Warnings and Alarms* for details on the trip function.

- Because the motor wiring carries high frequency current, it is important that wiring for mains, motor power, and control are run separately. Use metallic conduit or separated shielded wire. Failure to isolate power, motor, and control wiring could result in less than optimum equipment performance.
- All frequency converters must be provided with short-circuit and over-current protection. Input fusing is required to provide this protection, see *Illustration*. If not factory supplied, fuses must be provided by the installer as part of installation.

Refer the maximum fuse ratings in Fuse Specifications.

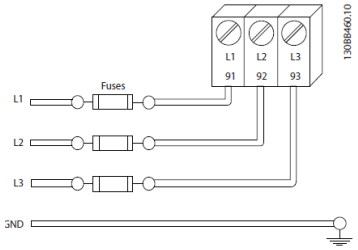


Illustration: Frequency Converter Fuses

Wire Type and Ratings

- All wiring must comply with local and national regulations regarding cross-section and ambient temperature requirements.
- Danfoss recommends that all power connections be made with a minimum 75 °C rated copper wire.
- Refer the *Power-dependent Specifications* for recommended wire sizes.

3.8 Earth (Grounding)

Requirements

⚠ WARNING ⚠

GROUNDING HAZARD!

For operator safety, it is important to ground the frequency converter properly in accordance with national and local electrical codes as well as instructions contained within these instructions. Ground currents are higher than 3,5 mA. Failure to ground the frequency converter properly could result in death or serious injury.

NOTE

It is the responsibility of the user or certified electrical installer to ensure correct grounding (earthing) of the equipment in accordance with national and local electrical codes and standards.

- Follow all local and national electrical codes to ground electrical equipment properly.
- Proper protective grounding for equipment with ground currents higher than 3,5 mA must be established, see *Leakage Current (>3,5 mA).*
- A dedicated ground wire is required for input power, motor power and control wiring.
- Use the cable clamps supplied with the device for proper ground connections.
- Do not ground one frequency converter to another in a "daisy chain" fashion.
- Keep the ground wire connections as short as possible.
- Use of high-strand wire to reduce electrical noise is recommended.
- Follow motor manufacturer wiring requirements.

Leakage Current

Follow national and local codes regarding protective earthing of equipment with a leakage current > 3.5 mA. Frequency converter technology implies high frequency switching at high power. This will generate a leakage current in the earth connection. A fault current in the frequency converter at the output power terminals might contain a DC component which can charge the filter capacitors and cause a transient earth current. The earth leakage current depends on various system configurations including RFI filtering, screened

motor cables, and frequency converter power. EN/IEC61800-5-1 (Power Drive System Product Standard) requires special care if the leakage current exceeds 3.5 mA. Earth grounding must be reinforced in one of the following ways:

- Earth ground wire of at least 10 mm².
- Two separate earth ground wires both complying with the dimensioning rules.

See EN 60364-5-54 § 543.7 for further information.

Using RCDs

Where residual current devices (RCDs), also known as earth leakage circuit breakers (ELCBs), are used, comply with the following:
Use RCDs of type B only which are capable of detecting AC and DC currents.
Use RCDs with an inrush delay to prevent faults due to transient earth currents.
Dimension RCDs according to the system configuration and environmental considerations.

Grounding Using Shielded Cable

Earthing (grounding) clamps are provided for motor wiring.

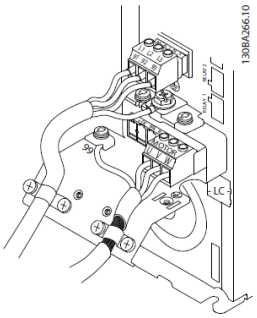


Illustration: Grounding with Shielded Cable

3.9 Motor connection

⚠ WARNING ⚠

INDUCED VOLTAGE!

Run output motor cables from multiple frequency converters separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out. Failure to run output motor cables separately could result in death or serious injury.

- For maximum wire sizes see Power-dependent specification.
- Comply with local and national electrical codes for cable sizes.
- Motor wiring knockouts or access panels are provided at the base of IP21 and higher (NEMA1/12) units.
- Do not install power factor correction capacitors between the frequency converter and the motor.
- Connect the 3-phase motor wiring to terminals 96 (U), 97 (V), and 98 (W).
- Ground the cable in accordance with grounding instructions provided.
- Torque terminals in accordance with the information provided.
- Follow motor manufacturer wiring requirements.

The following *Illustration* represents mains input, motor, and earth grounding for basic frequency converters. Actual configurations vary with unit types and optional equipment.

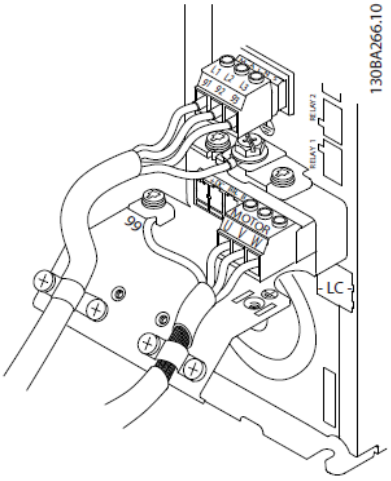


Illustration: Example of Motor, Mains and Earth Wiring

3.10 Back-EMF from PM motor

⚠ WARNING ⚠

PM motors produce voltage when the rotor shaft is turned. The generated voltage is fed back into the connected frequency converter. When the voltage level is high enough, the motor can generate enough energy to power up the frequency converter, even when it is disconnected from mains. To avoid PM motor produced voltage when the rotor shaft is turned and for maintenance work on frequency converter and PM motor it is recommended to take care the following safety precautions.

- Disconnect PM motor from frequency converter.
- Short circuit of the motor winding.
- Block motor shaft against movement.

⚠ WARNING ⚠

Frequency Converter powered on, at Disconnected Mains if PM motor shaft turns.

3.11 Brake Resistor

⚠ WARNING ⚠

The user is responsible for the compliance of the specification for installation and operation of a braking resistor on the drive. The manufacturer's specifications must be mandatory to comply. In elevator applications, the use of devices with braking electronics and braking resistors is generally necessary. Using a braking resistor ensures that the energy is absorbed in the braking resistor and not in the frequency converter. For detailed information on the use, selection, installation, wiring, and cabling of braking resistors, refer to the braking resistor manufacturer's documentation. The drive can monitor the braking resistor based on the measured power and issue an overload warning. It is necessary to set the brake resistor data in parameter 2-11, 2-12
and the parameter 2-13 for enabling the monitor function.

⚠ WARNING ⚠

Monitoring braking power is not a safety function. A thermal switch may be required for this. The braking resistor circuit is not protected against earth leakage current. Do not touch the braking resistor as it can get very hot during or after braking. To avoid a fire hazard, you must place the braking resistor in a safe environment. All cables connected to the braking resistor must be able to withstand the increased thermal stress.
The braking electronics in the frequency converter can fail due to a defect and the braking resistor can be permanently energized in this case. In the event of an error, the power supply to the frequency converter must be interrupted. Corresponding information can be

called up via a digital output on the frequency converter (see parameter 19-84=4 and Parameter 19-81 Warnings and Alarms). Monitoring braking power is not a safety function. A thermal switch is required for this. The braking resistor circuit is not protected against earth leakage current. Do not touch the braking resistor as it can get very hot during or after braking. To avoid a fire hazard, you must place the braking resistor in a safe environment.

3.12 Environment

Equipment containing electrical components may not be disposed of together with domestic waste. It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

3.13 Schematic drawing, examples

Schematic Lift Drive LD302

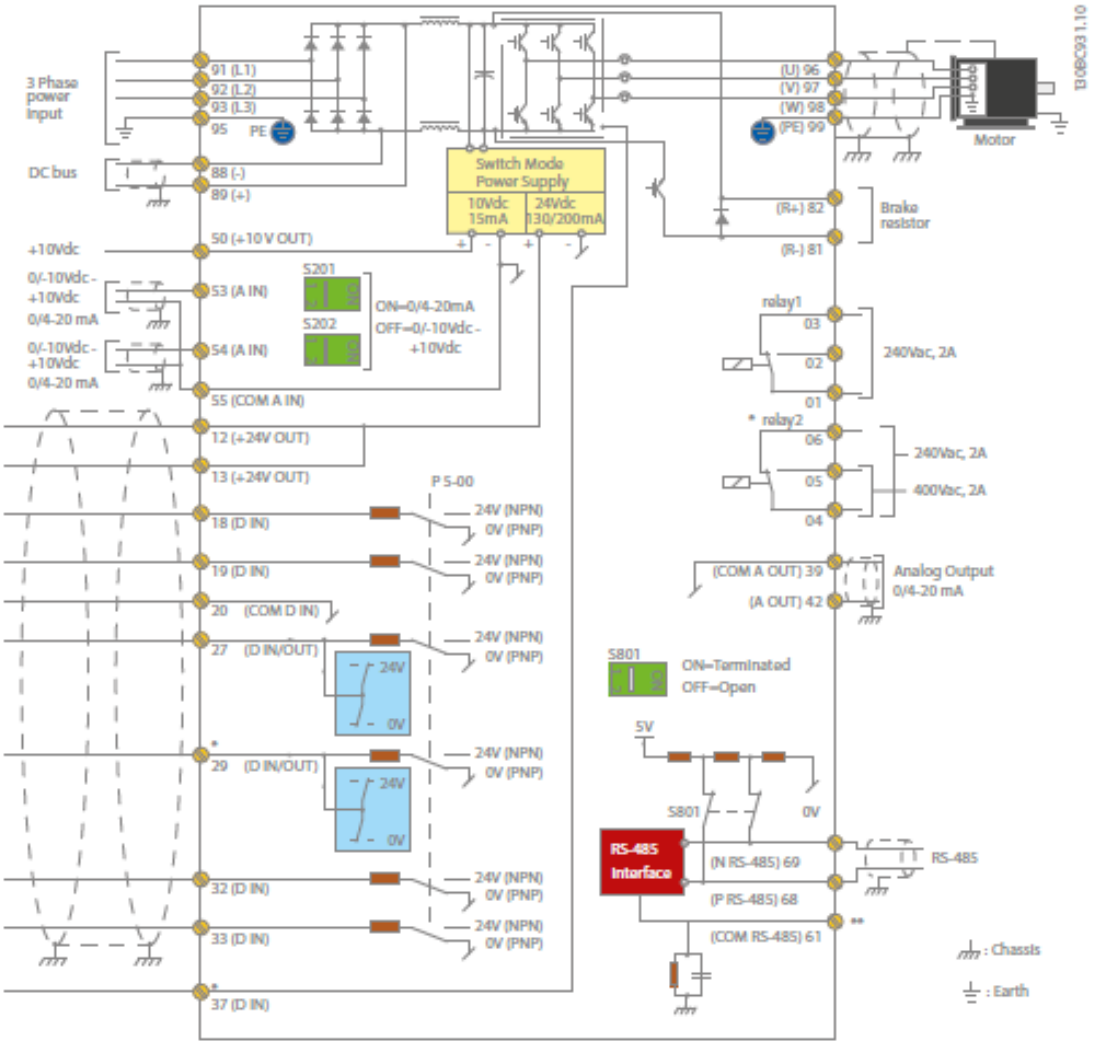
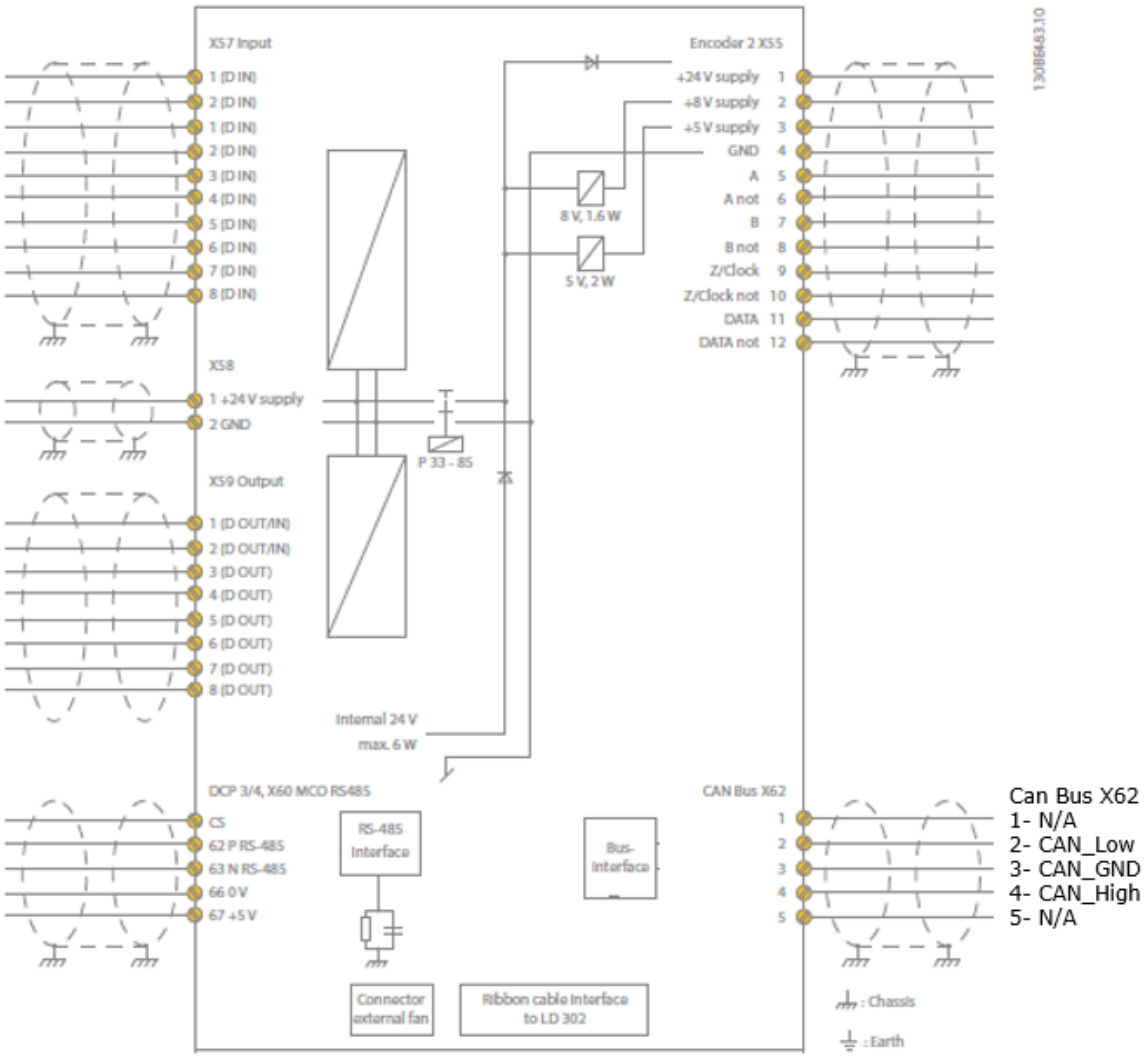


Diagram showing all electrical terminals without options. A = analog, D = digital

For instructions on Safe Stop installation please refer to the section Safe Stop Installation in the VLT®AutomationDrive FC 302 Design Guide.

Schematic Lift Controller MCO 361

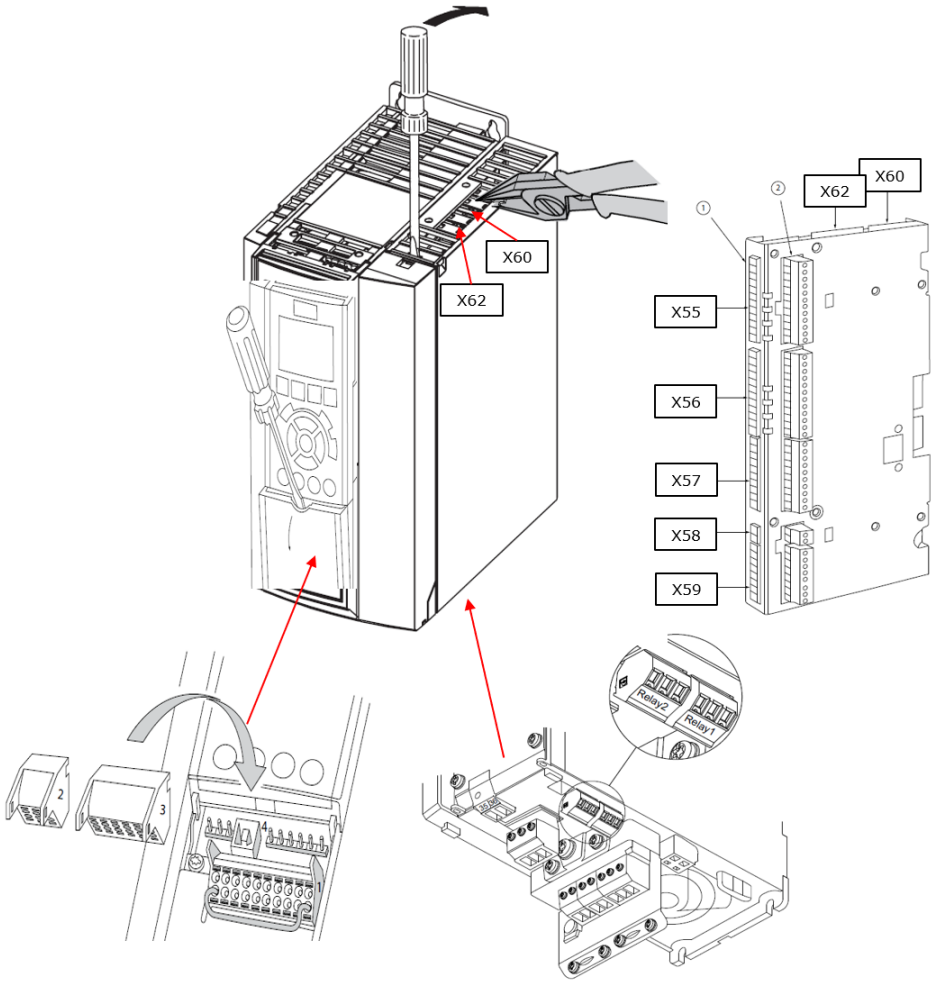


The numbers represent the terminals on the drive.
VLT Lift Drive standard interfaces:

- RS485
- USB
- DCP 3/4
- CanOpen DSP 417

Location Terminals

USB socket connector and the terminal strips for the control terminals 18 - 69 are located below the front cover of the LCP. The terminal strips X55, X56, X57, X58 and X59 are located on the right behind the front cover. The front covers can e.g. be removed with a screwdriver. The terminal strips X60 and X62 are on the top right of the housing. The connections X60 and X62 are exposed by breaking out the provided windows. The connectors for supply, motor, braking resistor and for the relays are located on the bottom of the housing.



Item	Description	Item	Description
1	Terminal blocks, on the top	X58	24 V/DC supply
2	Terminal blocks, on the side	X59	Digital outputs
X55	Encoder Terminal	X60	
X56	Not used	X62	Can Terminal
X57	Digital Inputs		

3.14 Encoder connection

Terminal X55

Encoder- Terminal X55 (Umax 30V)												
Terminal- Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Description	**24 VDC**	**8VDC**	**5 VDC**	**GND**	**A**	**/A**	**B**	**/B**	**Clock**	**/Clock**	**Data**	**/Data**
TTL- Encoder	see Data Sheet			GND	A	/A	B	/B	-	-	-	-
HTL- Encoder	see Data Sheet			GND	A	/A	B	/B	-	-	-	-
SIN/COS	see Data Sheet			GND	A	/A	B	/B	-	-	-	-
SIN/COS + Absolute	see Data Sheet			GND	A	/A	B	/B	Clock	/Clock	Data	/Data
Example												
ECN 1313 (Endat) with **5 V main supply**	-	-	V+ and Sensor +	GND and Sensor-	A	/A	B	/B	Clock	/Clock	Data	/Data
SinCos with SSI	see Data Sheet			GND	A	/A	B	/B	Clock	/Clock	Data	/Data
SinCos with BISS	see Data Sheet			GND	A	/A	B	/B	Clock	/Clock	Data	/Data

Encoder Option MCB 102

Encoder- Option MCB 102												
Terminal- No. X31/	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Description	**24 VDC**	**8VDC**	**5 VDC**	**GND**	**A**	**/A**	**B**	**/B**	**Z**	**/Z**	**D**	**/D**
TTL- Encoder	see Data Sheet			GND	A	/A	B	/B	-	-	-	-
SIN/COS	see Data Sheet			GND	A	/A	B	/B	-	-	-	-
SIN/COS + Absolute	see Data Sheet			GND	A	/A	B	/B	Clock	/Clock	Data	/Data
Absolute only	see Data Sheet			GND	-	-	-	-	Clock	/Clock	Data	/Data
Example												
Endat 2.2	see Data Sheet			GND	-	-	-	-	Clock	/Clock	Data	/Data

Resolver- Option MCB 103

Resolver- Option MCB 103												
Terminal- No. X32/	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Description	**REF+**	**REF-**	**COS+**	**COS-**	**SIN+**	**SIN-**	**A+**	**A-**	**B+**	**B-**	**Z+**	**Z-**
Resolver	R1	R2	S1	S3	S2	S4	-	-	-	-	-	-

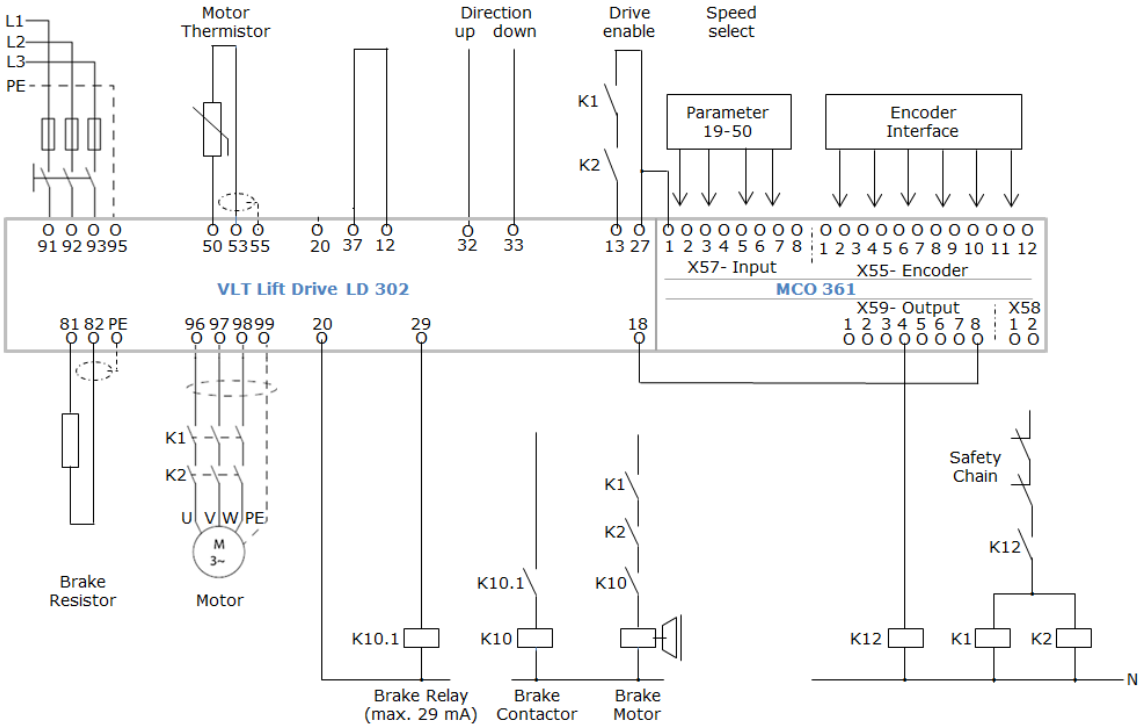
Encoder mirroring

The encoder information from terminal X55 can be mirrored to output X56. The output can be activated with parameter 19-61. The input is used as a divider as follows.

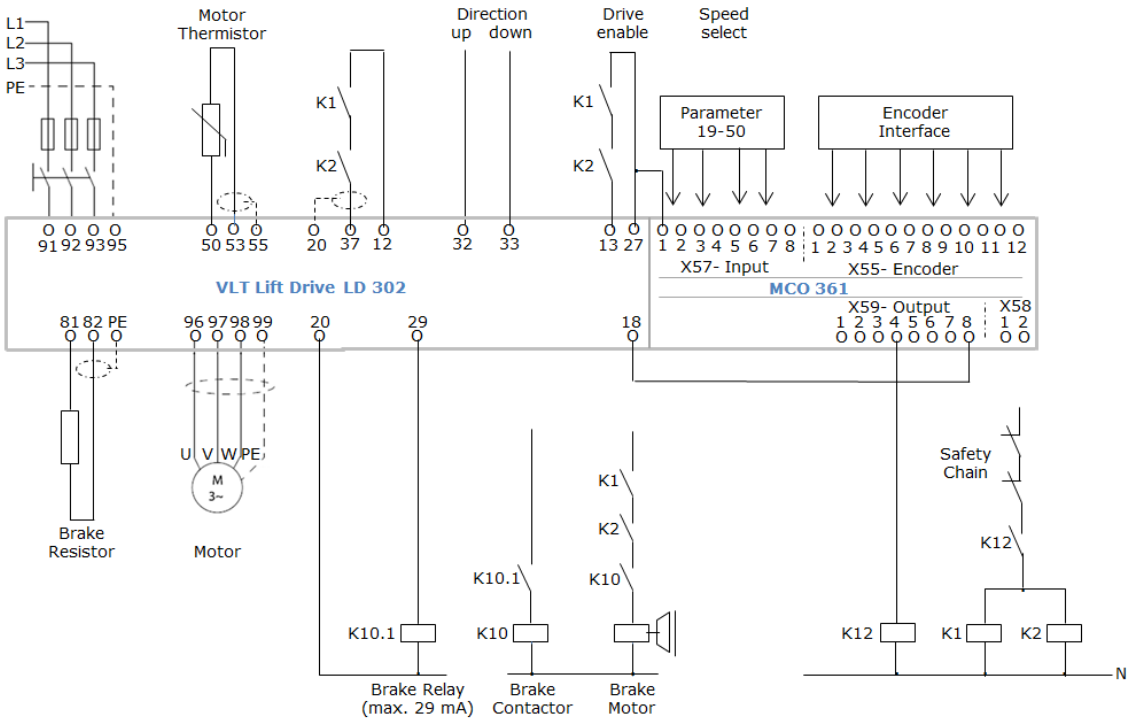
Nr.	Name	Parameter description
19-61	Encoder mirroring	Output Encoder Signals [0] No Output [1] Output 1:1 [2] Output 2:1 [3] Output 4:1 [4] Output 8:1 [5] Output 16:1 [6] Output 32:1 [7] Output 64:1 [8] Output 128:1 [9] Output 256:1 [10] Output 512:1 [11] Output 1024:1 [12] Output 2048:1 [13] Output 4096:1 [14] Output 8192:1

3.15 Examples

Operation with Motor Contactors K1 and K2



Operation without Motor Contactors



4 Programming

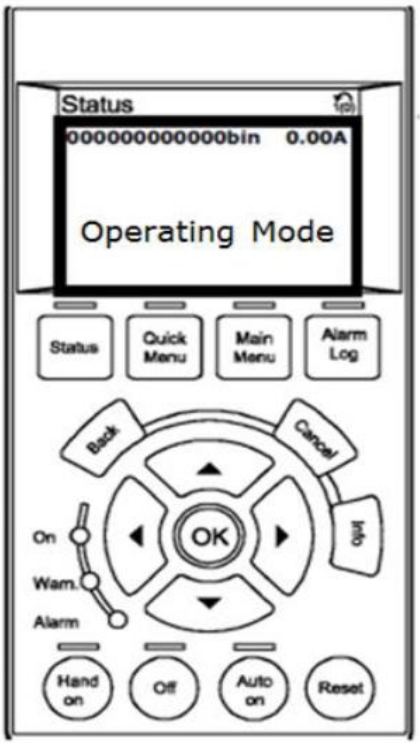
4.1 Local Control Panel

The local control panel (LCP) is the combined display and keypad on the front of the unit and has several user functions.

- Start, stop, and control speed in local control
- Display operational data, status, warnings and cautions
- Programming frequency converter functions
- Manually Reset the frequency converter after a fault

LCP Layout, functional groups

The graphical LCP is divided into four functional groups A, B, C and D



Display area A:

Display area B:
Menu keys for changing the status display, programming or accessing the alarm and error memory.

Display area C:
Navigation keys for programming functions, moving the display cursor, and speed control in local operation. Also included are the status indicator lights.

Display area D:
Operation mode keys and reset.

Display functional group A

After power-up the frequency converter, the LCP displays "Operation Mode".
The LCP displays the input status terminal X.57 (0 bin=0 V/DC, 1 bin=24 V/DC) and the actual motor current in Ampere.

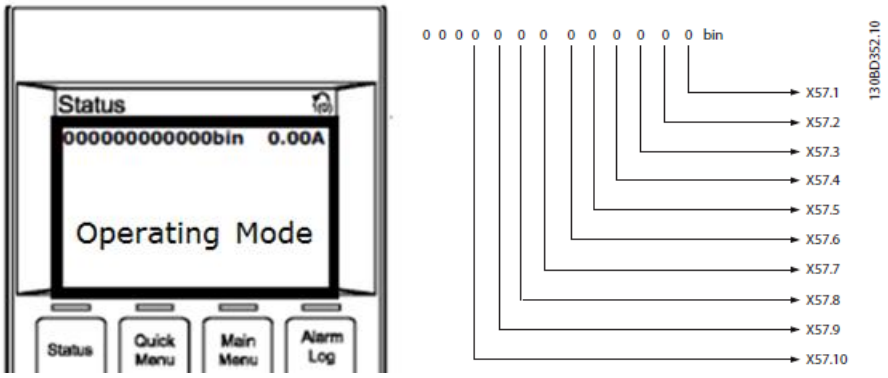


Illustration: LCP Display, Input Status Terminal X.57, and Motor Current

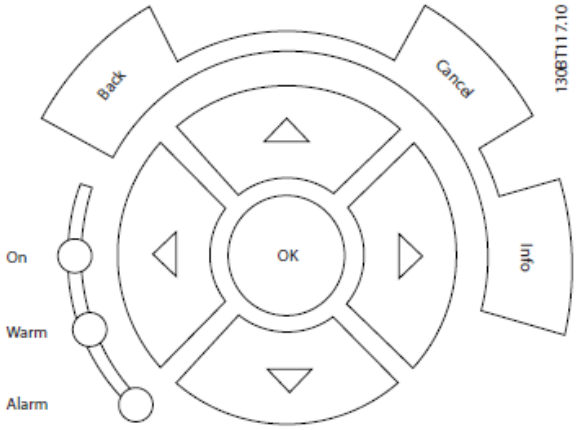
Display functional group B, LCP Menu keys

Menu keys are used for menu access and parameter set-up, toggling through status display modes during normal operation, and viewing fault log data.

LCP- Key	Function
Status	Press to display operational information. Displays the Lift application status message. Displays the status of the digital input signals of X57. The symbol in the upper right corner of the LCP display shows the motor rotation direction and the active set-up.
Quick Menu	Allows access to programming parameters for initial set-up instructions and many detailed application instructions. Select "*Q1 My Personal Menu"* to set-up the Lift application parameters.
Main Menu	Allows access to all programming parameters. Press twice to access top-level index. Press once to return to the last location accessed. Press and hold to enter a parameter number for direct access to a parameter.
Alarm Log	Displays a list of current warnings, the last 5 alarms, and the maintenance log. For details select the alarm number using the navigation keys and press [OK].

Display functional group C, Navigation Keys

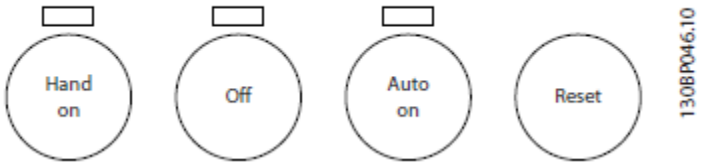
Navigation keys are used for programming functions and moving the display cursor. The navigation keys also provide speed control in local (hand) operation. Three frequency converter status indicator lights for On, Warning and Alarm are also located in this area.



LCP- Key	Function
Back	Reverts to the previous step or list in the menu structure.
Cancel	Cancels the last change or command as long as the display mode has not changed.
Info	Press for a definition of the function being displayed.
Navigation Keys	Use the four navigation keys to move between items in the menu.
OK	Use to access parameter groups or to enable an option.

Indicator lamp	Indicator	Function
Green	ON	The ON indicator lamp activates when the frequency converter receives power from mains voltage, a DC bus terminal, or a 24 V external supply.
Yellow	WARN	In case of warning conditions, the yellow WARN indicator lamp becomes on and a text appears in the display area to identify the reason.
Red	ALARM	A fault condition causes the red alarm indicator lamp to flash and an alarm text is displayed.

Display functional group D, Operation Keys
Operation keys are located at the bottom of the LCP.



Key	Function
Hand On	Starts the frequency converter in local control. Use the navigation keys to control the frequency converter speed. An external stop signal by control input or serial communication overrides the local hand on.
Off	Stops the motor but does not remove power to the frequency converter.
Auto On	Puts the system in remote operational mode. Responds to an external start command by control terminals or serial communication. Speed reference is from an external source.
Reset	Resets the frequency converter manually after a fault has been cleared.

4.2 Back Up and Copying Parameter Settings

Programming data is stored internally in the frequency converter.
Data can be uploaded into the LCP memory as a storage back-up
Once stored in the LCP, the data can be downloaded back into the frequency converter.
Data can also be downloaded into other frequency converters by connecting the LCP into those units and downloading the stored settings. (This procedure is a quick way to program multiple units with the same settings.)
Initialization of the frequency converter to restore factory default settings does not change stored data in the LCP memory.

!! Back up and copy only possible if P19-88 = 0, fast-boot function is not active.

Restoring Default Settings
Initialization restores the unit to factory default settings. All made parameter settings changed from factory settings, e.g. motor data, and monitoring records, will be lost. Uploading data to the LCP provides a backup before initialization.

Restoring the frequency converter parameter settings back to default values is done by initialization of the frequency converter.

Manual Initialization
1. Disconnect power to the Lift Drive and wait for the display to turn off.
2. On LCP, Press and hold the LCP buttons, **[Status]**+ **[Main Menu]** + **[OK]** at the same time and apply power to the unit.
3. Release the LCP keys after 5 s.

Factory default parameter settings are restored during start-up.
After powering-up the Lift Drive wait until the Lift application is loaded, and continue parameter setup, after the LCP displays “Operation Mode”.

4.3 Main Menu

In the Main Menu, the Parameters are organized in various parameter groups. The graphical local control panel (LCP) displays the parameter groups after pressing the "Main Menu" Button on the LCP. For easy selection of correct setup and optimized operation for the complete Lift application, the Lift Drive LD302 contains within the Main Menu additional the Parameter group 19-**. Parameter group 19-** contains all necessary Parameter to setup the complete Lift application.
Within the Parameter group 19-** it is possible to setup parameter for:

- electrical Lift Components. E.g. Lift Motor, Encoder, mechanical Brake.
- mechanical Lift components. E.g. Ratio, Suspension, Traction.
- requirement concerning Lift dynamic and comfort. E.g. Lift speed, motion profile.

Parameter groups overview
The following table contains all the Main Menu Parameter groups.
Outside of the 19-** Parameter group are only limited Parameter groups and Parameter are available to setup additional or special functions which are not supported within the Parameter group 19-**. The different colors indicate the parameter groups for possible access outside the 19-** Parameter group.

	Parameter setup for Lift application
	Read only
	Optional parameters
	Do not touch!

No.	Parameter groups Menu name	Parameter group Description
0-**	Operation/Display	Setup LCP display, operation and handling.
1-**	Load and Motor	Setup Motor data, Motor Thermal Protection.
2-**	Brakes	Please do not change settings here!
3-**	Reference/Ramps	Please do not change settings here!
4-**	Limits/Warnings	Please do not change settings here!
5-**	Digital In/Out	Please do not change settings here!
6-**	Analog In/Out	Please do not change settings here!
7-**	Controllers	Please do not change settings here!
8-**	Comm. and Options	Please do not change settings here!
13-**	Smart Logic	Please do not change settings here!
14-**	Special Functions	Setup special Functions e.g. switching Frequency, EMV-Filter, reset Function, Fan control, Mains Failure.
15-**	Drive Information	Read only, Drive information e.g. Drive Type, Software Version, operation hours.
16-**	Data Readouts	Read only, Drive status information, parameter for troubleshooting.
18-**	Data Readouts 2	Read only, display parameter for troubleshooting.
19-**	**Application Parameter**	**Lift Application Parameter settings for the complete Lift setup. E.g. setup for, Lift Motor with or without Encoder, mechanical Ratio, Suspension, Traction, Brake control, Floor level, Lift speed**
30-**	Special Features	Please do not change settings here!
32-**	MCO Basic Settings	Setup Encoder, PID Controller
33-**	MCO Adv. Settings	Setup MCO- Terminal X60, CAN node, DCP3 / DCP4
34-**	MCO Data Readouts	MCO Display parameters for troubleshooting

4.4 Parameter overview

Motor Construction			
ID	Parameter Name	Factory setting	Unit
1-10	Motor Construction	[1] PM, non salient SPM	

ASM- Motor Data			
ID	Parameter Name	Factory setting	Unit
1-20	Motor Power [kW]	depends on drive	kW
1-22	Motor Voltage	depends on drive	V
1-23	Motor Frequency	depends on drive	Hz
1-24	Motor Current	depends on drive	A
1-25	Motor Nominal Speed	depends on drive	Rpm
19-02	Motor cos phi	69	

PM- Motor Data			
ID	Parameter Name	Factory setting	Unit
1-24	Motor Current	depends on drive	A
1-25	Motor Nominal Speed	depends on drive	Rpm
1-26	Motor Cont. Rated Torque	depends on drive	Nm
1-30	Stator Resistance (Rs)	depends on drive	Ohm
1-37	d-axis Inductance (Ld)	depends on drive	mH
1-39	Motor Poles	depends on drive	
1-40	Back EMF at 1000 Rpm	depends on drive	V

19-* Lift Application Parameter			
ID	Parameter Name	Factory setting ASM / PM- Motor	Unit
19-01	Motor number	0	
19-02	Cos Phi	69	
19-03	Encoder Autotuning	0	
19-04	Car direction	0	
19-05	Encoder direction	1	
19-06	Encoder monitor	1	
19-07	Encoder resolution	2/3	
19-08	Abs. encoder type	0	
19-09	Abs. encoder offs	0	
19-10	Traction sheave	650/320	mm
19-11	Ratio	36.85/1.0	
19-12	Suspension	1/2	
19-13	Brake lift delay	300/0	ms
19-14	Brake delay	600	ms
19-15	Brake close delay	600	ms
19-16	Max. Torque	0.00	%
19-17	Source start torque	0	
19-19	Run in Dist.	60.0	mm
19-20	Max. speed	1.000	m/s
19-21	V4, Nominal speed	1.000	m/s
19-22	V0, Leveling speed	0.100	m/s
19-23	Vi, Inspection speed	0.300	m/s
19-24	V3, Intermediate speed 1	0.800	m/s
19-25	V2, Intermediate speed 2	0.300	m/s
19-26	Vn, Releveling speed	0.010	m/s

19-27	Floor level distance	5.0	mm
19-28	V1, Intermediate speed 3	0.200	m/s
19-30	Acceleration	0.700	m/s²
19-31	Deceleration	1.000	m/s²
19-32	Start Jerk	0.600	m/s³
19-33	Accel. Jerk	0.600	m/s³
19-34	Decel. Jerk	1.000	m/s³
19-35	Run in Jerk	0.400	m/s³
19-38	Comfort	0	
19-40	KP - gain at start	100/50	
19-41	KP - gain at operation	100/50	
19-42	I time at start	200.0/12.0	ms
19-43	I time operation	200.0	ms
19-44	Filter Time start	10.0/1.0	ms
19-45	Filter Time operation	10.0	ms
19-46	Pos. gain start	0.0000/0.1000	
19-47	Pos. error start	100	mm
19-48	Pos. error max	1000	mm
19-50	Run - in mode	0	
19-52	evac. limit VVC+	3.52	A
19-53	Control V1	0.800	m/s
19-54	Control V2	0.300	m/s
19-55	L - start acc	0.020	m/s²
19-56	L- start speed	0.050	m/s
19-57	L-start time	200	ms
19-58	Delay after Stop	100	ms
19-59	Torque down time	200	ms
19-60	Test - run mode	0	
19-61	Encoder mirroring X55 - X56	0	
19-62	Open Loop	0	
19-63	Motor adaptation	0	
19-64	Store param.	0	
19-65	Monitoring functions	0	
19-66	Digital- Serial	0	
19-67	Function Relay 1	1	
19-68	Time Delay Coast	5	ms
19-69	Sync Position	0	
19-70	Monitor Drive + Motor		
19-71	Setup counter	0	
19-72	DCP4 corr. factor	1.000	
19-73	DCP CMD	0	
19-74	DCP STAT	0	
19-79	Error behavior	0	
19-80	Log No	1	
19-81	Error code	0	
19-82	Error time	0	h
19-83	Function Error log	0	
19-84	Function X59.1-7	0	
19-85	User Par 1985	0	
19-86	Special Functions	0	
19-87	Brake monitor delay	2.000	s
19-88	Fast Boot Mode	0	
19-89	User Par 1989	0	

19-90	SW- Version	Version No.	
19-91	Reference torque	Depends on installation	%
19-92	Status	Status No.	
19-93	Dir change counter 1	-1	
19-94	Dir change counter 2	0	
19-96	User Par 1996	1000	
19-97	Brake slip	0.08	
19-98	Abs enc position	0	
19-99	Distance during dec.	0	mm

Additional Parameters			
ID	Parameter Name	Factory setting	Unit
1-53	Model Shift frequency	depends on drive	Hz
4-16	Torque limit Motor Mode	depends on drive	%
4-17	Torque Limit Generator Mode	depends on drive	%
4-18	Current Limit	depends on drive	%
14-01	Switching frequency	depends on drive	kHz
14-50	RFI Filter	[1] On	
32-00	Incremental Signal Type	[1] RS-422 (5V TTL)	
32-01	Incremental Resolution	1024	
32-60	Proportional factor	30	

16-* Data Readouts			
	Parameter Name	Factory setting	Unit
16-1* Motor Status			
16-10	Power [kW]	0	kW
16-12	Motor Voltage	0	V
16-13	Frequency	0	Hz
16-14	Motor Current	0	A
16-16	Torque [Nm]	0	Nm
16-17	Speed [RPM]	0	RPM
16-18	Motor Thermal	0	%
16-3* Drive Status			
16-30	DC Link Voltage	0	V
16-34	Heatsink Temp.	0	°C
16-35	Inverter Thermal	0	%
16-39	Control Card Temp. [°C]	0	°C
16-* Inputs and Outputs			
16-60	Digital Input*	0000000000	bin
16-62	Analog Input 53	0.000	
16-64	Analog Input 54	0.000	
16-66	Digital Output [bin]	0000	bin
16-71	Relay Output [bin]	0000000000	bin
34-40	Digital Input [bin]	000000000000	bin
Process Data			
34-50	Actual Position	0	1mm/100
34-56	Track Error	0	1mm/100
34-57	Actual Velocity	0	1mm/100s

* Getting the status of the input terminals of the control card:

P16-60 [bin]	0	0	0	0	0	0	0	0	0	0
Input terminal	-	-	-	37	18	19	27	29	32	33

5 Commissioning

5.1 Guideline for simple and fast setup

Recommended steps for the initial commissioning:

1. Wiring according to the examples in chapter 9.1 to adapt the drive to your control system.
2. Setting up language
3. Setup of motor data

Note: Motor data shall be entered in the given order. It is not possible to change just one parameter as the drive software will always ensure proper values for the following settings. E.g. change of P 1-20 will lead to change of all mentioned motor data. So, all mentioned settings need to be repeated for the parameters P1-24 to P1-39! As well any change of those data required a new motor adaptation (P19-63)

P1-20 motor power
P1-24 motor current
P1-25 motor speed
P1-26 motor torque
P1-39 motor poles

4. Calculation of eventual missing data on PM Motors:

Number of motor poles.
If the number of motor poles is not given by the nameplate, the value can be calculated by using the nominal frequency and nominal speed in rpm of the motor with the following formula.

$$p = \frac{2 * fnom[Hz] * 60}{nnom[rpm]}$$

Nominal motor torque.
The nominal torque can be calculated if missing by using the nominal power of the motor and the nominal speed with the following formula.

$$Mnom = \frac{Pnom[W] * 9{,}55}{nnom[rpm]}$$

5. Setup of mechanical data:
   P19-10 Traction sheave diameter
   P19-12 No of suspensions
   P19-20 Maximum Speed (usually the same as nominal speed)
   P19-21 Nominal speed

6. Setup of control source and adaptation (Examples):
   P19-50 Run- in mode
   P19-66 Dig Serial (Power cycle the drive, in case of any change)
   P19-67 Adjust the function for output relay 1 according to your needs.
   P19-84 Adjust the function(s) for digital outputs according to your needs.
   P19-86 Special functions

7. Motor adaptation and first operation:
   After all settings are made, P19-63 (Motor adaptation) shall be set to 1.

A start command e.g. revision mode shall be applied. The drive will perform now at standstill the motor adaptation. As soon this is finished, the drive will turn off the inverter by itself. As next step the Lift should be driven in revision mode to the lower half of the shaft.

8. Test of encoder direction:
   Set P 19-03 to [1]. Start the lift in one direction and move the car for appr. 1m. Stop the lift and check the setting for P 19-05.
   If P 19-05 is [0], the encoder direction suits the motor direction, and the lift is ready for operation now.
   If P 19-05 is [1], the encoder is inverted compared to motor direction. If the is any absolute encoder connected to the drive, follow the following steps to avoid issues later:
   1. Set P 19-05 to [0]
   2. Remove power from the drive and wait until it is dis- charged
   3. Swap two motor phases
   4. Turn the drive on again
   5. As soon as the drive on the LCP displays "operating mode", the lift is ready for operation

9. Test run (Inspection speed), check of basic operation and directions (chapter 6.1.1)

10. Activation of required monitoring functions

11. Optimization (chapter 6.2)

12. Wiring Examples with Parameter setup

5.2 Commissioning using Quick Menu

For simple and fast setup of the Lift application, the Lift Drive LD 302 offers an additional Quick Menu for parameter setup, step by step. All relevant parameter to get the Elevator up and running are listed in the quick menu. For later optimization further settings can be found in group 19-* in the main menu. For commissioning the Lift Drive LD 302, we strongly recommend the Quick Menu!

Overview Quick Menu Parameter

Quick Menu- Parameter		
	Motor- Type	
General Settings	ASM	PM
0-01, Language		
19-01, Motor number		
1-10, Motor Construction		
1-* Motor data	1-20, Motor Power [KW]	1-20, Motor Power [KW]
	1-22, Motor Voltage [V]	1-22, Motor Voltage [V]
	1-23, Motor Frequency [Hz]	1-23, Motor Frequency [Hz]
	1-24, Motor Current [A]	1-24, Motor Current [A]
	1-25, Motor Speed [rpm]	1-25, Motor Speed [rpm]
		1-26 Motor Torque [Nm]
		1-39 Motor poles
	19-02 Motor Cos Phi	
19-10, Traction sheave [mm]		
19-11, Gear Ratio		
19-12, Suspension		
19-20, Vmax, max.-Speed [m/s]		
19-21, V4, nominal Speed [m/s]		
19-77		
19-66, Digital Serial (Control)		
19-50, Run-in mode		
19-86, Special Function		
19-67, Function Relay 1		
19-63, Motor adaptation (AMA)		
19-03, Encoder Autotuning		
19-05, Encoder direction		
19-04, Car direction		

Quick Menu

At the graphical local control panel (LCP), Press **[QUICK MENU]** and choose **[Q1]**- My Personal Menu and **[OK].**
Within the Quick Menu, [Q1]- My Personal Menu, start with the first Parameter, 0-01 Language and continue step by step the following parameter.

Setting Language

No.	Name	Parameter Description
0-01	Language	Select the Language [0] English [1] German [X] …….

Setup motor data

Motor data can be entered on two different ways.

1. Motor numbers (See appendix "Drive Motor Database") contains motor construction-, electrical and encoder data. After entering a motor number, all relevant parameters will be set and optimized for the given motor. Not further information regarding the motor and encoder are required.

2. Setting up the motor by name plate information. After setting the data, an automatic motor adaptation (AMA) will optimize the control of the motor.

Setup motor data by motor number

No.	Name	Parameter Description
19-01	Motor number	Select the ASM or PM motor type stored in LD 302 motor type database (see Apendix "Drive Motor Database"). By selecting a certain motor type, all required motor data are set automatically within the LD 302. See Lift manual appendix, Drive Motor Database, motor-table for motor type and associated motor number. 1. Enter motor type number. 2. Save the selected motor type. 3. Press **[OK] and [Cancel]** to save the settings. If selecting [0], enter the following parameter for ASM or PM motors.

Update Quick Menu

To update the Quick Menu, press on the graphical local control panel (LCP) again the LCP button **[Quick Menu]**. After press **[Q1]**- My Personal Menu and then continue the commissioning with the next parameter.
The update procedure of the Quick Menu is necessary to refresh the Quick Menu with the right parameters depends on Motor number, Motor type and motor construction.

Setup the motor by name plate information

Setup Motor Construction

No.	Name	Parameter Description
1-10	Motor Construction	[0] Asynchronous [1] PM,non salient PM

Update Quick Menu

To update the Quick Menu, press on the graphical local control panel (LCP) again the LCP button **[Quick Menu]**. After press **[Q1]**- My Personal Menu and then continue the commissioning with the next parameter. The update procedure of the Quick Menu is necessary to refresh the Quick Menu with the right parameters depends on Motor, Motor type and motor construction.

Depends on the used motor type, continue the motor data setup with the following parameter setup description for asynchronous motor or PM motor.

Setup motor data for asynchronous motor

After selecting the Motor construction "asynchronous" and update the Quick Menu, continue within the Quick Menu, [Q1**]**- My Personal Menu, to setup the following motor parameters for the asynchronous motor.

No.	Name	Parameter Description Enter the nominal motor data according to the motor nameplate.
1-20	Motor Power [KW]	Enter the nominal motor power
1-22	Motor Voltage [V]	Enter the nominal motor voltage
1-23	Motor Frequency [Hz]	Enter the nominal motor frequency
1-24	Motor Current [A]	Enter the nominal motor current
1-25	Motor Speed [rpm]	Enter the nominal motor speed
19-02	Motor cos phi	Set the motor cos phi value, multiplied by 100. The input of the cos phi value causes automatically a new calculation of the advanced motor data, 1-30 Stator Resistance (Rs) to 1-35 Main Reactance (Xh).

Operation in the field weakening area for asynchronous motor

Older motors, which were designed for operation directly on the mains, should be operated above their nominal speed when operated on the frequency converter.

The ratio of frequency and voltage can no longer be kept constant by the frequency converter after a certain point (field weakening point). From this point, the motor torque decreases quadratically with the increased frequency. That the frequency converter can also optimally control the motor in this area, the advanced motor data in P 1-30 – P 1-35 and the motor cos phi P14-43 must be correct. The Automatic motor adaptation should be carried out to determine the equivalent circuit diagram data. See Automatic Motor Adaptation, P19-63. Furthermore, a voltage reserve for operation in field weakening can be entered in the P 1-54. 10 to 30 V are recommended here.

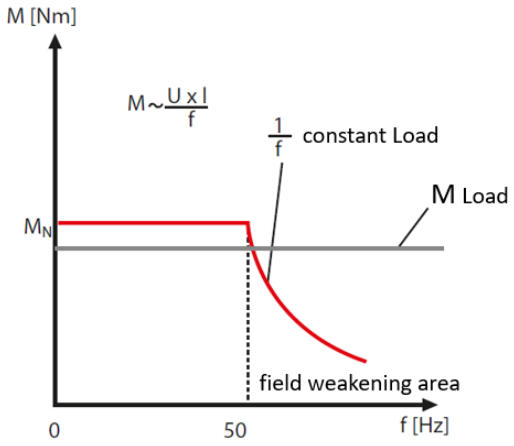


Figure: M/f behavior of asynchronous motor

5.3 Setup motor data for PM motor

After selecting the Motor construction "PM Motor" and Update the Quick Menu, continue within the Quick Menu, [Q1**]**- My Personal Menu, to setup the following motor parameters for the Lift PM motor.

No	Name	Parameter Description Enter the nominal motor data according to the motor nameplate.
1-20	Motor Power [KW]	Enter the nominal motor power
1-24	Motor Current [A]	Enter the nominal motor current
1-25	Motor Speed [Rpm]	Enter the nominal motor speed
1-26	Motor Torque [Nm]	Enter the nominal motor Torque
1-39	Motor Poles	Enter the number of motor poles.

5.4 Setup Brake Resistor Data

For the connected brake resistor, it is necessary to enter the correct value for the resistance (Ohm) and power. In addition, it is necessary to activate the braking function and the monitoring function.

Nr.	Name	Parameter Setup
2-10	Brake Function	[1] Brake Resistor
2-11	Brake Resistor (Ohm)	XXX, Resistor value in Ohm
2-13	Brake Power Limit (kW)	XXX, Power value in kW
2-14	Brake Power Monitoring	[10] Warning 300ms

5.5 Setup incremental encoder data

For Lift application with motor feedback, it is necessary to setup the encoder data.

No.	Name	Parameter Description
32-00	Incremental Signal Type	[0] None (for induction motors open loop) [1] RS-422 (5V TTL) [2] Sinusoidal 1Vpp
32-01	Incremental Resolution	Pulses per revolution

5.6 Setup Mechanical data

No.	Name	Parameter Description
19-10	Traction sheave [mm]	Enter the value for Diameter of traction sheave or enter [-1] to calculate the value. The calculation is based on parameter value settings for P1-25 motor nominal speed, P19-11 ratio, P19-12 suspension and P19-21 nominal cabin speed.
19-11	Gear Ratio	Enter the value of the Gear ratio or enter [-1] to calculate the value. The calculation is based on parameter value settings for P1-25 motor nominal speed, P19-10 traction sheave, P19-12 suspension and P19-21 nominal cabin speed.
19-12	Suspension	Number of suspensions
19-20	V max	Maximum (nominal speed)
19-21	V4	Nominal speed

5.7 Predefined Comfort Settings

The comfort can be adjusted to the typical usage of the lift. However, especially the usage of option P19-38 = [2] requires verification of P19-30 and P19-31

No.	Name	Parameter Description
19-38	Comfort	[0] no preselection active [1] gentle [2] dynamic [3] normal

5.8 Setup control source

No.	Name	Parameter Description
19-66	Digital-Serial	[0] Drive control by digital terminals [1] Serial bus control DCP3 [2] serial bus control DCP4 [3] CanOpen DSP417 Power cycle drive after change of control type

5.9 Setup control type

No.	Name	Parameter Description
19-50	Run-in mode	Set mode due to desired control type as described

5.10 Setup special functions

No.	Name	Parameter Description
P19-86	Special Function	[00] none [x1] **S**imple **C**ontrol [x2] Dir=V0 [x3] SC + DF [x4] **S**oft-**S**top at **D**irection=0 [x5] SSD + SC [x6] SSD + DF [x7] SSD + SC + DF [1x] **S**hort **F**loor function [2x] **D**eceleration with **S**peed **C**ompensation Only used for open loop application (without encoder), for closed loop application (with encoder) the setting has no function. [3x] SF + DSC

5.11 Setup in- and outputs

19-67	Function Relay 1	[0] Function can be selected via parameter P5-40. Parameter 5-40 includes options that are generally not required for elevator operation. For detailed information, please refer to the FC 302 programming manual. [1] VLT Ready (Frequency Inverter Operational Ready) This function is intended for controlling a short-circuit contactor. As long as the frequency converter is not experiencing a fault, the short-circuit is not activated. Only in the event of a fault is the short-circuit engaged, which can assist in braking. This function helps to avoid unnecessary switching noise. However, its use must be in accordance with the system's risk assessment. [2] Short-Circuit Contactor With this output function, the drive can control an external short-circuit relay to short-circuit the windings of a PM motor. The short-circuit is always active when the motor is not being powered by the frequency inverter [3] Contactor Output This output is used to control the main contactors or relays for the STO (Safe Torque Off). These switching devices are typically located at the end of the safety chain. When a valid start signal is present, a logical "1" is output. After the end of the run, this output is deactivated. (See timing diagram in Chapter 7.2 Mechanical Brake Control) [4] Ready The frequency inverter is ready, and no fault is present.

		[5] Short-Circuit Contactor (at Standstill) See [2]. In contrast to option [2], this selection waits for the motor to come to a complete standstill. [6] Speed V > 0.2 m/s This signal is typically used in connection with early-opening doors. [7] Start Activated When the frequency inverter is ready and a valid start signal is present, the output is set to 1. This feedback allows the control system to proceed with the start. Some control systems require this handshake.

6 Operation

6.1 First operation after commissioning

After setting up the drive as described in chapter "commissioning", the drive is ready to start operation. However, depending on the mechanical system further adaptations can be necessary. Please follow in case of unexpected behavior the instructions below.

6.2 Installation, Inspection and Testing

During the installation phase it is very important to have a reliable function of the drive to enable smooth handling of the installation process. Balancing might be not adjusted to final stage and low speeds are used to run trough the shaft. For the drive it is important to ensure the avoidance of overloading during this phase. Therefore, Inspection Speed shall be used for all travels in that phase when the lift is controlled manually on top of the car (inspection) or from the control panel. For inspection operation (Manual control on top of the car) two speed operation is possible. The low speed shall always be the Inspection Speed and the higher speed can be V1 or V2 (Intermediate speeds). The change up and down is always possible. In case of limited capabilities of the control system, alternatively the switching frequency in Parameter 14-01 can be adjusted for all operations to 4 kHz (0- 18KW) or 3 kHz for the powers above. After full setup of the lift, the switching frequency can be adjusted to the desired value for normal operation.

6.3 Switching frequency

Referring to chapter 2.4, the switching frequency (P14-01) can be a mean to realise derating. Therefore, the value in Parameter 14-01 must be set according to the selection process for the site. Parameters like motor current, output frequency and ambient conditions can influence the cycling and temperature of the power modules. As a result, losses will be limited by decreasing switching frequency and vice versa

6.4 Test

As first step after programming the drive it is highly recommended to test the basic operation in inspection mode with reduced speed. In case of unintended behavior please follow the instructions in the next sup- chapters.

Car direction

In case Motor runs controlled, but in wrong direction, the reference can be adjusted to the mechanical system:

No.	Name	Parameter Description
19-04	Car direction	[0] normal [1] inverted

Uncontrolled movement (With absolute encoder)
In case of used absolute encoder, the motor shall be connected U-V-W to the drive terminal U-V-W in the right order. If this is double checked, a wrong encoder offset can lead to an uncontrolled movement. Please make sure that P19-05 is set to 0.
The encoder offset can be measured with P19-09.

No.	Name	Parameter Description
19-09	Abs. encoder offs	In new motors the absolute encoder is mounted by factory, so the offset is 0. If encoder was dismounted or changed, the exact position to the rotor shaft shall be determined. [-2] detection of encoder offset Activate inspection mode control panel. Offset will be determined after stop [-1] absolute encoder value will be displayed in P19-98. No movement of the drive possible [0-8192] Encoder Offset
19-98	Abs. enc. position	Shows the value of the absolute encoder. Value is updated after powering up

6.5 Start-error or Track-error or accelerates unexpected or no move

Encoder function
Check the upper two LEDs at terminal block X55 where the encoder is connected. The LEDs show the status of channel A and B of the incremental encoder. If there is a broken wire or a short circuit the LEDs will be switched off.

Illustration: Terminal X55, LED´s

Encoder Auto tuning P19-03
The frequency inverter can detect the encoder direction. P19-03 must be set to 1 and the inspection mode must be activated. The frequency inverter starts the motor using "control without feedback" and checks the direction of the encoder speed. Enter P19-03 = 1 and start using the inspection mode control panel. The elevator will only move a few centimeters. **Caution:** Perform this function only when operating with an incremental encoder. Afterwards, P19-05 is automatically set to the measured encoder rotation direction.

No.	Name	Parameter Description
19-03	Encoder Autotuning	[0] Not active [1] Active
19-05	Encoder direction	[0] normal direction [1] direction inverted

Encoder pulses
Use Parameter 34-50 "Actual Position" to read out the actual position value.
Depends on the motor direction, the actual position value must increase for positive motor direction and decrease for negative motor direction. If the encoder pulses, for the position information, are counted not correctly, check the encoder wiring and the mechanical coupling from motor and encoder.

6.6 Noise or vibrations during acceleration or deceleration (low frequency)

Reduce P19-41 "KP – gain at operation", until the motor makes no noise or vibrations. (Minimum 20). Motors without any load can only be run with the minimum value of 20 in P19-41.

No.	Name	Parameter Description
19-41	KP-Gain at operation	Proportional part of the speed controller. Decrease the value when motor generates noise or vibration.

Noise during operation
If the resonance frequency of the mechanical system matches to the harmonics in the output frequency of the drive, vibrations will occur. P 19-45 can damp this behavior. Usually, lower values solve the vibrations. Recommended values are 1 to 8 ms.

No.	Name	Parameter Description
19-41	KP-Gain at operation	Proportional part of the speed controller. Decrease the value when motor generates noise or vibration.
No.	Name	Parameter Description
19-45	Filter time operation [ms]	Filter time of the speed controller, can be used to filter out vibrations from the system or disturbances of the encoder-signal

6.7 Optimization

Start Behavior
Press **[Main Menu],** select group 19-** Application Parameters and press **[OK].**

In case of rollback at start, P 19-14 can be increased to ensure that the mechanical brake is fully opened before the reference is set. For test purpose the value can be set to 1500 ms. Then controller settings for the start (Parameter P19-40, P19-42, P19-44 and P19-46, See chapter 5.3.4 Speed PID controller) shall be adjusted to eliminate rollback.
Then P19-14 can be set to -1 and the drive will measure brake release time at next start.
Increased values of P19-40 and reduced values in P19-42 help to reduce rollback.
P19-46 is an additional fast zero-position controller to eliminate remaining rollback.
In case of instable control during start, P19-40 shall be decreased, and P19-42 increased.

No.	Name	Parameter Description	PM-motor recommended values	Asynchronous- motor recommended values
19-13	Brake Lift delay [ms]	Delay time for motor magnetization. (for open loop application). The value is determined automatically from motor data	0	300-800
19-14	Brake delay [ms]	Time delay until brake is fully applied. Also defines the active time of the start speed controller	300-1200	300-1200
19-40	KP-Gain at start	Determines the proportional (P) gain of the speed controller at startup. **Note:** Higher values result in a more abrupt load takeover. The value should be increased if the drive rotates backward at startup.	50-500	50-100
19-42	I-time at start [ms]	Determines the integral (I) gain of the speed controller in ms at startup. **Note:** Smaller values result in faster load takeover. The value should be decreased if the drive rotates backward at startup.	12-1000	200
19-44	Filter time at start [ms]	Determines the filter time of the encoder signals at startup. Input in 1/10 ms. **Note:** Increase the value if the encoder signal is poor. The smaller the value, the faster or more abrupt the load takeover.	1.0	10.0
19-46	Pos. gain start	Determines the proportional (P) gain of the position controller at startup. The position controller startup is disabled when parameter 19-46 = 0.1. Values are required for gearless motors. **Note:** Higher values result in a more abrupt load takeover. Default setting: 0.2 to 0.5.	0.2-0.5	0.0-0.4

Pre Torque before start

The drive can apply torque to the motor shaft, before the mechanical brake opens. This usually improves the behavior during the release of mechanical brake. It is recommended to adjust the brake release time and start controller settings upfront. Then the drive can measure the required start torque (Set P19-17 to -1) and apply this value at every start. Another possibility is to work with an active load measurement. The load cell information can be given by analog input 54 or via serial communication protocol. P19-16 defines the maximum torque in that case. Set P19-17 to [1] to enable automatic load compensation. In case of serial communication, the value is part of the protocol, else Analog input 54 will be used for load information 0- 100%. P19-16 shall be set to required motor torque during operation with empty car up. The motor torque will be shown during operation in parameter 16-22.

Controller behavior during operation

In case of overshoot at the end of acceleration or deceleration, a decreased I time P19-42 can optimize this behavior.

Parameters for Stop behavior

The smoothness during approach to the floor generally depends on the approach distance (P19-19) and the approach speed (P19-22). We recommend keeping the default values to ensure a comfortable approach.
However, shorter approach distances during positioning or higher approach speeds can result in stronger vibrations.
In the event of rollback after stop, the time behavior of the PLC and the brake closing delay P19-15 should be checked.
P19-58 determines the delay time in ms for the delayed engagement of the mechanical brake (brake closed) after reaching flush position (in position).
P19-59 determines the time of the torque ramp-down in ms until the motor turns off. The brake is closed, and the torque is reduced to 0 Nm within the ramp time, after which the motor is turned off. Affects the mechanical noise of the brake when the motor is off.

No.	Name	Parameter Description
19-19	Run in distance [mm]	Deceleration distance from P19-22 run in speed to stop at floor level. With DCP4, the function determines the stopping distance in millimeters.
19-22	V0 [m/s]	Run in speed V0
19-15	Brake close delay [ms]	The brake release time in ms ensures that when the flush position is reached, the motor continues to be powered until the mechanical brake is closed. After outputting 0V to terminal 29, the frequency inverter continues to supply power to the motor until the set brake release time has elapsed. Only then will the "position reached" signal be output at terminal X59.7. The time delay ensures that the motor remains magnetized long enough until the brake is closed.
19-58	Delay after stop [ms]	Determines the delay time in milliseconds for the delayed engagement of the mechanical brake (brake closed) after reaching the flush position (in position).
19-59	Torque down time [ms]	Time for decreasing the torque when mechanical brake is closed. Determines the time of the torque ramp-down in milliseconds until the motor turns off. The brake is closed, and the torque is reduced to 0Nm within the ramp time; afterward, the motor is turned off. Affects the mechanical noise of the brake when the motor is off.

7 Functional descriptions

7.1 Automatic motor adaptation, AMA

Automatic motor adaptation (AMA) is an automated procedure used to measure the electrical characteristics of the connected motor and provides an accurate electronic motor model. It allows the drive to run the motor with optimal performance and efficiency. AMA is performed at standstill or during elevator operation. At standstill the measurement will be done under closed brakes and is load independent. The AMA routine supports asynchronous- and PM Gearless motors.

NOTE: AMA cannot be used with a sine-wave filter connected.

AMA is required after manual input of motor nameplate data. The basic measurement will be done at standstill (P19-63=1). After this measurement the motor is ready for operation. However, if this measurement fails on induction motors, 19-63=3 estimates data for the given motor. Further optimization (P1963=4) is optional and can be used for late fine tuning.

AMA, Motor adaption description

No.	Name	Parameter Description
19-63	Motor adaption for asynchronous and PM motor	[0] not active / AMA completed [1] AMA at standstill [2] reserved for future use [3] calculation of motor data [4] optimization during normal operation

AMA at standstill

1. Set the Parameter P19-63 = [1] and confirm with **[OK]**
2. Activate Inspection Mode. (Inspection mode control panel)
3. The motor is energized, and the AMA measurement starts without opening the mechanical brake.
4. The AMA procedure is finished when the LCP status display changes from "P19-63 [1]" → back to the status display "P19-63 [0]"
5. Disable Inspection Mode (Inspection mode control panel)

AMA during operation

1. Set the Parameter P19-63 = [4] and confirm with **[OK]**
2. The elevator should run now at least three times with nominal speed in normal operation.
3. The AMA procedure is finished when the LCP status display changes from "P19-63 [4]" →back to the status display "P19-63 [0]"

Equivalent Motor Data

If an AMA is carried out for ASM or PM motors, the equivalent motor data will be always overwritten. The parameters for the equivalent motor data for ASM and PM motors are listed in the table below.

Nr.	Parameter- Name	Motor- Typ
1-30	Stator Resistance (Rs)/[Ohm]	ASM
1-31	Rotor Resistance (Rr)/[Ohm]	ASM
1-33	Stator Leakage Reactance (X1)/[Ohm]	ASM
1-34	Rotor Leakage Reactance (X2)/ [Ohm]	ASM
1-35	Main Reactance (Xh)/ [Ohm]	ASM
1-36	Iron Loss Resistance (Rfe)/ [Ohm]	ASM
1-37	d-axis Inductance (Ld)/ [mH]	PM
1-40	Back EMF at 1000 RPM in [V]	PM

The values in parameters 1-30 to 1-36 indicates the resistance between line to common.
The value in parameter 1-37, for the PM motor axis inductance between line to common.

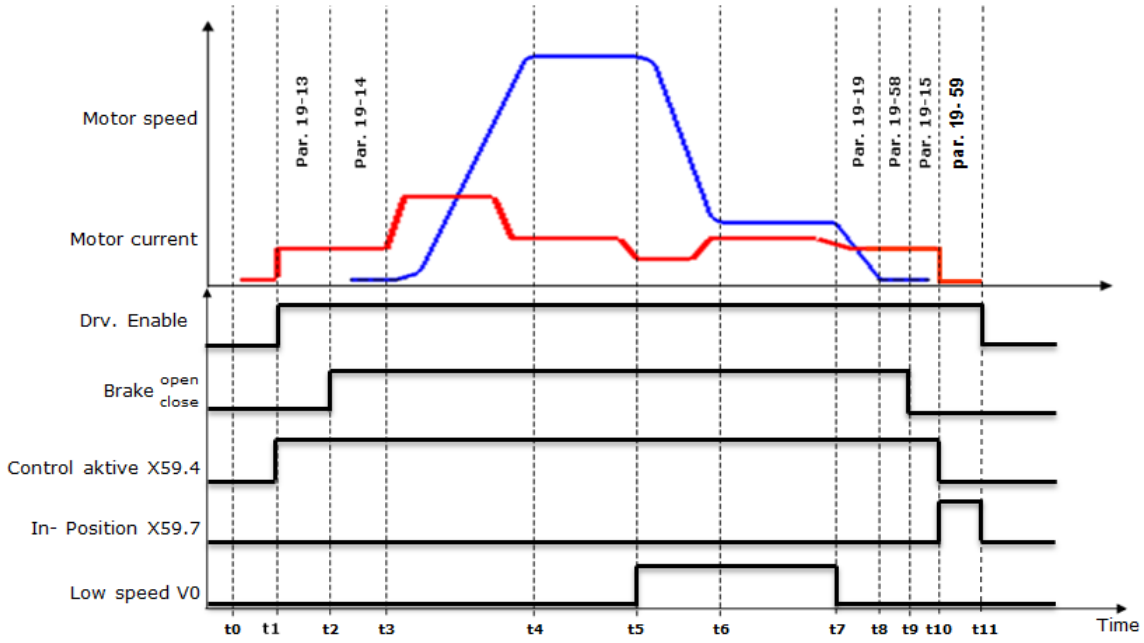
NOTE:
In data sheets for motors are usually also specified the line-to-line data.
In this case divide the value by 2 to get the line to common (star point) value.
This also applies to measured values with a measuring device.

The value in parameter 1-40 indicates the back EMF in volts referred to 1000 rpm.

NOTE:
Data sheets for motors usually also contain information on the back EMF based on the nominal motor speed. The back EMF referred to 1000 rpm can be calculated as follows.

Example: Back EMF 320V at 1800 RPM.
Back EMF=(320V/1800) *1000=178V

7.2 Mechanical Brake Control



Time	Description
t0	In- Position
t1	Motor control on
t2	Delay and open brake
t3	Brake is open, speed reference active
t4	Max. speed
t5	Deceleration command
t6	Low speed V0
t7	Stop command
t8	Positioning
t9	Brake close
t10	Motor off
t11	In- Position
Parameter	Description
19-13	Brake Lift delay
19-14	Brake delay
19-19	Run in distance
19-58	Delay after Stop
19-15	Brake close delay
19-59	Torque down time

Measurement of mechanical brake delay P19-14 and monitoring time P19-87
To optimize the timing of the mechanical brake, the mechanical delay can be measured by the drive.

Conditions:
- The car shall be empty and the ratio car-weight/ counterweight shall be as desired (e.g. 50%).
- The preload torque in Parameter P19-16 is automatically set to zero only for the measurement and is reset to its original value after the measurement.

Measurement procedure, Brake delay P19-14:
- Set P 19-14 to -1
- Start the Lift (e.g. Inspection mode)

After the start, the value in P19-14 will be set to the measured time. If the brake does not react within 2000 ms, the measurement could not be completed, the value of P19-14 will stay at -1. Please check the installation.

Measurement procedure, Brake monitor time P19-87:
- Precondition: P19-65 is set to x3
- Set P 19-87 to -1
- Start the Lift (e.g. Inspection mode)

After the start, the value in P19-87 will be set to the measured time. If the brake does not react within 2000 ms, the measurement could not be completed, the value of P19-87 will stay at -1. Please check the installation.

Measurement procedure, Reference torque P19-91:
- Precondition: P1965 is set to x3
- Set P19-91 to -1
- Operate the lift at nominal speed through the whole shaft

After the start, the value in P19-91 will be updated to the maximum torque deviation from the holding torque related to the nominal motor torque. The value will be taken as reference for the contactless brake monitoring during constant speed operation.

7.3 Control of the mechanical brake with SBU 2.0

The SBU 2.0 is an electronic module for controlling the mechanical brake. Details can be found in the documentation for the SBU 2.0. The relevant input parameters and event messages are shown below.

Commissioning SBU with VLT LiftDrive LD302
After the installation has been completed, parameter 19-77 must be set to "1" on the frequency converter to commission the SBU. Switch the frequency converter mains off to apply the change and switch it on again after the display is dark. During startup, the SBU is now parameterized and prepared for operation. If the frequency converter shows "Operating mode" or "no motor data" in the status display, the commissioning of the SBU is complete. If necessary, settings on the SBU can now be changed.

The process in short:
1. Complete installation and verification of connections
2. Set parameter 19-77 to 1 on the frequency converter
3. Disconnect the frequency converter from the mains power supply and restart it again
4. If necessary, adjust the settings of the SBU

Parameter setup for SBU 2.0
Parameter 19-77, SBU- Parameter Index.
Parameter 19-78, SBU- Display/Input of the associated parameter values.

Par.	Index	read/ write	Default Value	Remark
19-77	1	r		SBU-control word
19-77	2	r		SBU-control word
19-77	10	rw		Travel distance from starting point before brake test [mm]. 0 = after acceleration
19-77	11	rw		Type of evacuation 0 = normal operating mode 1 = CAN The SBU gets the current speed from the shaft encoder. The evacuation speed is set in Par.19-78=14. 2 = Timer The evacuation takes place with a continuous pulse control of the brake. The pulse times are set in Par.19-78=12 & 13. 3 = FU The speed monitoring is monitored by the Drive. Speed specification in Par.19-54.
19-77	12	rw	500	SBU evacuation pulse time [ms]
19-77	13	rw	500	SBU evacuation pause time [ms]
19-77	14	rw	200	SBU evacuation speed [mm/s]
19-77	15	rw	50	Time duration of overexcitation [ms]
19-77	16	rw	0	Time duration of the switch-off ramp [ms]
19-77	17	rw	205	Overexcitation Voltage [V]
19-77	18	rw	105	Holding voltage [V] (105V – 205V)
19-77	19	rw	4	Shaft encoder node-id
19-77	20	rw	2	Number of brakes (1 to 3)
19-77	21	r		Shaft encoder - Resolution (number of pulses)
19-77	22	r		Shaft encoder – Path of resolution impulses
19-77	24	r		SBU SW-Version
19-77	-1			Set SBU to test mode (test signals can be set in the SBU)
19-77	-2	r		Array read error

Common test functions SBU 2.0

Brake test A
In the following, the function is checked by applying a brake during the ride.
Carry out the following test at standstill of the elevator:

- Set the SBU index parameters to path specification. Par. 19-77 = 10
- Set the path specification in mm. Par. 19-78 = 1000 (e.g. 1000 = 1000mm = 1m)
- Switch SBU to test mode. Par. 19-77 = -1
- Activate brake test A. Par. 19-78 = 1
- Enable a start command. (Inspection mode control panel).
- After the distance, the selected brake engages.
- The display shows: [SBU test brake A / Test finished].
- It must not be possible to start the elevator, the motor remains without current.
- Switch off the test mode of the SBU. Par.19-77 = 0

Brake test B
In the following, the function is checked by applying a brake during the ride.
Carry out the following test at standstill of the elevator:

- Set the SBU index parameters to path specification. Par. 19-77 = 10
- Set the path specification in mm. Par. 19-78 = 1500 (e.g. 1500 = 1500mm = 1,5m)
- Switch SBU to test mode. Par. 19-77 = -1
- Activate brake test A. Par. 19-78 = 2
- Enable a start command. Inspection mode Control panel).
- After the distance, the selected brake engages.
- The display shows: [SBU test brake A / Test finished].
- It must not be possible to start the elevator, the motor remains without current.
- Switch off the test mode of the SBU. Par.19-77 = 0

Test STO- Function
In the following, the STO- circuit is not closed by an independent relay.
Carry out the following test at standstill of the elevator:

- Switch SBU to test mode. Par. 19-77 = -1
- Test of the monitor function. Par. 19-78 = 5
- Enable a start command. (Inspection Mode control panel).
- The display shows: [SBU- Test K1/K2 / Test finished].
- No error is generated!
- It must not be possible to start the elevator, the motor remains without current.
- To end the test run, switch the inverter off and on again once.

Test of the monitor function K1/K2 (EN81-20 5.9.3.4.4)
In the following, the non-dropout of K1/K2 is simulated by an independent relay.
Carry out the following test at standstill of the elevator:

- Switch SBU to test mode. Par. 19-77 = -1
- Test of the monitor function. Par. 19-78 = 6
- The display shows: [SBU- Test K1/K2 / Test finished].
- The error memory, Par. 19-81 displays 516.
- It must not be possible to start the lift (EN81-20 5.9.3.4.4)
- Switch off the test mode of the SBU. Par.19-77 = 0

Contactless monitoring with SBU 2.0

Setup:
After basic setup and commissioning the contactless monitoring features can be activated.

Steps:

- Measurement of mechanical brake delay as described in chapter "Measurement of mech. brake delay P19-14 and monitoring time P19-87"
- Set P19-65 to xx3 (For details please check P19-65 description)
- Measurement of monitoring time P19-87 as described in chapter "Measurement of mech. brake delay P19-14 and monitoring time P19-87"
- Testing of contactless brake monitoring.

NOTE:

- It is Mandatory to perform the steps as described above at commissioning, after each important change in Lift configuration and during recurrent testing of the Lift.

1. Test of brake 1, no holding torque
a. Set P 19-77 to -1
b. Set P 19-78 to 11
c. Start the lift.
d. Expected reaction: Drive will deactivate the inverter and show Triplock (272) in LCP
e. Triplock shall be removed by setting P19-64= -1

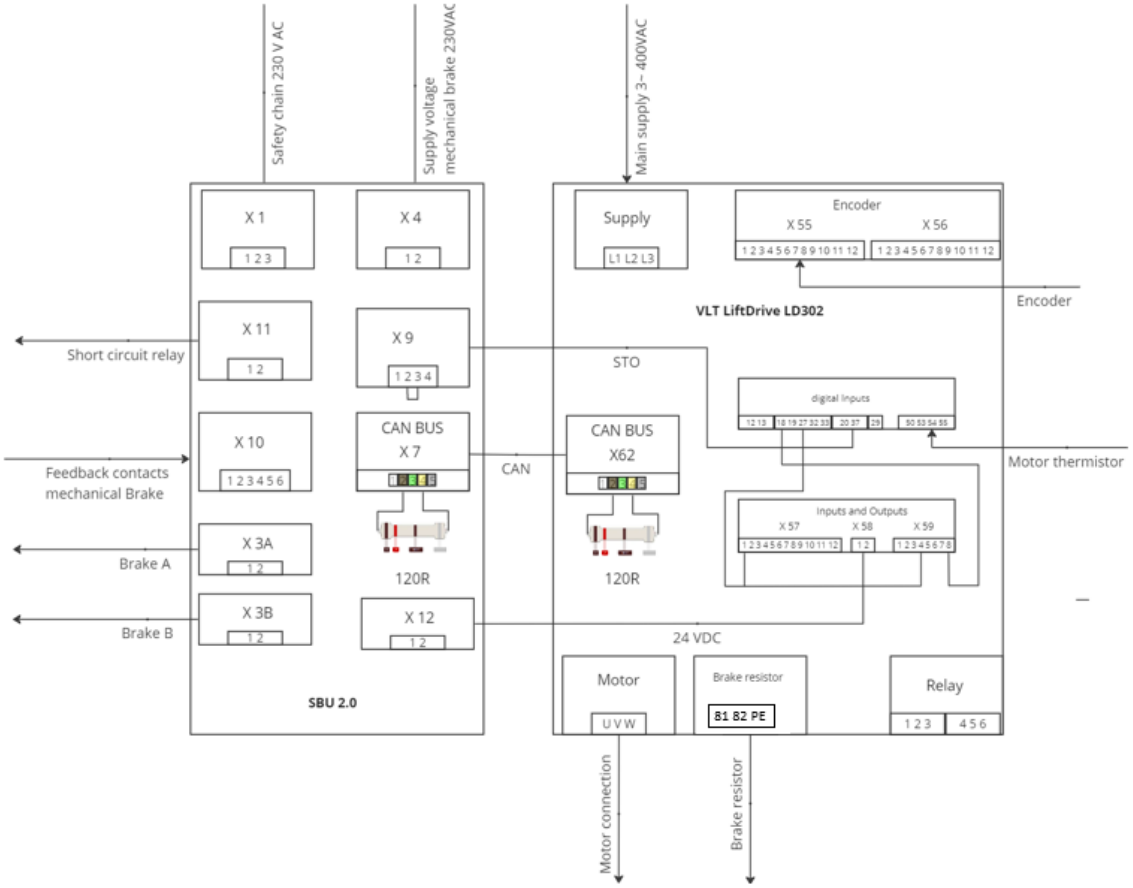
2. Test of brake 2, no holding torque
a. Set P 19-77 to -1
b. Set P 19-78 to 12
c. Start the lift.
d. Expected reaction: Drive will deactivate the inverter and show Triplock (273) in LCP
e. Triplock shall be removed by setting P19-64= -1

3. Test of brake 1, brake does not release
a. Set P 19-77 to -1
b. Set P 19-78 to 13
c. Start the lift.
d. Expected reaction: Drive will deactivate the inverter and show Triplock (274) in LCP
e. Triplock shall be removed by setting P19-64= -1

4. Test of brake 2, brake does not release
a. Set P 19-77 to -1
b. Set P 19-78 to 14
c. Start the lift.
d. Expected reaction: Drive will deactivate the inverter and show Triplock (274) in LCP
e. Triplock shall be removed by setting P19-64= -1

Schematic diagram of the LiftDrive LD302 with SBU#

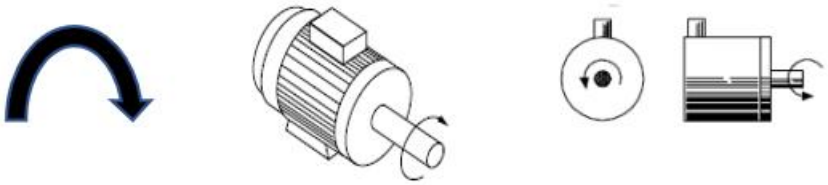
The following schematic shall be seen as example and leads to a working system. Safety requirements of the whole control cannot be covered in this example. Therefore, the safety considerations need to be covered as part of system engineering process.
In case the system is designed according to the example, the simple control mode needs to be activated in P 19-86.



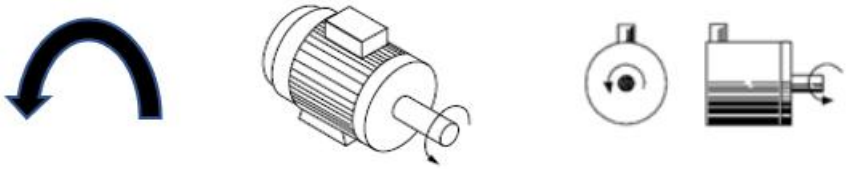
7.4 Motor and Encoder rotation direction

It is necessary to check the rotation direction for motor and encoder.
For the Lift- application applies:
Upward movement: Motor rotates clockwise with positive reference.
Downward movement: Motor rotates counter- clockwise with negative reference.
Upward movement: encoder counts up (P34-50)
Downward movement: encoder counts down (P34-50)

View rotation clockwise:



View rotation counter- clockwise:



Note:
If the motor direction of rotation does not match, the direction of rotation must be changed by swapping two motor- phases

The counter direction of the encoder is displayed in Parameter 34-50 Actual Position.
The value in Parameter 34-50 increases when the motor rotates clockwise.
The value in Parameter 34-50 decreases when the motor rotates counter- clockwise.

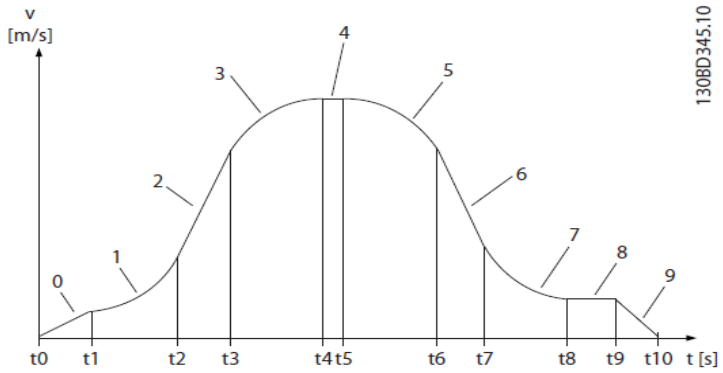
If the encoder counter direction does not match to the direction of the motor, the counting direction of the encoder must be changed with:
Swapping two encoder tracks

7.5 Speeds, Acceleration, Jerks

Speeds

No.	Name	Parameter Description
19-20	max. speed [m/s]	Set the max. speed in m/s for the Lift. Depending on the nominal motor speed and the settings in parameters 19-10 to 19-12, the maximum speed is limited to 125% of the rated motor speed.
19-21	V4 [m/s]	Nominal speed
19-22	V0 [m/s]	Leveling speed
19-23	Vi [m/s]	Inspection speed
19-24	V3 [m/s]	Intermediate speed 1
19-25	V2 [m/s]	Intermediate speed 2
19-26	Vn [m/s]	Releveling speed
19-28	V1 [m/s]	Intermediate speed 3

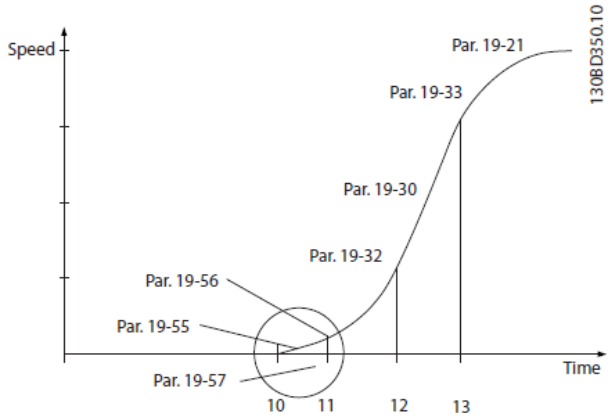
Overview of the motion profile
The profile of the elevator operation can be separated into 10 single parts of movement which can be adjusted individually.



Parameter	Identifier	Name	Description
19-19	9	Run in distance [mm]	Distance of last proximity switch to ground level
19-21	4	V4 [m/s]	Nominal speed
19-22	8	V0 [m/s]	Run in speed
19-30	2	Acceleration [mm/s²]	
19-31	6	Deceleration [mm/s²]	
19-32	1	Start Jerk [mm/s³]	when jerk values are too low, programmed acceleration values may not be reached
19-33	3	Accel. Jerk [mm/s³]	
19-34	5	Decel. Jerk [mm/s³]	
19-35	7	Run in Jerk [mm/s³]	
19-55	0	L-start acc [mm/s²]	Linear start function can be deactivated when L-start time is set to 0
19-56		L-start speed [mm/s]	
19-57		L-start time [ms]	

Linear start

Linear start is useful for comfortable start of the elevator in difficult mechanical environment. E.g. L- Type car frame or glide shoes.



Parameter	Description	Unit
19-57	L- start time [ms]	[ms]
19-55	L- start Acceleration	[m/s²]
19-56	L- start Speed	[m/s]
19-32	Start Jerk	[m/s³]
19-30	Acceleration	[mm/s²]
19-33	Acceleration Jerk	[m/s³*]
19-21	Nominal Speed, V4	[m/s]

Predefined Comfort Settings

To adapt the ride comfort to the general use of the lift, selecting P 19-38 will change all settings for the Acc, Dec and Jerk parameters. Please note that the settings in parameters 19-30 and 19-31 will not exceed the limits set for the respective lift.

No.	Name	Parameter Description
19-38	Comfort	[0] no preselection active [1] comfort [2] dynamic [3] normal

Control during Inspection mode panel control and inspection

When operating in Inspection mode panel control, the speed Vi must always be used. During inspection, the small speed Vi should always be selected, and if a higher speed is necessary, the faster speed V1 should be used. (fast, slow) This allows the switching between the speeds.

7.6 Control for Inspection or Revision Mode

In the following, the operating modes "Revision" and "Inspection" are collectively referred to as "inspection" or "inspection mode." For the operation of the frequency inverter, no distinction between these modes is necessary. A dedicated speed is configured in the frequency inverter for inspection mode. Depending on the type of control, the corresponding inspection speed (Vi) should be used.

⚠ GEFAHR ⚠

Bei Nichtbeachtung besteht die Gefahr von Personenschäden oder Materialschäden.
Diese können jeweils durch zu hohe Geschwindigkeiten auftreten oder eine Überlastung des Frequenzumrichters.

The inspection speed is set in parameter 19-23. The maximum adjustable speed is 0.63 m/s and is limited to this value in accordance with EN 81-20.

⚠ WARNUNG ⚠

During inspection mode, the frequency inverter operates with a reduced switching frequency to prevent a reduction in service life due to unusual stress. All installation operations as well as the transport of test loads should be carried out in this operating mode.
If a second speed is to be available for inspection mode (fast/slow), the use of V1 is recommended. The setting is made in parameter 19-28, and the value range is also limited to 0.63 m/s.

7.7 Release from Safety- Gear / - Catch

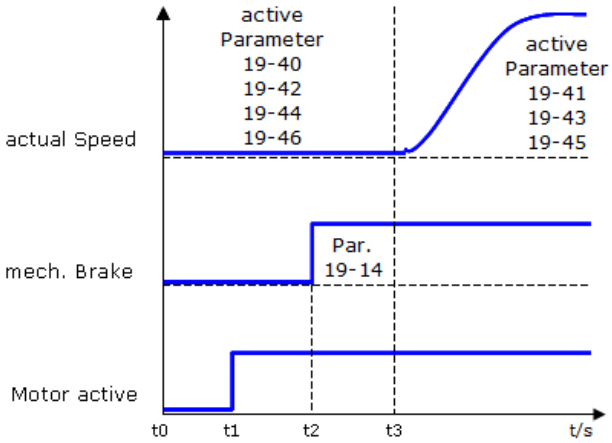
Function "Release from Safety- Gear / - Catch".
To release the cabin from the mechanical safety gear, the frequency converter is equipped with a so-called "shaking function." To activate this, set parameter 19-60 to the value Index [2]. After starting in inspection mode, the mechanical brake is released and periodic torque pulses are applied to the motor in order to free the cabin from the safety catch. The release from the safety catch must only be performed in the "UP" direction. The function deactivates automatically after the cabin has moved 100 mm or after the frequency inverter has been stopped by a control signal.
If the cabin is still held by the safety catch, it is necessary to reactivate the function by setting parameter 19-60 again.

7.8 Deceleration distance

In Lift installations it is useful to know the actual deceleration distance before starting operation. For this purpose, it is possible to calculate the distance for each speed. Those calculated values can be used for the optimization of the control system. The value is based on the deceleration distance of the chosen speed down to v0 including 100 mm run in speed and including run in distance (P19-19).

No.	Name	Parameter Description
19-99	Distance during deceleration	Shows the calculated deceleration distance of the last travel [-1] calculates deceleration distance V1 (P19-28) [-2] calculates deceleration distance V2 (P19-25) [-3] calculates deceleration distance V3 (P19-24) [-4] calculates deceleration distance V4 (P19-21)

7.9 Speed PID controller



Speed controller settings at start

No.	Name	Parameter Description	PM-Motor recommended values	Asynchron-Motor recommended values
19-40	KP-Gain at start	Proportional part of the speed controller. Decrease the value when motor makes noise.	50	100.0
19-42	I-time at start [ms]	Integral part of the speed controller	12	200.0
19-44	Filter time at start [ms]	Filter time of the speed controller, can be used to filter out vibrations from the system or disturbances of the encoder-signal	1	4.0-10.0
19-46	Pos. gain start	Position controller gain during start	0.2 - 0.5	0

Speed controller settings during operation

No.	Name	Parameter Description	PM-motor recommended values	Asynchronous- motor recommended values
19-41	KP-Gain at operation	Proportional part of the speed controller. Decrease the value when motor makes noise.	30 -70	100.0
19-43	I-time operation [ms]	Integral part of the speed controller	200.0	200.0
19-45	Filter time operation [ms]	Filter time of the speed controller, can be used to filter out vibrations from the system or disturbances of the encoder-signal	4.0-10.0	4.0-10.0

7.10 Control sources P19-66

No.	Name	Parameter Description
19-66	Digital-Serial	[0] Drive control by digital terminals [1] Serial bus control DCP3 [2] serial bus control DCP4 [3] Can Open DSP417 Power cycle drive after change of control type

Operation with serial bus DCP3 and DCP4

The drive supports the serial Lift protocol DCP3 and DCP4. Due to this protocol all necessary signals and information will be transferred by the serial bus. As a matter to the fact the wiring of the input control signals for direction and speed can be reduced.

Connections

Terminal block	Terminal number	MCO
X60	CS	Chip Select
	62	RXD/TXD P
	63	RXD/TXD N
	66	0V
	67	5V

Data readouts

No.	Name	Parameter Description
19-73	BUS CMD	Display parameter for DCP command byte and selected speed from Lift controller. Use Lift drive setup tool for logging.
1974	BUS STAT	Display parameter for DCP status byte and extended status to Lift controller. Use Lift drive setup tool for logging.

DCP4 settings

In DCP4 the motor encoder shall be aligned to the shaft encoder. For this reason, the Lift controller transmits the actual shaft encoder position to the drive after each movement. The distance deviation is displayed in P19-69 Sync Position. To align motor encoder with shaft encoder the deviation in P19-69 shall be entered manually in P19-72 Position corr. factor.

No.	Name	Parameter Description
19-69	Sync Position	The position deviation is updated after each journey. This allows for the alignment of residual path detection. The correction value is determined and displayed with P19-69 = 1. After that, the elevator is free to move as desired. The displayed values range from 0.950 to 1.050 (+/-5%). If exceeded, error 225 is generated. In case of deviations, the system data should be reviewed. **Note:** Alignment of the residual path detection is mandatory. The correction value adjusts the mechanical lift parameters to the motor encoder, enabling optimal positioning at the stop. The displayed correction value must then be entered in P19-72
19-72	DCP4-Position corr. factor	Value adapts the mechanic settings of the Lift drive to the shaft encoder. Only when P19-72 is aligned with 19-69 an optimum approach at floor level is possible. Alignment of residual path detection in DCP4. Here, the correction values determined under P19-69 are entered. The values must be within 1 +/- 5%. If exceeded, error 225 is generated. Verify system data in case of deviations. Only when P19-72 is aligned with 19-69, an optimal approach to floor level is possible.

Operation with Can Open DSP417

The drive supports Can Open DSP417.
Supported Features:

- Heartbeat guarding of lift controller
- Profile velocity mode
- Profile position mode (Can Open shaft encoder necessary)
- EMCY-telegram
- Virtual position encoder 3 (for slip measurement)
- Virtual terminal (for remote parametrization and diagnosis)
- Pre-torque at start (with Can Open load measuring device) in preparation

Connection

Terminal block	Terminal number	Can Bus
X62	1	N/A
	2	CAN_Low
	3	CAN_GND
	4	CAN_High
	5	N/A

NOTE: If the drive is the last node in the network an external termination according to CAN Open specification is required. (120 Ohm between CAN-H and CAN-L)
The terminal strip X62 is located at the upper right on the casing. The connections are exposed by breaking out the designated windows.

Speed setting

All speed references are set directly by the Lift controller via CAN-Bus.
P19-20 Max. speed used for speed limitation
P19-22 V0 used together with P19-19 Run in distance to define the run-in ramp.
All other speed parameters not used in CAN-Open DSP417.

No.	Name	Parameter Description
19-66	Digital-Serial	[3] Can Open DSP417
33-90	CAN node ID	2 (Default)
33-91	CAN baud rate	[21] 250 Kbps (Default)

NOTE:
Power cycle the drive after change of control type.

Data readouts

No.	Name	Parameter Description
19-73	BUS CMD	Display parameter for DSP command byte
1974	BUS STAT	Display parameter for DSP status byte

7.11 Position mode

In position mode, the motor encoder shall be aligned to the shaft encoder. For this reason, the Lift controller transmits the actual shaft encoder position to the drive after each movement. The distance deviation is displayed in P19-69 Sync Position. To align motor encoder with shaft encoder the deviation in P19-69 shall be entered manually in P19-72 position corr. factor.

No.	Name	Parameter Description
19-69	Sync Position	The position deviation is updated after each journey. This allows for the alignment of residual path detection. The correction value is determined and displayed with P19-69 = 1. After that, the elevator is free to move as desired. The displayed values range from 0.950 to 1.050 (+/-5%). If exceeded, error 225 is generated. In case of deviations, the system data should be reviewed. **Note:** Alignment of the residual path detection is mandatory. The correction value adjusts the mechanical lift parameters to the motor encoder, enabling optimal positioning at the stop. The displayed correction value must then be entered in P19-72
19-72	DCP4-Position corr. factor	Value adapts the mechanic settings of the Lift drive to the shaft encoder. Only when P19-72 is aligned with 19-69 an optimum approach at floor level is possible. Alignment of residual path detection in DCP4. Here, the correction values determined under P19-69 are entered. The values must be within 1 +/- 5%. If exceeded, error 225 is generated. Verify system data in case of deviations. Only when P19-72 is aligned with 19-69, an optimal approach to floor level is possible.

7.12 Operation with absolute encoder (SSI/EnDat/BISS-C)

For running PM-motors with frequency converters it is necessary to know the exact rotor position. Usually the rotor position is determined with the help of an additional single turn absolute encoder which is mounted on the rotor shaft. The Danfoss Lift drive doesn´t need an absolute encoder for the operation of pm motors. It detects the rotor position by creating a test signal before the first start of the motor. However, it is possible to use a single turn absolute encoder for the rotor position detection as well. It is recommended to switch to absolute encoder type after the normal commissioning is finished.

Note: Operation with Absolute encoder can only work if Encoder direction P19-05=0!

No.	Name	Parameter Description
19-08	Abs. encoder type	[0] no absolute encoder active [1] SSI encoder [2] EnDat encoder [3] BISS-C
19-09	Abs. encoder offs	In new motors, the absolute encoder is factory-installed, thus the offset is 0. The input value is used to set the offset between the absolute encoder and the position of the motor shaft. After input, the absolute encoder offset should be saved. Par.1964=1. The value range is 0 to 8192. The value 8192 corresponds to 360°. Par.19-09 = -1. For absolute encoders, the absolute value can be displayed in the parameter. Par.19-09 = -2. The encoder offset can be determined with the next return journey (Inspection mode control panel) after stopping (e.g., after changing the encoder). Note: No offset needs to be entered for incremental encoders. Parameter 19-09 = 0. If the motor manufacturer has performed a mechanical alignment for motors with absolute encoders, it is generally not necessary to enter an offset. For safety, the offset should be checked. Par.19-09 = -1. [-2] Determination of Encoder Offset The encoder offset is determined with the next return journey (Inspection mode control panel) . The offset is calculated after stopping. [-1] For absolute encoders, the absolute value can be displayed in parameter 19-98. No movement of the drive is possible. [0-8192] Absolute Encoder Offset.
19-98	Abs. enc. position	Display of the rotor position determined by the absolute encoder after power on. If P19-09 = -1, the rotor position display is continuously updated. The value is updated after power is turned on.

7.13 Operation with UPS, Evacuation mode

In operation with UPS, it may be necessary to know the direction of the load.
The frequency converter automatically detects the slight load direction at each start.

Load direction

The specific load direction can be indicated with a digital output. See P19-84.
For PLCs without possibility to use the given load direction, the drive can choose the light load direction independently. Parameter 19-86 shall be set to 2X or 3X. See P19-86.

No.	Name	Parameter Description
19-85	Load direction	[-1] Load direction down (full cabin) [1] Load direction up (empty cabin)

For an empty cabin, the load direction should be P19-85 =1.
If not, set P19-84 to 2, inverse.

Cabin load	load direction	P19.85	Output X59.1
Empty	Up	1	0
Full	Down	-1	1

The cabin load is measured directly after the mechanical Brake is opened. So, it is important for the proper functionality to set the value P19-14 brake delay long enough.

UPS Mode

If a UPS with reduced power is used for evacuation, this must be communicated to the frequency converter via a signal at input X57.8 or via serial communication. In UPS mode, the speed is always limited to the evacuation speed (P19-22).

NOTE: In case of mains loss, the supply shall not change from 3~ to 1~ during operation and wise versa. The loss of normal supply shall lead to a stop of the lift. Then the drive can be controlled for evacuation. If normal supply voltage appears during evacuation, the drive shall be stopped before changing the supply voltage!

7.14 Operation VVC+ open loop for induction motors

The drive can operate asynchronous motors without encoder in open loop mode.

Function	Parameter-number	Parameter name	Value recommended values	Remark
Basic Setting	P32-00	Incremental Signal Type	[0] None	No encoder is needed
Release Brake	P19-13	Brake Lift delay	300-1000ms	Motor magnetizing time before releasing the brake.
	P19-14	Brake delay	0-500ms	Delay of speed reference until the brake is totally opened.
Start	19-55	L-start acc	100mm/s² - 200mm/s²	To avoid a rollback of the cabin it can be necessary to use the linear start function to accelerate the drive quickly to the minimum speed.
	19-56	L-start speed	0.050m/s - 0.100m/s	
	19-57	L-start time	200ms-1000ms	
Close Brake	P2-21	Activate brake speed	0-300 rpm	Speed level of engaging the brake.
	P19-15	Brake close delay	300-100ms	Additional magnetizing time to hold the load until the brake is fully closed.

7.15 Extended Settings

Nr.	Name	Parameter Description
P19-86	Special Function	[00] Standard Control [x1] **S**imple **C**ontrol, Release function via direction inputs [x2] Dir=V0, Control without V0 [x3] SC + Dir=V0 [x4] **S**oft-**S**top at **D**irection=0, Soft stop on direction [x5] SSD + SC [x6] SSD + Dir=V0 [x7] SSD + SC + Dir=V0 [1x] **S**hort **F**loor function, short stop journey [2x] **USV**-Operation, Evacuation in load direction Only used for open loop applications (without encoder), with closed loop (with encoder) the setting has no function. [3x] SF and USV

Simple Control, Release function via directional inputs

With simple control operation can be started by enabling the direction signals at T32/33. The enable signals will be wired as normal however the normally opened relays contact in the path of the motor contactors k1 and k2 will now be controlled by the contactor function of the drive. This can be digital output X59.4 or relays 1 (P19-67 Function Relay 1 [3] contactors). That means, with the setting of a direction signal and a speed signal the relays contact of K12 will be switched, which leads to the switching of the motor contactors and the enable signal to T27 and X57.1.

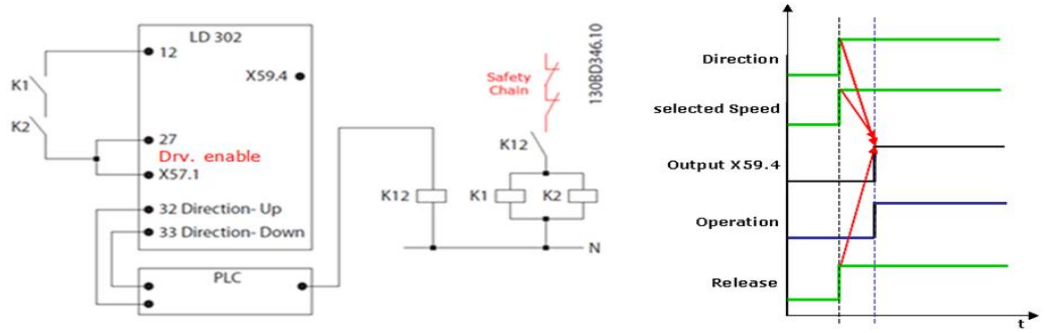


Illustration: Parameter 19-86 Enable Simple Control= [0]

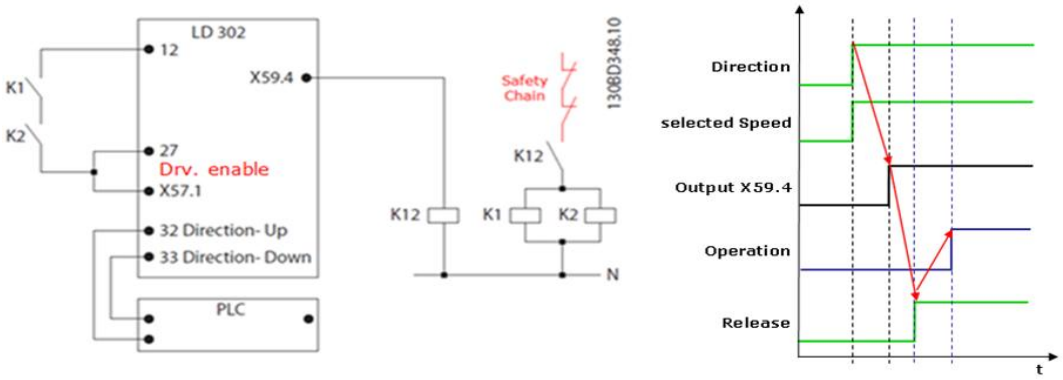


Illustration: Parameter 19-86 Enable Simple Control= [1]

Dir=V0

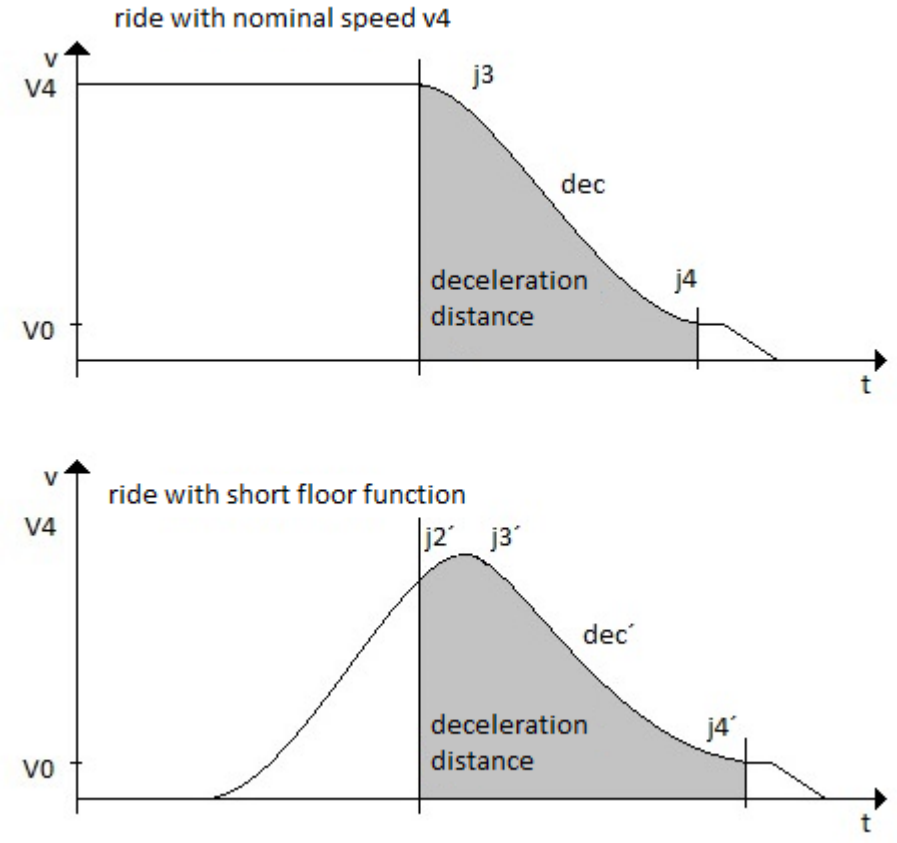
This function uses the directions signals up and down for V0. The run-in speed V0 is always active when a direction signal is active. The priority is on the fast speed input. When fast speed is disabled, slow speed is active. This function can be used with all control modes where V0 run in speed has the lowest priority. That is P19-50 = 1 or 8.

Soft stop at Dir=0

When disabling the direction signals during movement a soft stop will be executed. The mechanical brakes will be closed at standstill. The function can be used in combination with inspection boxes which use the direction signal to stop the drive.

Short floor function

The Lift drive executes the short floor function if the selected speed cannot be reached due to short floor distances. The jerks j2, j3 and j4 and the deceleration will be recalculated and adapted to the deceleration distance of the nominal speed v4. As a result, the approach at v0 is independent of the time when run in speed v0 is selected. An overshoot will be prevented as well as long slow speed duration. The short floor function is only available for nominal speed v4.



UPS operation in load direction
If this function is activated, the drive will operate the elevator in load direction, independent on the given direction control signals, in case of activated UPS input.

7.16 Use of terminals T27 and X57.1

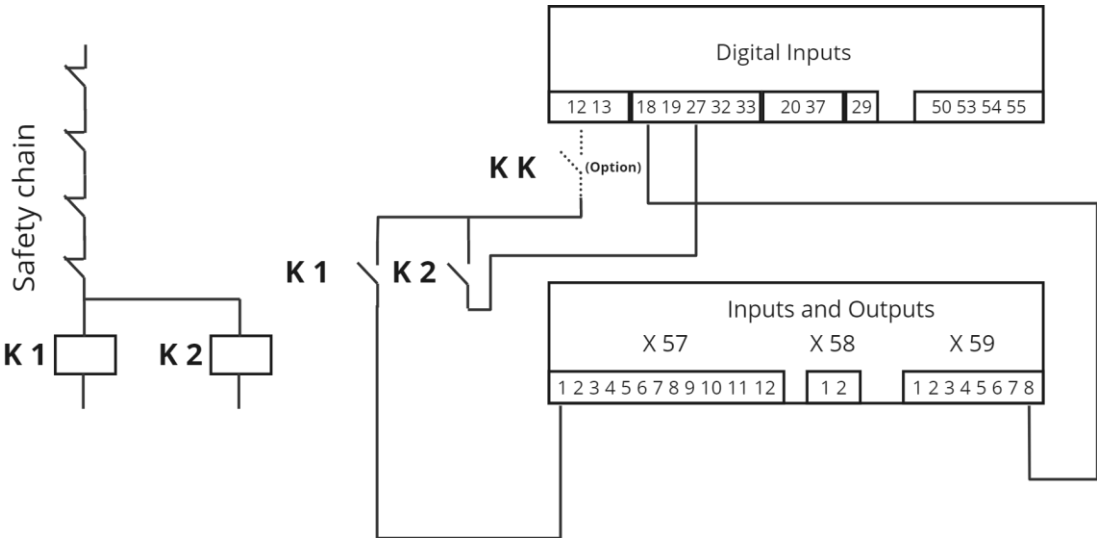
The following circuit examples for applications with terminals T27 and X57.1.
These are to be understood as examples and must be compared with the requirements of the respective controller.
The examples can also be linked to one another as desired.
The digital inputs T27 and X57.1 provide the following functions:

1. Load-free switching at the output of the frequency converter
2. Quick stop (coast) in the event of an open safety chain
3. Quick stop (coast) in the event of an active short circuit on the motor windings
4. Monitoring of the motor contactors or relays for the STO (see Chapter XX)

Both digital inputs T27 and X57.1 must not be permanently bridged with 24 VDC and must have the status "1" before each journey and be switched off after each journey. Otherwise, a new journey is not possible.

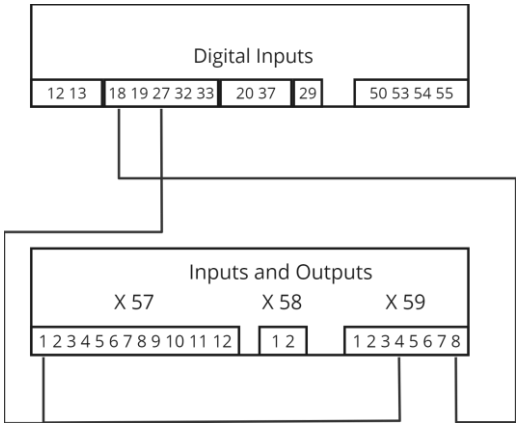
Application Monitoring motor contactors and optionally with short-circuit circuit for the motor windings (NC).

- System with relays or contactors for the motor, optionally with STO and optionally with a short-circuit circuit for the motor winding (NC). optional.



KK= short-circuit relay

- System without relays and contactors for motor, short circuit or STO



Function Outputs, Terminal X59.1 – X59.7

Nr.	Name	Parameterbeschreibung
19-84	Funktion X59.1-7	Functions of output X59.1 – X59.7 Parameter 19-84 displays a seven-digit value. Each digit represents outputs X57.1 to 7. The outputs are represented by one of the 7-digit display XXXXXXX. The assignment of the outputs is from left to right for output X59.7 to X59.1. A parameter value 0,1,2,3 or 8 defines the output function for each decimal place. Output functions: If the value of a decimal place is 0, the factory setting preset for this output applies. X59.1, Over Speed X59.2, Control Speed 1 X59.3, Control Speed 2 X59.4, Output contactor X59.5, Ready Signal X59.6, Over Temperature X59.7, Standstill Position reached To change the function of one or more outputs, you can enter the corresponding value at the respective location: 1: Output of the load direction See chapter Load direction, P19-85. 2: Output load direction inverse The purpose is to adapt to reverse the control logic. 3: Warning Direction change counter See chapter Direction change counter. If the counter falls below the warning value, this output function can be used to indicate a low counter value in the lift controller.

		4: Inverter brake IGBT fault. Error, brake resistor short circuit This output function can be used to indicate a critical error in the brake IGBT or brake resistor to the control logic. In the event of such an error, the power supply to the drive must be interrupted to avoid possible risks such as overload/fire. 5: Short circuit contactor (standstill) With this output function, the drive can control an external short circuit relay to short circuit the motor windings of a PM motor. 6: Speed V > 0.2 m/s This function provides a speed-related output signal when the actual speed is higher than 0.2 m/s. 7: Start activated (see P 19-67) The frequency converter is ready and has taken over the start. With this feedback, the missing direction or speed signals can be provided. This function is required by some lift controllers. 8: Stop next floor in case of brake failure If monitoring the mechanical brakes during operation detects a failure, this signal can be used by the elevator control system to stop at the next possible floor. The aim is to keep movements against closed brakes to a minimum.

Load direction

No.	Name	Parameter Description
19-85	Load direction	[-1] Load direction down (full cabin) [1] Load direction up (empty cabin)

7.17 Monitoring functionalities

No.	Name	Parameter Description
19-65	Monitoring	[000] Monitoring not active [xx1] monitoring brake feedback [nc]. Monitoring of brake feedback contacts normally closed, input X57.9 and 10. [xx2] monitoring brake feedback [nc]. Monitoring of brake feedback contacts normally open, input X57.9 and 10. [xx3] brake force monitoring. Monitoring of brake force via SBU [x1x] monitoring governor [no] Speed limiter normally open, terminal 19. [x2x] monitoring governor [nc] Speed limiter normally closed, terminal 19. [1xx] Contactor monitoring, terminal 27 and X57.1. [2xx] Safe Stop (STO) monitoring, terminal 37. [3xx] Contactor monitoring and Safe Stop (STO), terminal 27, terminal X57.1, and terminal 37. [3xx] Contactor monitoring and Safe Stop (STO), terminal 27, terminal X57.1, and terminal 37.

Monitoring of brake feedback due to DIN EN 81-20

The application controller MCO361 can monitor the feedback contacts of the mechanical holding brake. Monitoring can be carried out both with break contacts (NC) and with make contacts (NO). If an error is detected, restarting is prevented (locking).
Driving off is only possible again after a reset. Journeys with too little journey time (shorter than brake monitoring delay time P19-87) are not monitored. Driving off again is only possible when the brake is closed. The lock remains active even if the power supply is interrupted. See chapter Reset locked error.

An error is detected, when:

- at least one brake is not closed when the drive command is received.
  - o error mech. brake 1
- at least one brake does not open during travel (duration of constant travel) at least for the value in parameter 1987 (seconds)
  - o Error mechanical brake 2
- at least one brake does not close within the time specified in parameter 1987 after the end of a regular run.
  - o error mech. brake 3

States and reactions	Output status for mech. brake	State of feedback contacts at input X57.9 and X57.10	State delay time P19-87	Reaction of Lift drive
Before opening mechanical brake (before the drive)	0	Applied	x	x
	0	Not applied	x	Brake failure 1
Before closing mechanical brake	1	Released	x	x
	1	Not released	1	Brake failure 2
After closing mechanical brake	0	Applied	x	x
	0	Not applied	1	Brake failure 3

0 = Not active; 1 = Active; X = Not used

NOTICE

The notes apply under "An error is detected if:"
As a protection against manipulation the functionality of brake monitoring can only be deactivated by setting the drive to factory settings. However, a change of contact types is possible.

NOTICE

The monitoring due to DIN EN 81-20 is only available if in parameter 19-90 the identifier A3 is displayed. e.g. S_A3_B_X.XXT/RXXX.

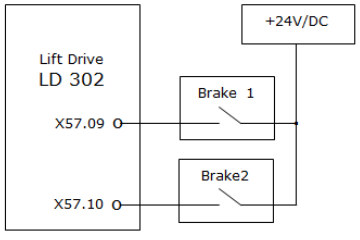


Illustration: Schematic drawing Brake Monitor with N.O. contacts, P 19-65 = [x1]

Test instruction for the installation:
During commissioning of the elevator and after every change of wiring and at every first or recurring check the proper functionality of the brake monitoring shall be rechecked.
At standstill one of the two brakes shall be released manually and a start signal shall be given. After receiving the start signal the message text "Brake failure 1" shall be displayed. The start shall be inhibited, and the drive shall be locked. The manually released brake can now be applied again. The fault can be reset by setting the value of P19-64 to -1 or pressing the LCP-keys [Back] + [Reset] simultaneously.

NOTICE
For reset of critical errors see chapter Reset locked error.

The procedure shall be repeated with the second brake. Reaction of the drive shall be as described before. If the reaction of the drive is not as described a fault or manipulation is suspected. The wiring shall be checked or changed if necessary.
After fault correction the complete test shall be repeated.
If the manual actuation of the brakes is not possible it is necessary to simulate the state "brake released" at the relevant signal input with a bridge to 24 VDC or an interruption of the signal.

Monitoring of brake force due to DIN EN 81-20
P19-65=XX3
The application controller monitors the brake performance via the motor torque behavior. This monitoring excludes automatic load adaptation. P19-17 shall be set to [0]!

Steps for put in operation:
1. Establish proper lift function
2. Recommended setting for P19-16=10%
3. Measure brake lift time, P19-14=-1, start lift
4. Activate brake force monitoring, P19-65=XX3
5. Measure brake monitoring delay, P19-87=-1, start lift, empty car
6. Measure torque behavior, P19-91=-1, start lift and run to the whole shaft
7. Activate warning output X59 to "stop next floor" (see P19-84, X59 function outputs)

Test instruction for the installation:
1. Activate test mode, P19-77=-1
2. Test holding force brake 1, P19-78=11, start lift, empty car, failure 272, TRIP LOCK
3. Test holding force brake 2, P19-78=12, start lift, empty car, failure 273, TRIP LOCK
4. Test brake 1 does not open, P19-78=13, start lift, empty car, failure 274, TRIP LOCK
5. Test brake 2 does not open, P19-78=14, start lift, empty car, failure 274, TRIP LOCK

NOTICE
For reset of critical errors see chapter Reset locked error.

Monitoring of the governor feedback contact
P19-65 x1x [no]/ x2x [nc]

The feedback contact of the speed governor device can be monitored by the Lift drive. For this purpose, the digital input 19 on the control card can be used. The function cannot be combined with the standby function of the drive which uses the same digital input.
The function locks the drive if one of the following situations is detected.

- Start signal received and no change of signal level from low to high was detected before.
- Signal level of feedback contact changed from high to low during movement

The interlock stays active even in the case of a loss of power supply, unless a reset is done by setting P19-64 to the value -1 or by pressing the LCP-keys [Back] + [Reset] simultaneously. The monitoring can be implemented with normally open [no] contacts as well as with normally closed [nc] contacts.

NOTICE

For reset of critical errors see chapter Reset locked error.

Functional description:

• At each start it will be checked if the speed governor contact has been switched from low to high level before. If that is not the case it will be assumed that faulty wiring or defect contactors or short circuit to 24V could be the reason. The Lift drive creates an alarm and an interlock because this is seen as a dangerous malfunction.
  ○ Following failure will be created:
  - 249 Governor Fault

• During the operation the signal level of the speed governor contact is monitored as well. If signal level should drop to low an alarm will be created and the drive locked. This is seen as well as dangerous malfunction of the monitoring device.
  ○ Following failure will be created:
  - 249 Governor Fault
After the detection of a dangerous malfunction of the governor contacts the Lift drive stays out of order (locked).
The interlock stays active even in the case of a loss of power supply, unless a reset is done by setting P19-64 to the value -1 or by pressing the LCP-keys [Back] + [Reset] simultaneously.

NOTICE

For reset of critical errors see chapter Reset locked error.

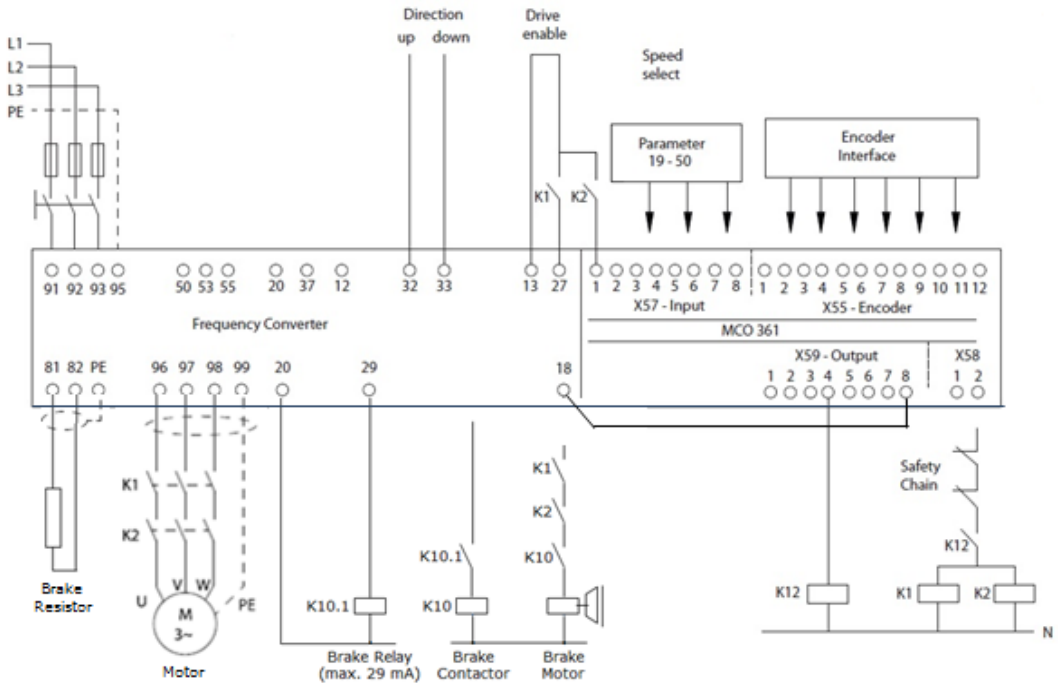
Monitoring of motor contactors, P19-65 1xx / 3xx

Due to separate wiring the digital input signals X57.1 and terminal 27 on the control card can be used for the monitoring of the motor contactors. The monitoring shall be done with normally opened [no] contacts. The function prevents the start of the drive if one of the following situations has been detected.

- Start signal received and no change of signal level from low to high on feedback contacts was detected before
- After the receiving a start signal and the output of signal contactors on X59.4 the signal level of the feedback contacts refuses to switch to high level within a time of 10 seconds.

After detecting a dangerous malfunction of the motor contactors, the lift drive remains locked. The appropriate wiring must be carried out to implement the monitoring of the motor contactors. The contacts of the motor contactors K1 and K2 must be connected separately to terminals 27 and X57.1 as shown below.

NOTE: For reset of critical errors see chapter "Reset locked error".



Error messages:

- At each start it will be checked if the motor contactors have been switched off before. If that is not the case, it will be assumed that faulty wiring or defect contactors or short circuit to 24V could be the reason. The Lift drive creates an alarm and an interlock because this is seen as a dangerous malfunction.
  - Depending on the cause one of the following failures will be created:
    - 253 CO1_T27 on, - 254 CO2_X57/1 on
- If after the receiving of a start signal and the output of the signal contactors on X59.4 the signal level of the feedback contacts refuses to switch to high level within a time of 10 seconds leads to an alarm and the start will be cancelled. The drive will not be locked because this is seen as a not critical fault which leads to a save state.
  - Depending on the cause one of the following failures will be created:
    - 251 CO1_T27 off, - 252 CO2_X57/1 of

Test of the function:
To test the function, use only one input, T27 or X57.1 and connect it permanently to 0 V/DC. Please disconnect the original wiring from the connectors before to avoid short circuits. With an active start command and a delay of max. 10 s, the frequency converter generates an alarm as described in the functional description. After the test, the wiring must be restored as provided in the circuit diagram.

NOTICE
For reset of critical errors see chapter Reset locked error.

Monitoring of STO
P19-65 2xx / 3xx
With this function, the STO (Safe Torque Of) can be monitored. This ensures the detection of wrong connections during installation at every start. This function is only relevant at operation without motor contactors.

Test of the function:
For the test, the wiring on the STO must be removed (Terminal 37). Terminal 37 must then be permanently connected to 24V/DC (terminal 12). An error message only appears at the start of the second journey. If there is no signal change after the second start, the frequency converter is locked and error message 259 (STO T37 on) is generated. After the test, the original wiring must be restored.

NOTICE
For reset of critical errors see chapter Reset locked error.

Monitor Motor and Drive

Nr.	Name	Parameter description
P19-70	Monitor Motor and Drive	[1] = Factory default [XX1] = Monitoring Motor Thermistor [X1X] = Deactivation of motor phase monitoring

7.18 Standby function
The function can decrease the power consumption of the drive when no operation is needed. All digital outputs and all relays will be switched of. If the control card temperature exceeds 56 °C degrees, the fan will be started with a reduced speed of 50%.
Standby function can be activated with input terminal 19 or by DCP telegram. If digital inputs are used to control the drive the standby function cannot be combined with the governor monitoring function.

7.19 Test run mode

19-60	Test run mode	[1] Gear ratio test function. The drive moves one revolution of the traction sheave. Can be used to check mechanic settings. [2] Fang Release function. Applies torque shocks to release cabin from mechanic fang device.

Gear ratio test function
Parameter 19-60 = 1. After start in inspection mode the drive will be started with slow speed. After one revolution of the traction sheave the motor will be stopped. Adjust the gear ration new if the traction shave does not exactly turn one revolution.

7.20 Release from the catch

Function release from the catch
Parameter 19-60 = 2. After starting in inspection mode, the mechanical brake is open and periodic torque shocks are applied to the motor to release the car from the catch. Releasing from the catch must only be in the "UP" direction. The function is automatically deactivated after the car has moved 100 mm or after the frequency converter has been stopped by a control signal.

7.21 Direction Change Counter

For ropes with a plastic sheath, the following counters can be used to determine the changing cycles. In the event of a device failure or after the factory setting, the counter values can be lost. Therefore, an additional, external counting device should be available.

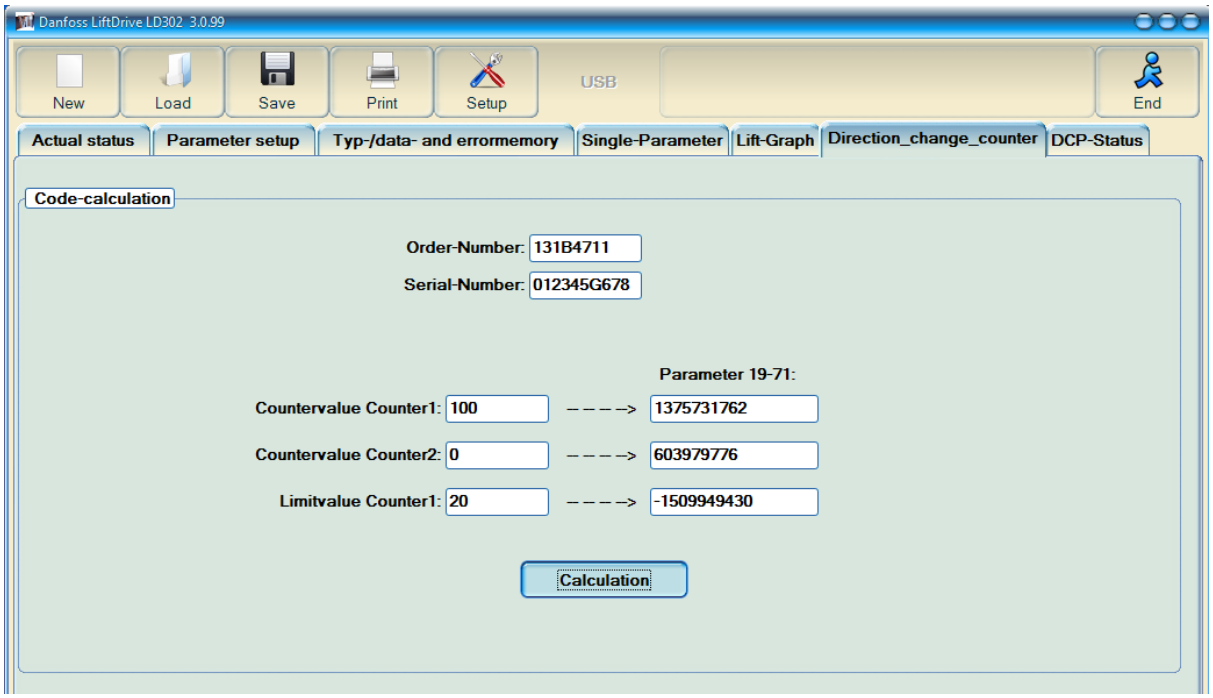
Direction Change 1:
Direction change counter 1 is deactivated in the factory setting. It can be activated by entering parameter 19-71 (Set Counter). The range of values for this counter is 1 to 16,000,000. After each movement with a changed direction, the counter value in parameter 19-93 (direction counter 1) is reduced by one.

Warning threshold:
If the counter value has fallen below the warning threshold, this is signaled via a digital output. The corresponding output can be defined by setting the output functionality to the value 3 in parameter 19-84. Furthermore, a message appears on the LCP when there are no other warnings. Reaching the warning threshold is recorded in the event memory.

Counter zero:
The elevator no longer runs in normal operation. A signal is set to the digital output. The cabin can only be moved using Ve (V0) and return speed (Inspection mode control panel speed). To unlock, a new value for counter 1 must be entered in parameter 19-71. Direction change counter 1 can be deactivated again by setting the drive to factory setting (all data will be lost).

Direction change counter 2:
Direction change counter 2 is always active. The counting direction is positive. The display parameter P19-94 has a value range from 0 to 2147483646. After reaching the maximum value, the counter starts again at zero. The change of direction counter 2 can be preset in the range from 1 to 16,000,000 using parameters 19-71.

Set counters and limits:
The entry is coded for the counter values and limits in parameter 19-71. The entry contains the information as to whether direction change counter 1, direction change counter 2 or the warning threshold for direction change counter 1 should be set. The setup tool is required to determine the input values. The Direction change counter tab must be selected in the setup tool. To generate the coded input values for P19-71, the order number (P15-46) must be entered in the Order-Number field and the serial number (P15-51) of the frequency inverter must be entered in the Serial-Number field. The target values for the counters can now be entered in the three fields. The input values for P19-71 are generated by selecting the "Calculation" button.



The values can then be entered one after the other in parameter 19-71. The input value is checked by the application. If the entry is successful, the parameter is set to "0". If the input data is not plausible, the value -1 appears.
From the activation of direction change counter 1, digital output 59.2 only outputs the counter warning. If the counter is deactivated (by factory setting), X 59.2 outputs a speed-dependent value.

7.22 Alarm log

Alarm log of the drive

The Alarm log of the drive can be reached by pressing [Alarm Log]. The alarm log shows a list of the last 5 alarms of the drive. To get additional information, select the alarm with the arrow keys and press [OK].

To get the exact information about the occurrence of the alarm, the alarm time can be compared with the operating hours of the drive in P15-00.

Example:

P15-50 = 345 h, alarm log time: 1217075s = 338 h 4min 35 s

The alarm occurred 7h 55min 25 s ago.

Alarm log of the Lift controller

No.	Name	Parameter Description
19-80	Log No	"Error memory of elevator controller MCO361. Display of a list of the last 10 alarms / errors. The last error is number '1'. Using parameter 19-80 = 1-10, alarms / errors 1-10 can be read out."
19-81	Error code	Display of the error code corresponding to the error numbers in P19-80.
19-82	Error time	Display of the error time in hours [h], corresponding to the error numbers in P19-80.
19-83	Function Error log	[0] Alarm, only stores the alarms [1] Reset, Clears the error memory [2] Alarm + Event + Messages, Stores the alarms, all events, and messages

7.23 Reset of errors with locking

If a safety-relevant error is detected, further operation is locked, and a new journey can only be carried out once the error has been reset by competent personnel. The lock remains active even if the power supply is interrupted. The lock is "voltage safe" stored until a reset is performed by entering P19-64= -1 or by simultaneously pressing the [Back]+[Reset] keys.

NOTICE

Reset of critical errors, message "Drive locked" with parameter P19-64 --> [-1]. may only be reset by trained specialists.

7.24 Short circuit function:

In practice, PM motors are short-circuited to provide stronger deceleration in case of a fault or to limit the speed during an evacuation. The VLT LiftDrive provides the following functions for this purpose:

1. Short circuit only in case of power failure and drive fault.
    - The contactor or relay used for the short circuit is permanently engaged and only disengages in the event of a power failure or fault in the frequency converter. See Parameter 19-67 [1] VLT Ready.

2. Short circuit in case of power failure, VFD fault, and rapid stop.
    - The contactor or relay used for the short circuit is permanently engaged and disengages in the event of a power failure, fault in the frequency converter, or when the drive is aborted by removing the signals from terminals 27, X57.1, or 37. In serial control, the function is also activated by an aborted drive. See Parameter 19-67 [2] Short circuit contactor.
3. Short circuit at standstill a. The short circuit is activated at every standstill.
    - For Relay 1, see Parameter 19-67 [5] Short circuit contactor at standstill. c. For digital outputs, see Parameter 19-84 (5) Short circuit contactor at standstill.

8 Troubleshooting

NOTICE

Reset of critical errors, message "Drive locked" with parameter P19-64 --> [-1]. may only be reset by trained personal.

NOTICE

Errors in the Alarm Log (Alarm Log Button on LCP) or Application log (P19-80) are stored as soon they occur. All logs contain the related operating time in seconds. Operating time in seconds is derived from P15-00 Operating Hours. Software tools will automatically calculate hours in seconds. By reading the logs on the LCP, the operating time needs to be converted manually by multiplying the value of P15-00 by 3600.
Please always check if the latest message in the log is still relevant before start troubleshooting. It can well be that the event occurred in the past and has nothing to do with the actual situation.

High Motor current on asynchronous motors

1. Check nominal motor data.
2. Perform the motor adaption. P 19-63 = [1] (See chapter "Automatic motor adaptation, AMA")

High motor current on PM motors

1. Check nominal motor data.
2. Perform the motor adaption. P 19-63 = [1] (See chapter "Automatic motor adaptation, AMA").
3. P19-03=-1 can be used in case the movement does not work. (Please check P 19-05 after the following operation. If the value of P 19-05 is -1 this parameter shall be set back to zero and two motor phases need to be changed.)
4. Check rotor offset (See chapter "Operation with absolute encoder")
5. Disable absolute encoder for test purpose (See chapter "Operation with absolute encoder")

Motor control fails in Open Loop (P 19-62=1)

Drive's standard settings are aligned to normal operation and duty cycle. It is expected that right motor data for the operation are provided. (S1, S3, S6- Data) In case the current during normal operation is higher than 100% of nominal motor current, it is advisable to adapt motors nominal current to the situation. Please be aware that current and torque have a proportional relation to each other. So as soon the nominal current (P1-24) gets increased, the nominal torque (P1-26) shall be increased proportional.

NOTICE

Please be aware, the following motor data shall be entered too! If nominal current gets changed, the speed, nominal torque and number of poles shall be entered. After those changes, it is mandatory to perform a new automatic motor adaptation (P19-63).

Example: Nominal motor current (name plate) 10A, nominal motor torque 500 Nm
Current for operation 20 A.
In that example the operation current is significantly higher than nominal current.

Solution:

- Change P1-24 Nominal current to 20A
- Change P1-25 Nominal Speed to nameplate value
- Change P1-26 Nominal Torque to 1000 Nm

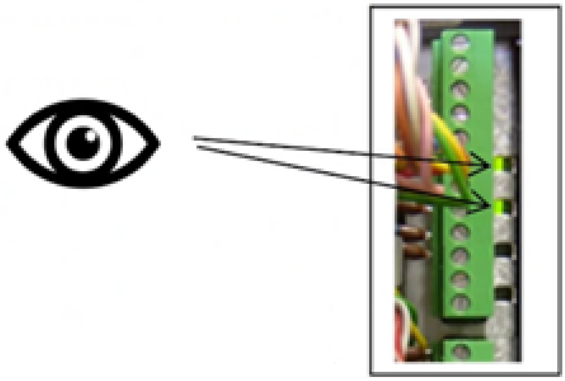
- Change P1-39 Number of Poles to Nameplate value.
- Perform AMA (P19-63=1 and start inspection mode for measurement)

Now Open Loop Operation (P19-62=1) should work as expected.

Motor noise or drive noise at motoric operation
Check input phases voltage and balance.

Motor noise, encoder failures, unstable operation

- Check shielding of motor and encoder cables.
- Check Encoder LED´s, Terminal X55.



If the LES's don't light up when the encoder turns, check:
- the encoder wiring on terminal X55, pin 1 to 8.
- if par. 19-98 =2
    - the encoder wiring on terminal X55, terminal 9 to 12.

Earth fault alarm at start
Check for mismatch between mains and motor connection.

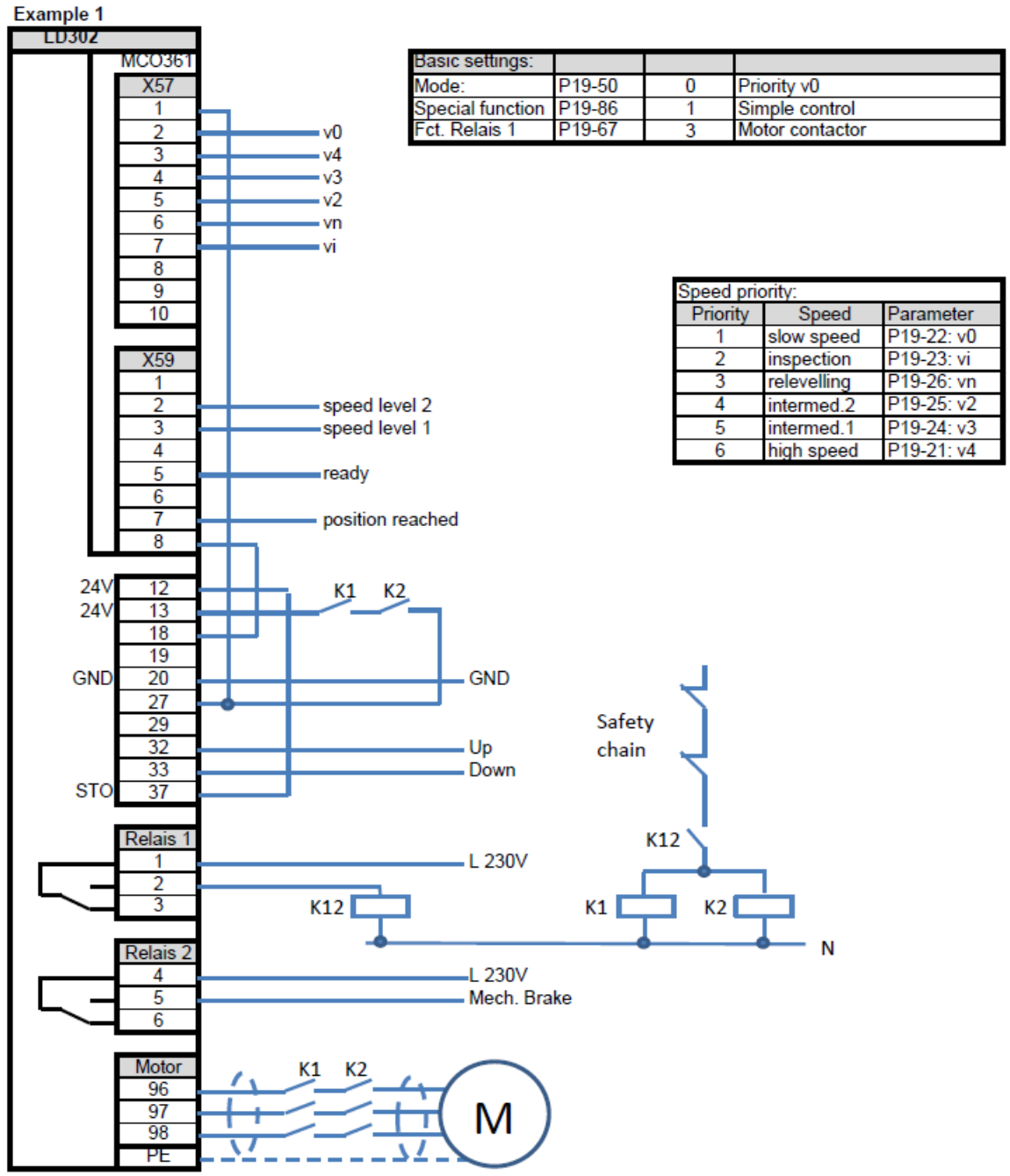
Sporadic A38 during operation
Check the EMC-compliant installation of motor and control cables. Pay special attention to extensive shield connections and sufficient grounding of components and system parts. See Chapter 10

9 Appendix

9.1 Wiring Examples with Parameter setup

Mode 0, digital, low speed priority

Example 1: Mode 0, Digital speed selection, low speed priority, direction priority up	
Configuration:	Motor contactors controlled by drive
Speeds: 6	Priority: slow speed, inspection, relevelling, intermed.2, intermed.1, high speed
Start Signal:	Start with direction signal

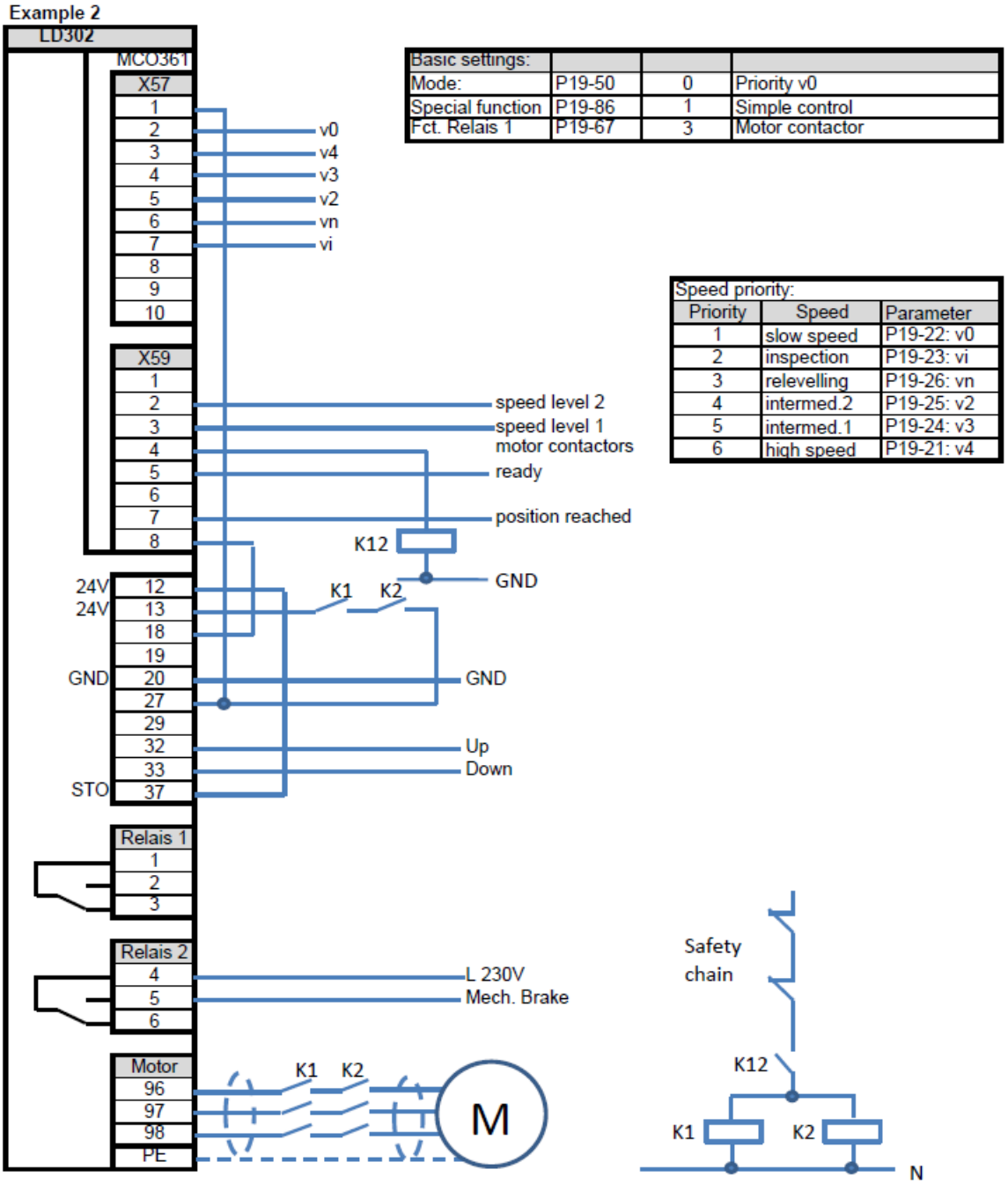


Basic settings:			
Mode:	P19-50	0	Priority v0
Special function	P19-86	1	Simple control
Fct. Relais 1	P19-67	3	Motor contactor

Speed priority:		
Priority	Speed	Parameter
1	slow speed	P19-22: v0
2	inspection	P19-23: vi
3	relevelling	P19-26: vn
4	intermed.2	P19-25: v2
5	intermed.1	P19-24: v3
6	high speed	P19-21: v4

Mode 0, digital, low speed priority

Example 2: Mode 0, Digital speed selection, low speed priority, direction priority up	
Configuration:	Motor contactors controlled by drive, Output X59.4
Speeds: 6	Priority: slow speed, inspection, relevelling, intermed.2, intermed 1, high speed
Start Signal:	Start with direction signal

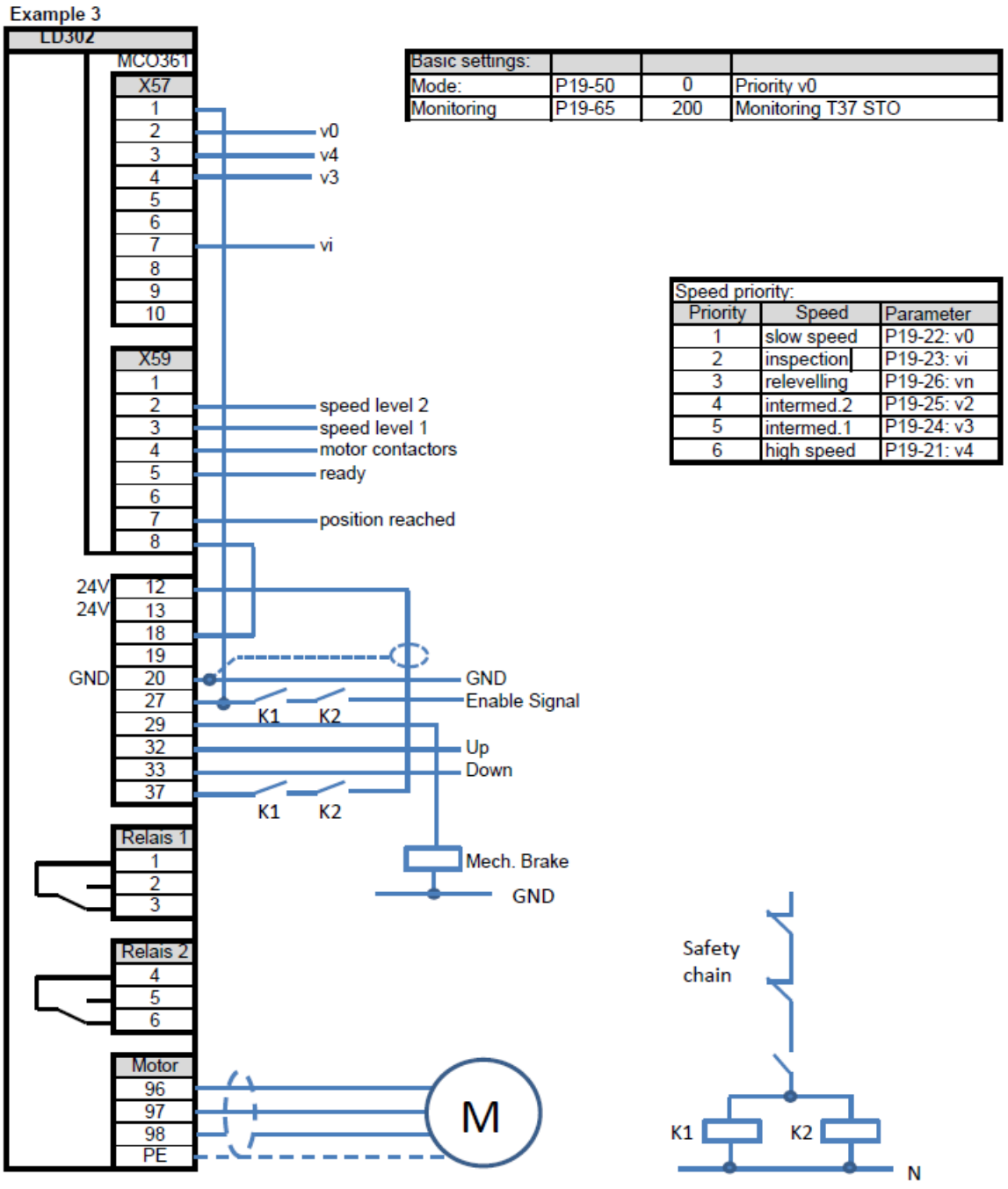


Basic settings:			
Mode:	P19-50	0	Priority v0
Special function	P19-86	1	Simple control
Fct. Relais 1	P19-67	3	Motor contactor

Speed priority:		
Priority	Speed	Parameter
1	slow speed	P19-22: v0
2	inspection	P19-23: vi
3	relevelling	P19-26: vn
4	intermed.2	P19-25: v2
5	intermed.1	P19-24: v3
6	high speed	P19-21: v4

Mode 0, 24V control signals to lift controller used

Example 3: Mode 0, only 24V control signals to lift controller used	
Configuration:	Without motor contactors, only 24V control signals to lift controller used
Speeds: 6	Priority: slow speed, inspection, relevelling, intermed.2, intermed 1, high speed
Start Signal:	Start with enable signal from lift controller, safety relays controlled by lift controller

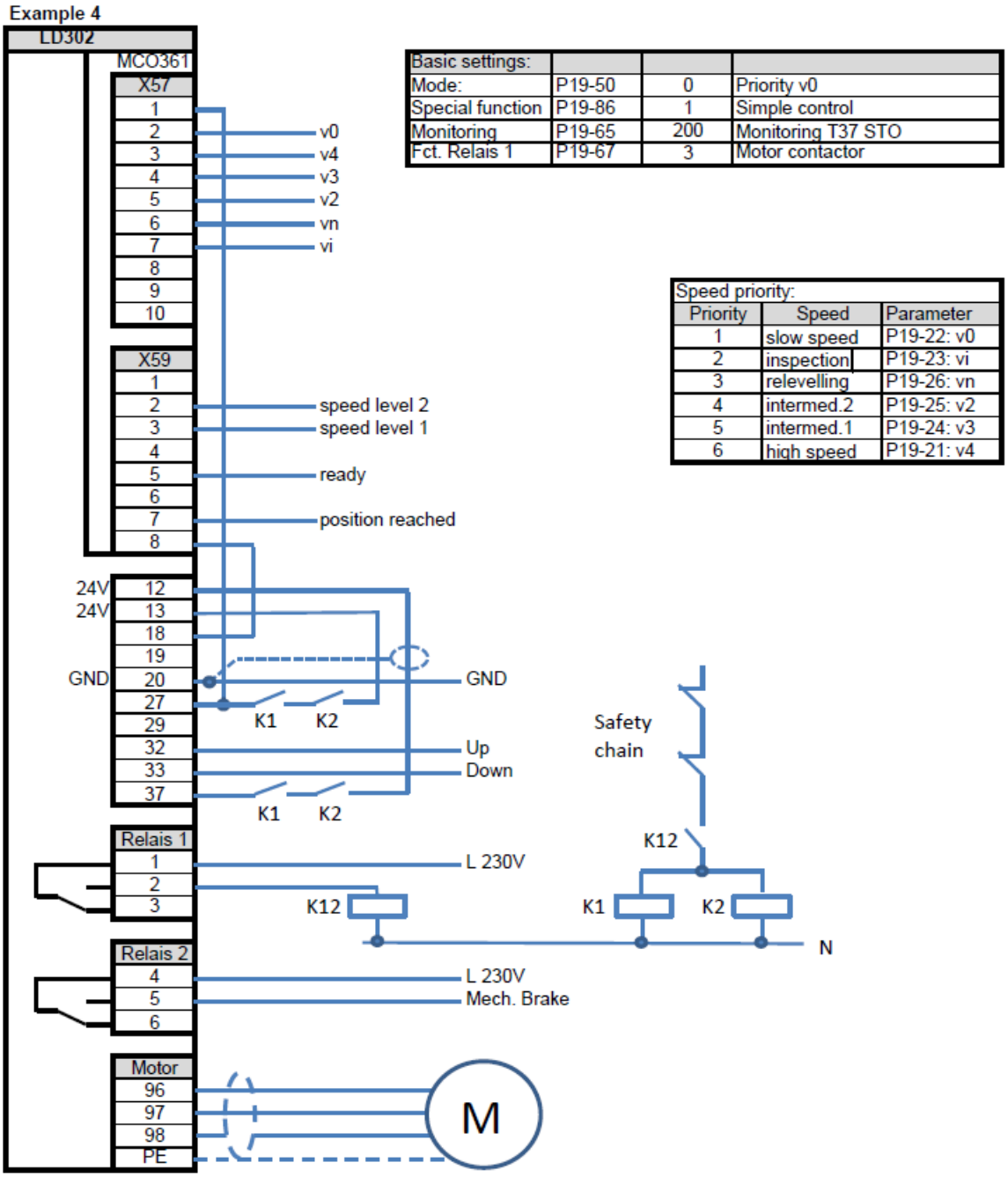


Basic settings:			
Mode:	P19-50	0	Priority v0
Monitoring	P19-65	200	Monitoring T37 STO

Speed priority:		
Priority	Speed	Parameter
1	slow speed	P19-22: v0
2	inspection	P19-23: vi
3	relevelling	P19-26: vn
4	intermed.2	P19-25: v2
5	intermed.1	P19-24: v3
6	high speed	P19-21: v4

Mode 0, digital, low speed priority

Example 4: Mode 0, Digital speed selection, low speed priority, direction priority up	
Configuration:	Without motor contactors
Speeds: 6	Priority: slow speed, inspection, relevelling, intermed.2, intermed.1, high speed
Start Signal:	Start with direction signal

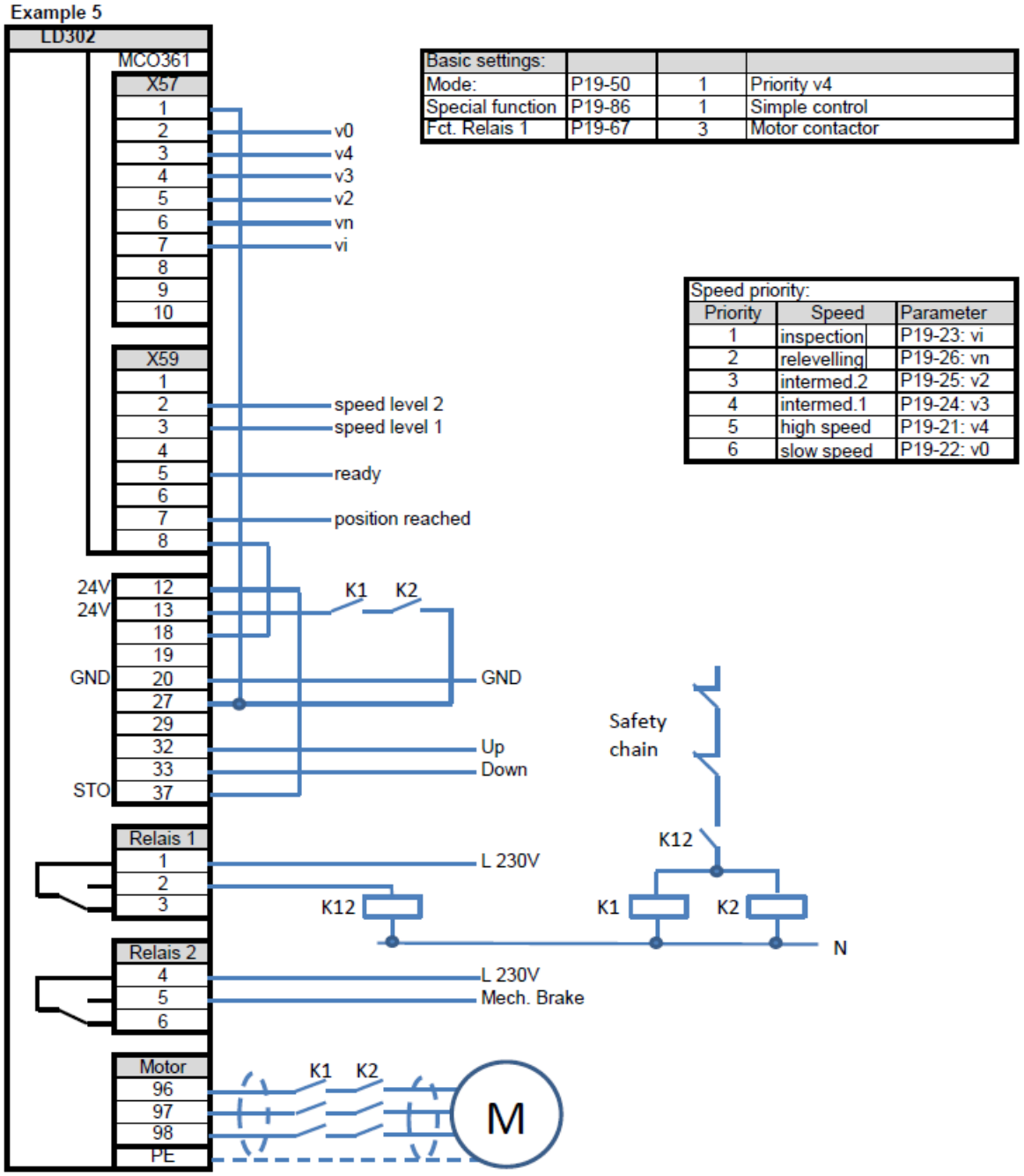


Basic settings:			
Mode:	P19-50	0	Priority v0
Special function	P19-86	1	Simple control
Monitoring	P19-65	200	Monitoring T37 STO
Fct. Relais 1	P19-67	3	Motor contactor

Speed priority:		
Priority	Speed	Parameter
1	slow speed	P19-22: v0
2	inspection	P19-23: vi
3	relevelling	P19-26: vn
4	intermed.2	P19-25: v2
5	intermed.1	P19-24: v3
6	high speed	P19-21: v4

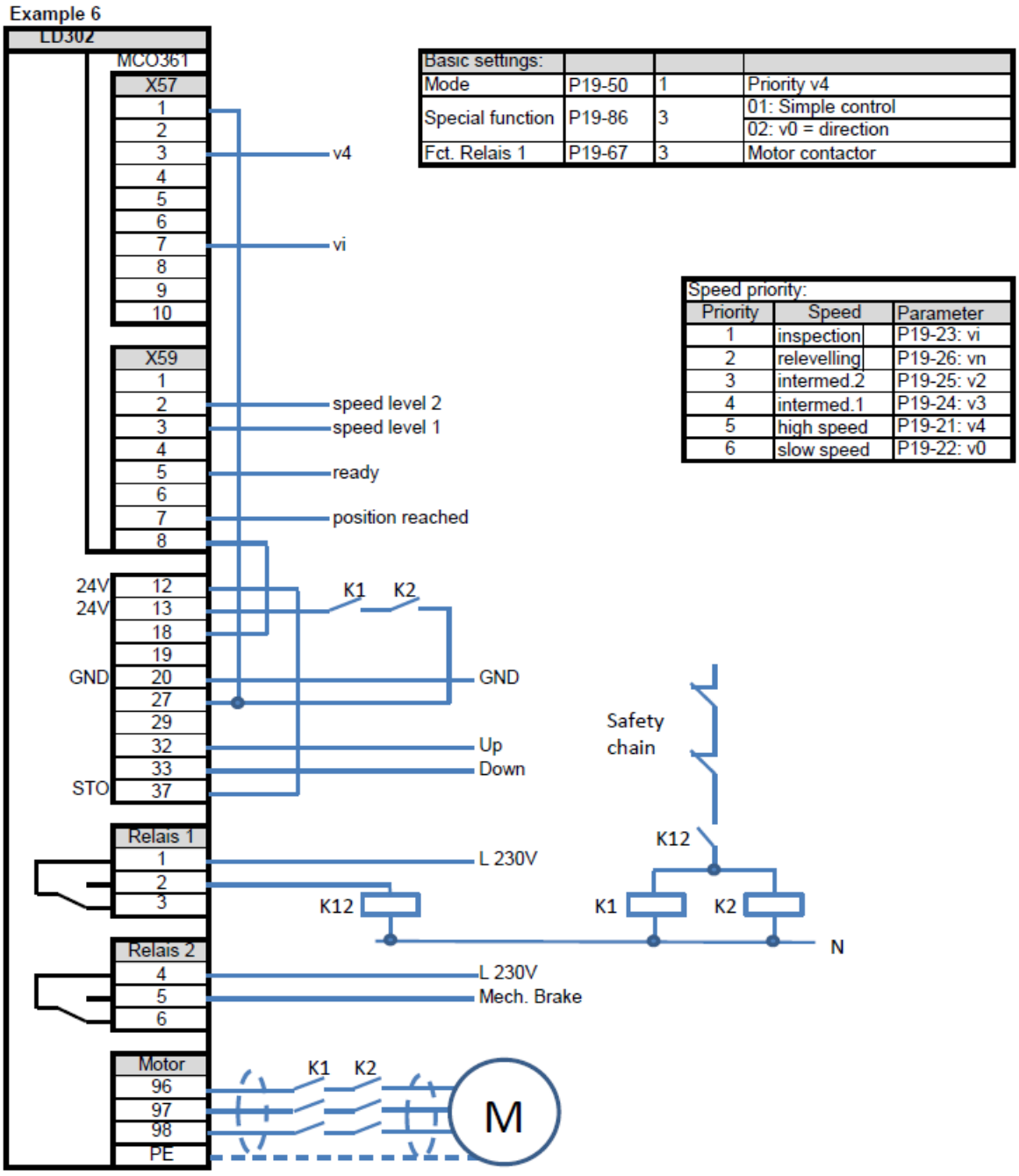
Mode 1, digital, high speed priority

Example 5: Mode 1, Digital speed selection, high speed priority, direction priority up-	
Configuration:	Motor contactors controlled by drive
Speeds: 6	Priority: slow speed, inspection, relevelling, intermed.2, intermed.1, high speed
Start Signal:	Start with direction signal



Mode 1, slow speed direction

Example 6: Mode 1, slow speed with direction signal	
Configuration:	Motor contactors controlled by drive
Speeds: 3	Priority: slow speed, inspection, high speed
Start Signal:	Start with direction signal

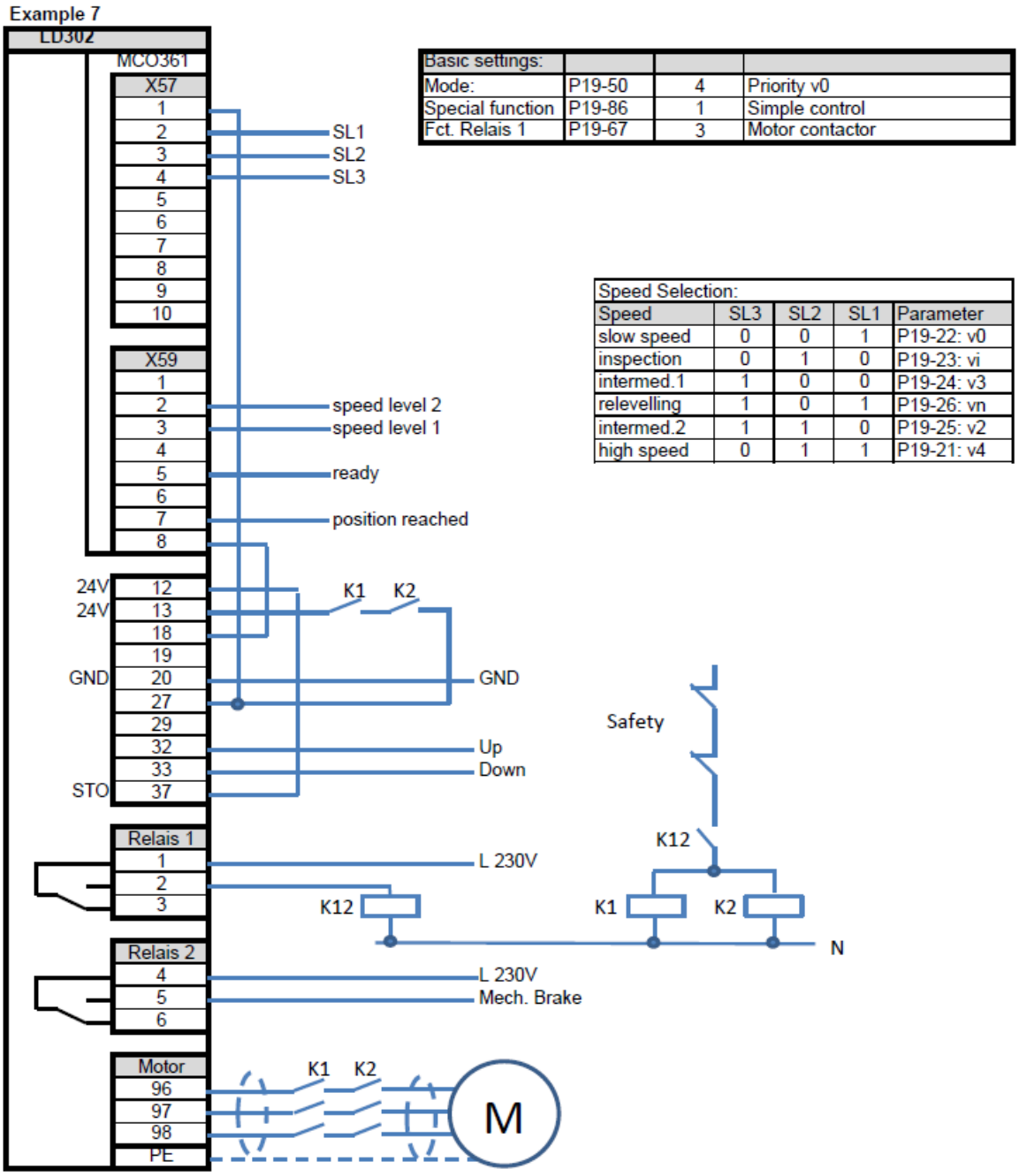


Basic settings:			
Mode	P19-50	1	Priority v4
Special function	P19-86	3	01: Simple control 02: v0 = direction
Fct. Relais 1	P19-67	3	Motor contactor

Speed priority:		
Priority	Speed	Parameter
1	inspection	P19-23: vi
2	relevelling	P19-26: vn
3	intermed.2	P19-25: v2
4	intermed.1	P19-24: v3
5	high speed	P19-21: v4
6	slow speed	P19-22: v0

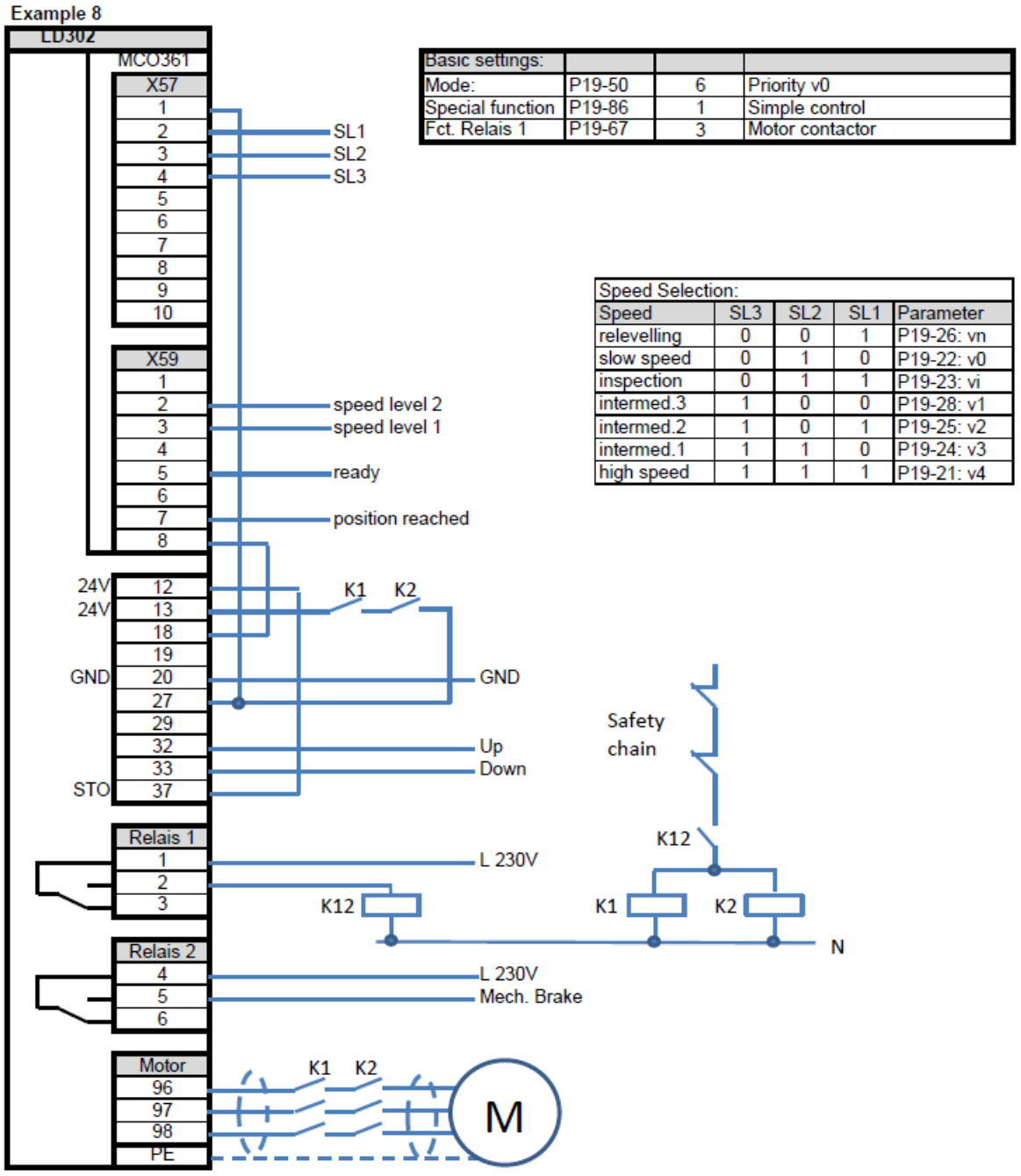
Mode 4, binary 1

Example 7: Mode 4, Binary speed selection 1, direction priority up	
Configuration:	Motor contactors controlled by drive
Speeds: 6	Slow speed, inspection, relevelling, intermed.3, intermed.2, intermed. 1, high speed
Start Signal:	Start with direction signal



Mode 6, binary 2

Example 8: Mode 6, Binary speed selection 2, direction priority up	
Configuration:	Motor contactors controlled by drive
Speeds: 7	Slow speed, inspection, relevelling, intermed.3, intermed.2, intermed.1, high speed
Start Signal:	Start with direction signal

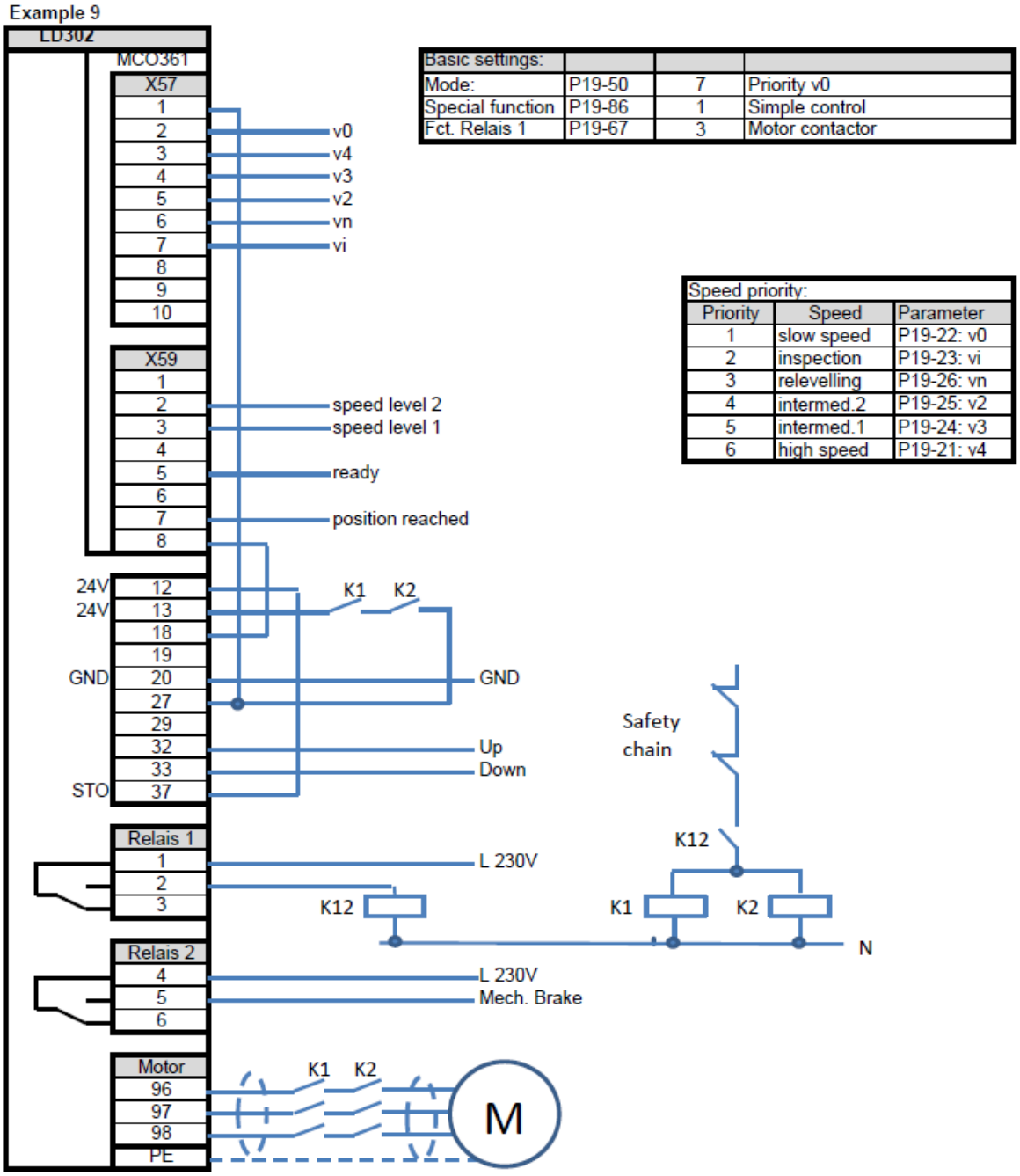


Basic settings:			
Mode:	P19-50	6	Priority v0
Special function	P19-86	1	Simple control
Fct. Relais 1	P19-67	3	Motor contactor

Speed Selection:				
Speed	SL3	SL2	SL1	Parameter
relevelling	0	0	1	P19-26: vn
slow speed	0	1	0	P19-22: v0
inspection	0	1	1	P19-23: vi
intermed.3	1	0	0	P19-28: v1
intermed.2	1	0	1	P19-25: v2
intermed.1	1	1	0	P19-24: v3
high speed	1	1	1	P19-21: v4

Mode 7, digital, low speed priority, direction priority down

Example 9: Mode 7, Digital speed selection, low speed priority, direction priority down	
Configuration:	Motor contactors controlled by drive
Speeds: 6	Priority: slow speed, inspection, relevelling, intermed.2, intermed.1, high speed
Start Signal:	Start with direction signal



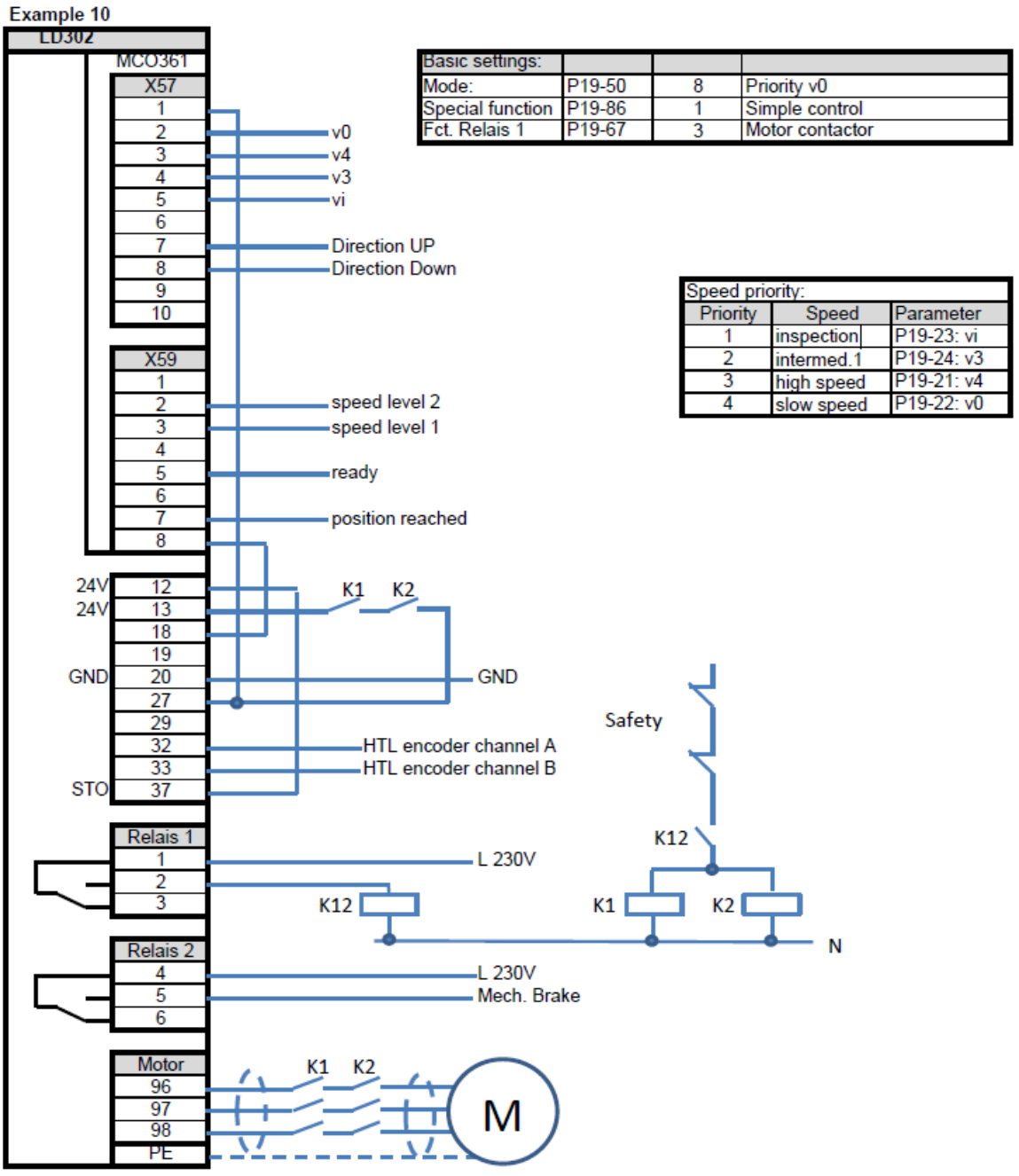
Basic settings:			
Mode:	P19-50	7	Priority v0
Special function	P19-86	1	Simple control
Fct. Relais 1	P19-67	3	Motor contactor

Speed priority:

Priority	Speed	Parameter
1	slow speed	P19-22: v0
2	inspection	P19-23: vi
3	relevelling	P19-26: vn
4	intermed.2	P19-25: v2
5	intermed.1	P19-24: v3
6	high speed	P19-21: v4

Mode 8, HTL-encoder, digital 1, direction priority up

Example 10: Mode 8, HTL-encoder, digital speed selection 1, direction priority up	
Configuration:	Motor contactors controlled by drive
Speeds: 4	Slow speed, inspection, intermed 1, high speed
Start Signal:	Start with direction signal



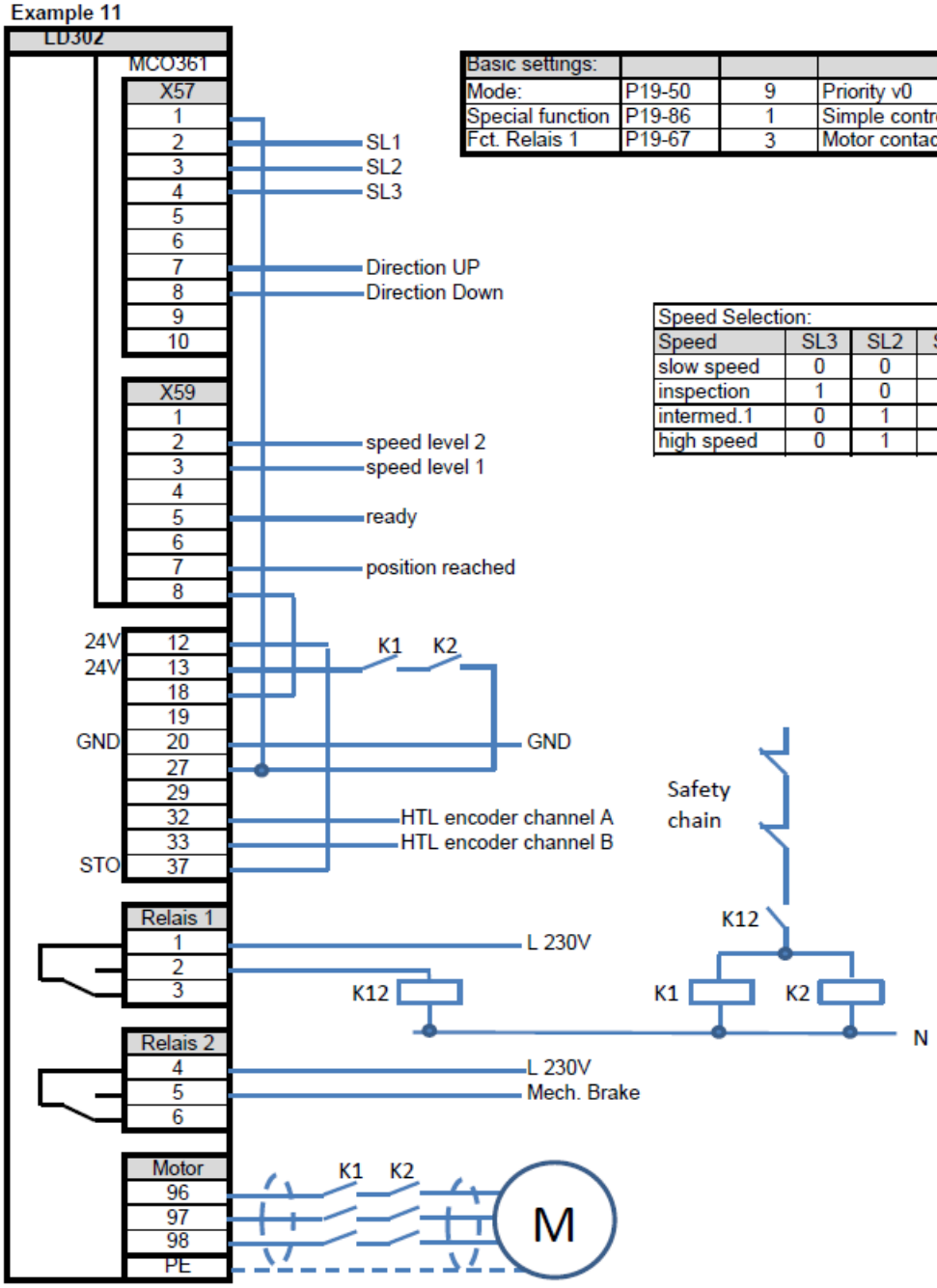
Basic settings:			
Mode:	P19-50	8	Priority v0
Special function	P19-86	1	Simple control
Fct. Relais 1	P19-67	3	Motor contactor

Speed priority:		
Priority	Speed	Parameter
1	inspection	P19-23: vi
2	intermed.1	P19-24: v3
3	high speed	P19-21: v4
4	slow speed	P19-22: v0

Mode 9, HTL-encoder, binary

Example 11: Mode 9, HTL-encoder, Binary speed selection, direction priority up	
Configuration:	Motor contactors controlled by drive
Speeds: 4	Slow speed, inspection, intermed 1, high speed
Start Signal:	Start with direction signal

Example 11

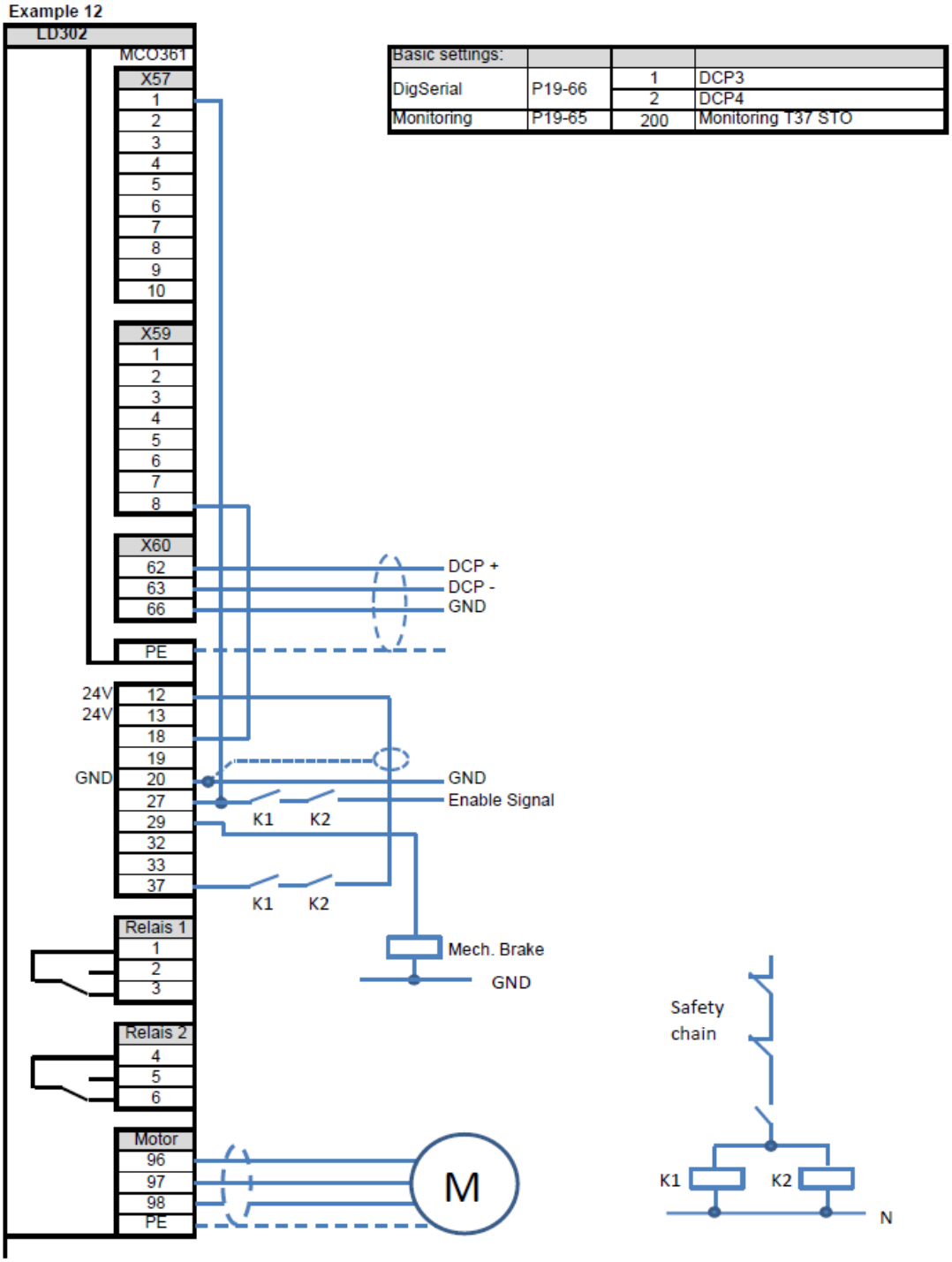


Basic settings:			
Mode:	P19-50	9	Priority v0
Special function	P19-86	1	Simple control
Fct. Relais 1	P19-67	3	Motor contactor

Speed Selection:				
Speed	SL3	SL2	SL1	Parameter
slow speed	0	0	1	P19-22: v0
inspection	1	0	0	P19-23: vi
intermed.1	0	1	1	P19-24: v3
high speed	0	1	0	P19-21: v4

Bus controlled /DCP3/DCP4

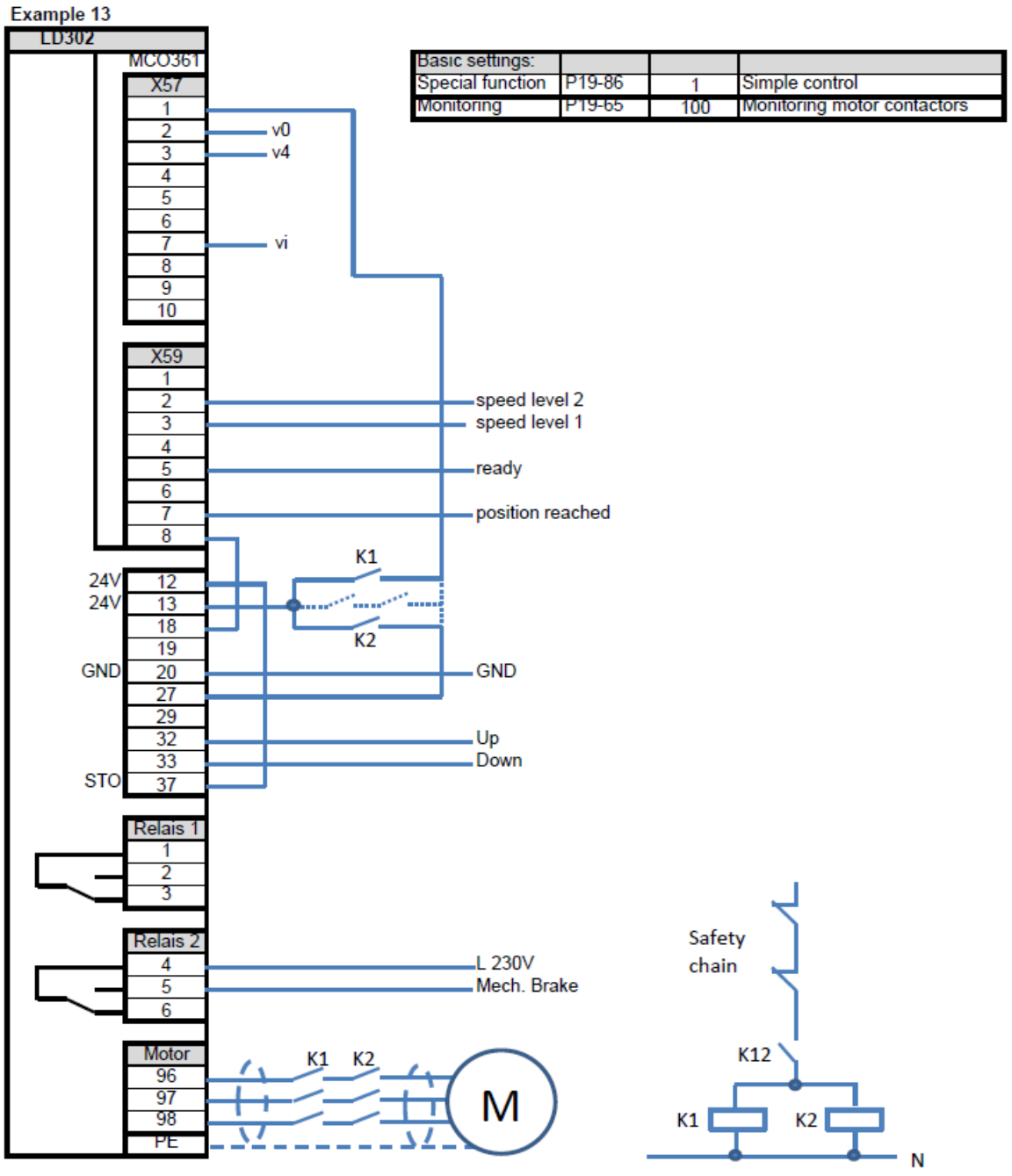
Example 12: Bus controlled /DCP3/DCP4	
Configuration:	Without motor contactors
Start Signal:	Bus controlled, Hardware enable signal from lift controller



Basic settings:			
DigSerial	P19-66	1	DCP3
		2	DCP4
Monitoring	P19-65	200	Monitoring T37 STO

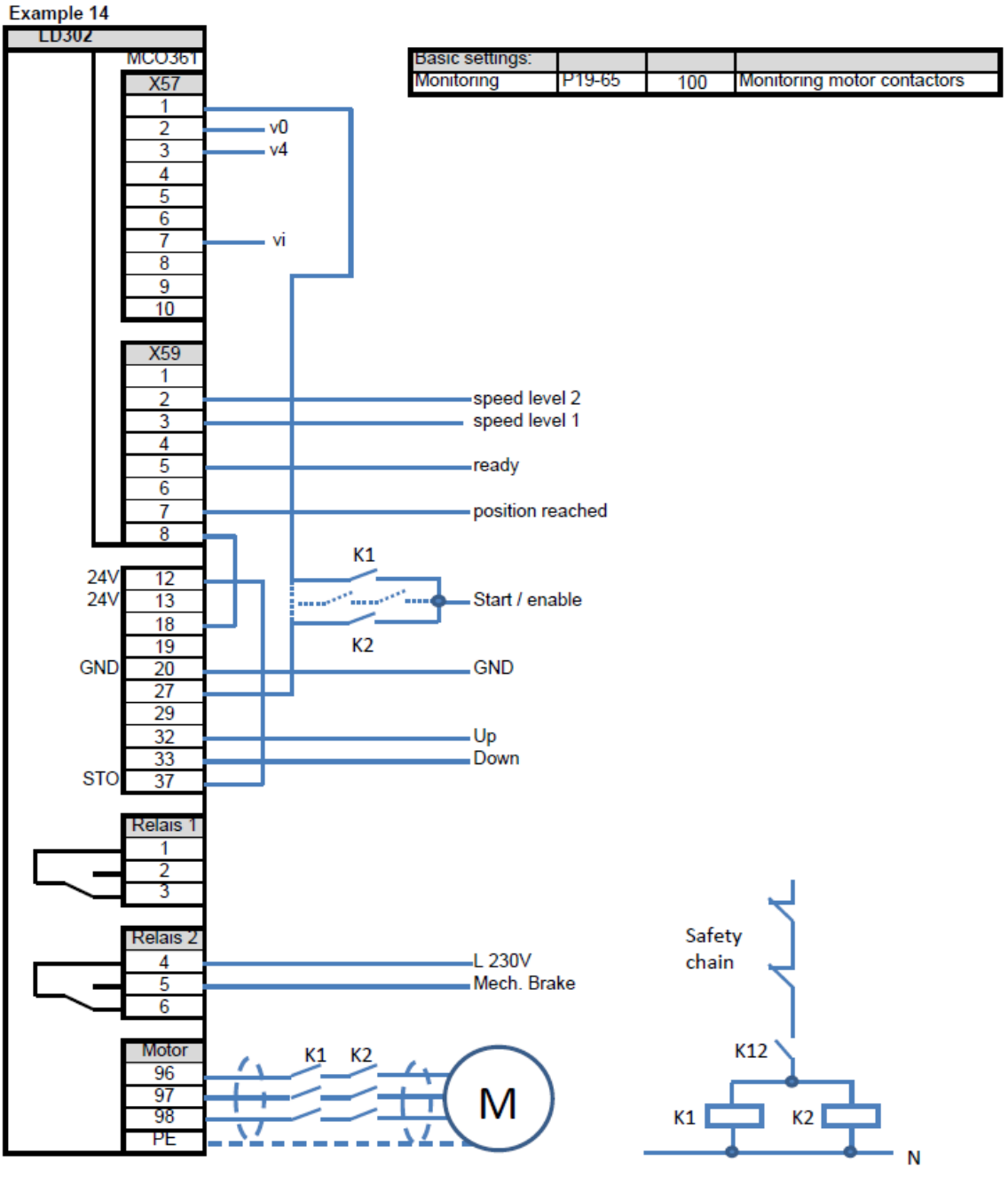
Monitoring of motor contactors

Example 13: Monitoring of motor contactors	
Configuration:	Start with direction signal



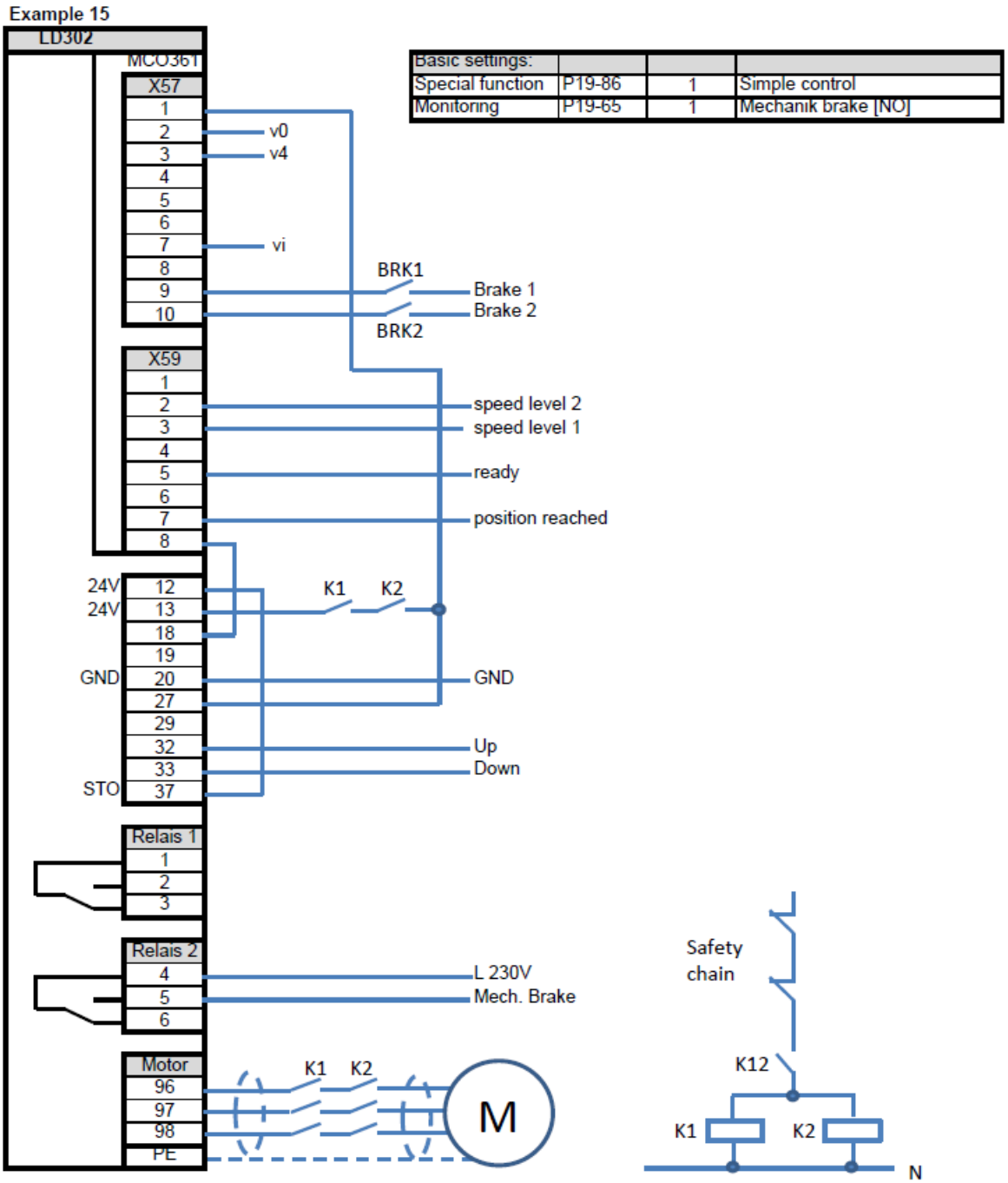
Monitoring of motor contactors

Example 14: Monitoring of motor contactors	
Configuration:	Start with enable signal



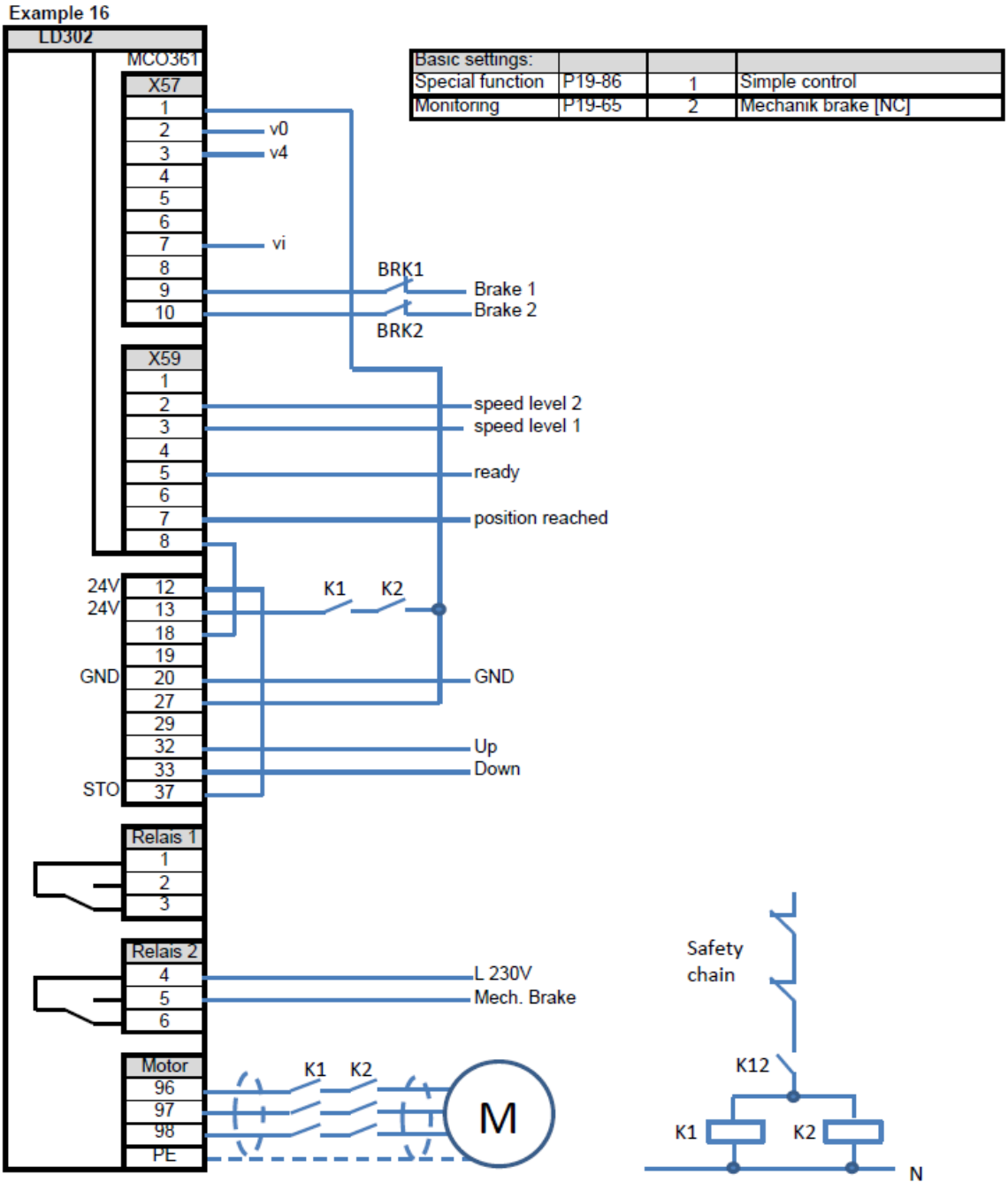
Monitoring brake feedback 1, normal open contacts

Example 15: Monitoring of brake feedback 1, normal open contacts	
Configuration:	Start with direction signal



Monitoring brake feedback 2, normal closed contacts

Example 16: Monitoring of brake feedback 2, normal closed contacts	
Configuration:	Start with direction signal



Basic settings:			
Special function	P19-86	1	Simple control
Monitoring	P19-65	2	Mechanik brake [NC]

9.2 Start and Stop Sequences

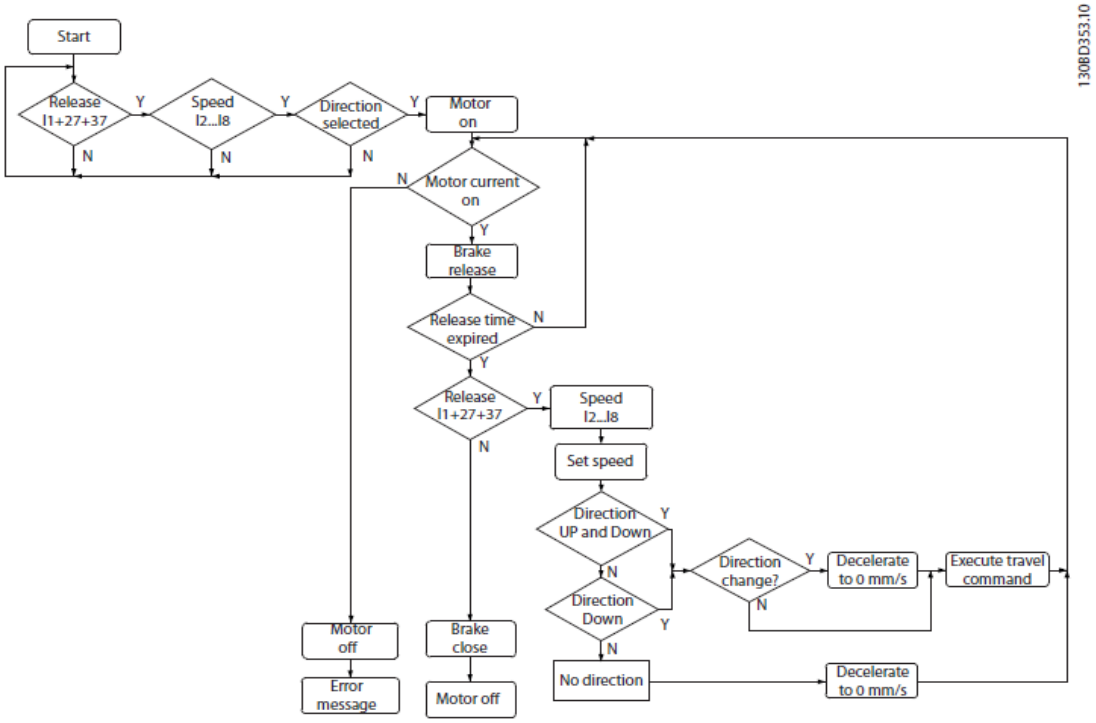


Illustration 4.1 Lift Control Start Sequence in operating mode

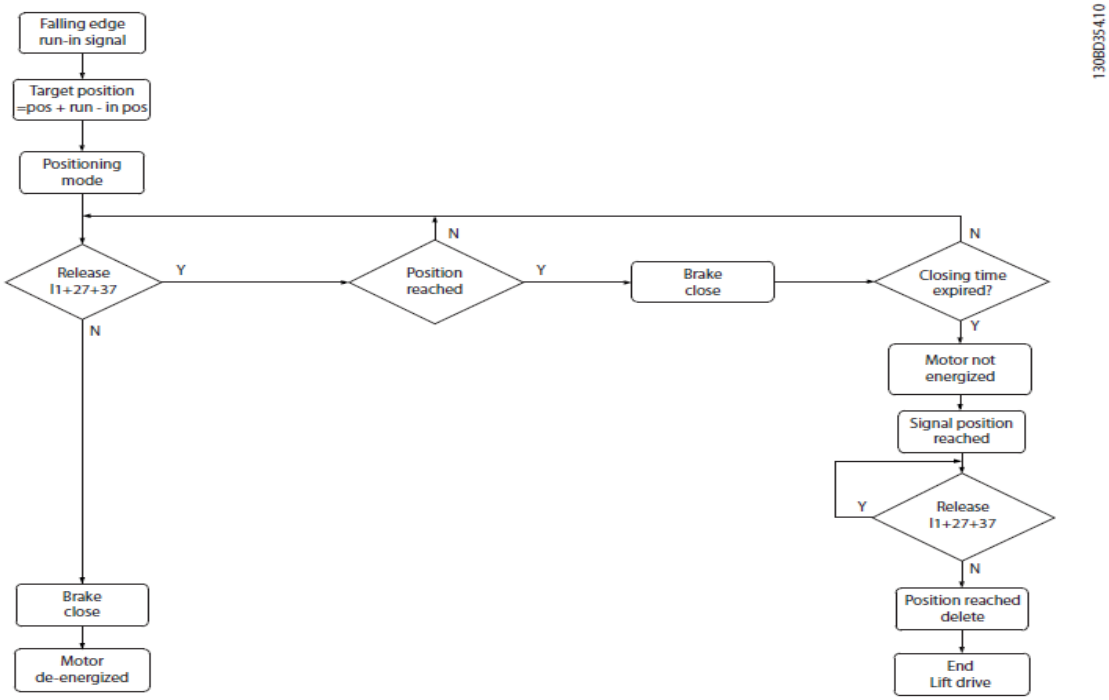


Illustration 4.2 Lift Control Stop Sequence in operating mode

9.3 Motor Nameplate Examples

9.4 Messages

Lift application message	Description
Act. Inspection mode!	Activate inspection mode for operation
AMA active	AMA, Automatic Motor Adaption active
Auto on!!	Push “Auto ON” button on LCP
Counter expired!!!	Direction change counter expired /Call Service
Counter low	Direction change counter low / Call Service
Operating Mode	Lift Drive ready for operation
Set Parameter	internal parameter calculation and adjustment
MCO Track Error	Track Error Limits exceeded
MCO Encoder Error	Encoder- fault, - short circuit, - wire breakage X55
No motor data!!	Drive has default settings, commissioning required
Overspeed	Too high car speed detected
Overtemp Heatsink	Overtemperature on heatsink
Overtemp Motor	Overtemperature on motor
Abs. encoder-test	Drive is in absolute encoder test-mode
Encoder Error SSI	SSI-encoder fault
Encoder Error ENDAT	EnDat encoder fault
Please wait	Wait until drive is ready

9.5 Warnings and Alarms

Warnings and Alarms in P 19-81

Warnings and Alarms			
P19-81			
No.	Warnings/Alarms of control card	Error type	Description
4	Mains phase loss	TRIP	A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at 14-12 Function at Mains Imbalance. Troubleshooting: Check the supply voltage and supply currents to the frequency converter.
7	DC overvoltage	TRIP	If the DC- Link voltage exceeds the limit value, the frequency converter switches off after a while. Troubleshooting: Check the connection of the braking resistor. If it is connected correctly and the error occurs again, the braking resistor could be incorrectly designed or overloaded.
8	DC under voltage	TRIP	The DC- Link voltage is too low. The frequency converter has switched off after a specified time delay. Check the supply voltage.
9	Inverter overload	TRIP	The frequency converter switches off due to overload.
12	Torque limit	TRIP	The torque has exceeded the value in 4-16 Torque Limit Motor Mode or the value in 4-17 Torque Limit Generator Mode. Troubleshooting If the motor torque limit is exceeded during ramp up, it will extend the ramp up time. This can lead to an unexpected long deceleration distance. If torque limit occurs while running, please check the dimensioning of drive and motor and that right motor data have been used for the setup. Often different data are mentioned on motor's nameplate eg. for S1 or S3 operation. Please check with your design which data have been calculated for the particular lift. On older motors with a high inertia it can happen that torque limit is used to limit the acceleration current.
13	Overcurrent	TRIP	The current limit of P 4-18 has been exceeded and the drive has tripped. Please check your settings for motor data (eg. S1 or S3 data) and the current limit settings of P 4-18. Those settings shall be aligned with the calculation for the particular lift.
14	Earth fault	TRIP	A ground fault has been detected between an output phase and ground. Check the insulation of the motor and the motor cable. Troubleshooting: Switch off the frequency converter and remove the

			ground fault. Use a suitable test device to check for ground faults in the motor or motor cable. To do this, it is essential that the motor cable is disconnected from the frequency converter.
16	Short circuit	TRIP	There is a short circuit at the motor output of the frequency converter. If a short circuit relay or contactor is connected, please check the connection and the control.
25	Brake resistor short circuit	TRIP	There is a short circuit at the brake resistor output. Switch off the frequency converter and replace the brake resistor if necessary
26	Brake resistor power limit	TRIP	The power transferred to the brake resistor has exceeded the setting value of parameter 2-12 and the power monitoring for the brake resistor in P 2-13 is active. Troubleshooting: Check the settings in parameters 2-11 to 2-13 Check the design of the brake resistor.
27	Brake chopper fault	TRIP	The brake resistor is monitored during operation, and of a short circuit occurs, the brake function is disabled, a warning is issued. The frequency converter is still operational, but since the brake transistor has short circuited, substantial power is transmitted to the brake resistor, even it is inactive. Troubleshooting: Remove power from the frequency converter and remove the brake resistor.
30	Motor phase U missing	TRIP	Motor phase U between the frequency converter and the motor is missing. Remove power from the frequency converter and check motor phase U.
31	Motor phase V missing	TRIP	Motor phase V between the frequency converter and the motor is missing. Remove power from the frequency converter and check motor phase V.
32	Motor phase W missing	TRIP	Motor phase W between the frequency converter and the motor is missing. Remove power from the frequency converter and check motor phase W.
33	Inrush fault	TRIP	Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature. WARNING/ALARM 36, Mains failure This warning/alarm is only active if the supply voltage to the frequency converter is lost and 14-10 Mains Failure is NOT set to [0] No Function. Check the fuses to the frequency converter and mains supply to the unit.
47	24V supply low	TRIP	The 24 V DC is measured on the control card. The external 24 V DC back-up power supply may be overloaded, otherwise contact the Danfoss supplier.
48	1,8V supply low	TRIP	The 1.8 V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card. Check for a defective control card. If an

			option card is present, check for an overvoltage condition.
63	Mechanic brake low	TRIP	The actual motor current has not exceeded the release brake current within the start delay time window.
67	Option module has changed	TRIP	One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the unit. ALARM 68, Safe Stop activated Safe Torque Off has been activated. To resume normal operation, apply 24 V DC to terminal 37, then send a reset signal (via Bus, Digital I/O, or by pressing [Reset].
80	Default settings	TRIP	The drive has been initialized with it's default settings. The alarm message will stay in error log all time until another initialization. Usually this message can be ignored after commissioning.
108	Track error	TRIP	Tracking limit P19-48 exceeded
150	No external 24 Volt		External 24 V supply is missing, There is no external 24V mains for digital Input available (or the Voltage is to low?). Activate external mains in Parameter 33-85.
154	Digital Output overloaded		Digital output on X59 overloaded
188	CAN-BUS Fault	TRIP	CAN communication timeout
192	Encoder error	TRIP	Short cut or wire break of encoder signals on X55
207	Over speed	TRIP	Overspeed
208	Start error	TRIP	Tracking distance limit P19-47 at start exceeded
209	Track error	TRIP	Tracking distance limit P19-48 at operation exceeded
214	DC-Voltage low	Trip	The supply voltage shall be checked. If the drive is supplied by single phase supply for evacuation, the evacuation input of the drive shall be activated to enable operation with too low input voltage.
216	Brake failure	TRIP	Drive signal for releasing the brake is missing or motor current too low
217	Brake failure 1	TRIP LOCK	Brake feedback signal not applied before releasing the brake
218	Brake failure 2	TRIP LOCK	Brake feedback signal not released before closing the brake
219	Brake failure 3	TRIP LOCK	Brake feedback signal not applied after closing the brake
220	Brake IGBT	TRIP	Brake IGBT defect or short circuit at the brake resistor
221	Serial bus fault	MESSAGE	Bus fault
225	DCP4 position deviation	TRIP	Position deviation between distance at motor feedback and cabin (absolute encoder) exceeded. Check parametrization of Lift drive / Lift controller
226	Fan Fault	TRIP	Monitoring of the device's internal fan has been activated. The last trip can still be completed.
228	No Motor Data	MESSAGE	No motor data available. Message is generated after setting the factory settings and disappears after entering valid motor data.

229	DCP4-Timeout	Error/ Alarm	DCP-4 journey monitoring. Position deviations of the motor encoder that are not reflected in the change in shaft encoder position
230	Directions signal mismatch	TRIP	Direction signals for positive and negative direction at start
232	Brake Resistor Overload	TRIP	Overload of Brake Resistor
236	Overtemperature motor	TRIP	Overtemperature of motor
237	Overtemperature drive	TRIP	Overtemperature of drive
238	V=0 Stop	MESSAGE	Quick- Stop
239	Timeout STO T37	TRIP	Signal on T37 is missing >10 sec after start signal
240	Timeout Quick- Start	TRIP	Speed signal is missing >5 seconds after quick start
241	Positioning not completed	MESSAGE	Time for positioning to floor level of 2 seconds exceeded
242	Direction change counter low	MESSAGE	Warning limit of direction change counter exceeded
243	Direction change counter expired	TRIP	Direction change counter exceeded, speed reduced to v0 and vi
246	Encoder error SSI	TRIP	Encoder Error SSI-absolute Encoder
247	Encoder error EnDat	TRIP	Encoder Error EnDat absolute Encoder
248	Missing Speed/Dir	MESSAGE	Speed or direction signal missing longer than 2 seconds during movement
249	Governor failure	TRIP LOCK	Monitoring of feedback contact of speed governor
250	Encoder error BISS	TRIP	Encoder error BISS absolute encoder
251	CO1 T27 off	TRIP	Time monitoring contactor monitoring signal at start. Signal change from 0 to 24VDC at T27 has not occurred within 10 seconds
252	CO2 X57.1 off/ Contactor monitoring signal timeout at start	TRIP	Time monitoring contactor monitoring signal at start. Signal change from 0 to 24VDC at X57.1 did not occur within 10 seconds. See chapter Error message
253	CO1 T27 on/ Contactor monitoring signal not switched to LOW state after travel	TRIP LOCK	Signal at terminal 27 not released before starting the journey / dangerous condition. See chapter Error message
254	CO2 X57.1 on/ Contactor monitoring signal not switched to LOW state after travel	TRIP LOCK	Signal at terminal X57.1 not released before starting the journey / dangerous condition. See chapter Error message
255	CO1T27 Stop	MESSAGE	Trip was aborted due to interruption of the signal at terminal 27.
256	CO2X57.1	MESSAGE	Trip was aborted due to interruption of the signal at terminal X57.1.
257	STOT37 Stop	MESSAGE	Trip was aborted due to interruption of the signal at terminal 37.
258	Bus Stop	MESSAGE	The lift controller set the enable to 0 during the journey. The frequency converter then aborted the journey. (for systems with DCP 3 / 4 or Can open)
259	T37 on	TRIP LOCK	The signal at STO terminal 37 was not dropped before the start of the journey. (Did you forget to remove the bridge from 12 to terminal 37?)

270	SBU Timeout	TRIP	SBU Communication Timeout.
271	SBU Alarm	TRIP	SBU Alarm during operation.
272	Brake 1 does not hold the load	TRIP LOCK	This alarm appears if the brake force monitoring is activated (P19-65=XX3). Brake 1 is not able to hold the actual load. See chapter Contactless monitoring with SBU 2.0.
273	Brake 2 does not hold the load	TRIP LOCK	This alarm appears if the brake force monitoring is activated (P19-65=XX3). Brake 2 is not able to hold the actual load. See chapter Contactless monitoring with SBU 2.0.
274	Brake does not release	TRIP LOCK	This alarm appears if the brake force monitoring is activated (P19-65=XX3). The brake does not release the drive. See chapter Contactless monitoring with SBU 2.0
305	VLT-Alarm of control card. See alarm log of control card	TRIP	Please push Alarm Log button on LCP to access the latest alarms.

Further Warnings and Alarms

WARNING 1, 10 Volts low
The control card voltage is below 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω. A short circuit in a connected potentiometer or improper wiring of the potentiometer can cause this condition.

Troubleshooting
Remove the wiring from terminal 50. If the warning clears, the problem is with the wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error
This warning or alarm only appears if programmed in *6-01 Live Zero Timeout Function*. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or faulty device sending the signal can cause this condition.

Troubleshooting
Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common). Check that the frequency converter programming and switch settings match the analog signal type. Perform Input Terminal Signal Test.

WARNING/ALARM 3, No motor
No motor has been connected to the output of the frequency converter.

WARNING 5, DC link voltage high
The intermediate circuit voltage (DC) is higher than the high-voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.

WARNING 6, DC link voltage low
The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.

WARNING/ALARM 10, Motor overload temperature
According to the electronic thermal protection (ETR), the motor is too hot. Select whether the frequency converter issues a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*. The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting
Check for motor overheating. Check if the motor is mechanically overloaded. Check that the motor current set in *1-24 Motor Current* is correct. Ensure that Motor data in parameters 1-20 to 1-25 are set correctly. If an external fan is in use, check in *1-91 Motor,* External Fan that it is selected. Running AMA in 1-29 Automatic Motor Adaptation *(AMA)* tunes the frequency converter to the motor more accurately and reduces thermal loading.

WARNING/ALARM 11, Motor thermistor over temp
The thermistor might be disconnected. Select whether the frequency converter issues a warning or an alarm in *1-90 Motor Thermal Protection*.

Troubleshooting
Check for motor overheating. Check if the motor is mechanically overloaded. Check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply). Also check that the terminal switch for 53 or 54 is

set for voltage. Check that *1-93 Thermistor Source* selects terminal 53 or 54. When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY Sensor is used, check for correct connection between terminals 54 and 55. If using a thermal switch or thermistor, check that the programming if *1-93 Thermistor Resource* matches sensor wiring. If using a KTY Sensor, check the programming of 1-95 KTY Sensor Type, 1-96 KTY Thermistor Resource and 1-97 KTY Threshold level match sensor wiring.

ALARM 15, Hardware mismatch
A fitted option is not operational with the present control board hardware or software.
Record the value of the following parameters and contact your Danfoss supplier:
15-40 FC Type
15-41 Power Section
15-42 Voltage
15-43 Software Version
15-45 Actual Type code String
15-49 SW ID Control Card
15-50 SW ID Power Card
15-60 Option Mounted
15-61 Option SW Version (for each option slot)

WARNING/ALARM 22, Hoist mechanical brake
Report value shows what kind it is.
0 = The torque ref. was not reached before time-out.
1 = There was no brake feedback before time-out.

WARNING 23, Internal fan fault
The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *14-53 Fan Monitor ([0] Disabled)*.

Troubleshooting
Check fan resistance. Check soft charge fuses.

WARNING 24, External fan fault
The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *14-53 Fan Monitor ([0] Disabled)*.

Troubleshooting
Check fan resistance. Check soft charge fuses. WARNING 25, Brake resistor short circuit
The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The frequency converter is still operational but without the brake function. Remove power to the frequency converter and replace the brake resistor (see *2-15 Brake Check*).

WARNING/ALARM 28, Brake check failed
The brake resistor is not connected or not working.
Check *2-15 Brake Check*. ALARM 29, Heatsink temp. The maximum temperature of the heatsink has been exceeded. The temperature fault resets when the temperature falls below a defined heatsink temperature. The trip and reset points are different based on the frequency converter power size.

Troubleshooting
Check for the following conditions.
- Ambient temperature too high.
- Motor cable too long.

- Incorrect airflow clearance above and below the frequency converter.
- Blocked airflow around the frequency converter.
- Damaged heatsink fan.
- Dirty heatsink.

For the D, E, and F enclosures, this alarm is based on the temperature measured by the heat sink sensor mounted inside the IGBT modules. For the F enclosures, the thermal sensor in the rectifier module can also cause this alarm.

Troubleshooting
- Check fan resistance.
- Check soft charge fuses.
- IGBT thermal sensor.

ALARM 38, Internal fault
When an internal fault occurs, a code number is displayed.

Troubleshooting
- Cycle power
- Check that the option is properly installed
- Check for loose or missing wiring

It may be necessary to contact your Danfoss supplier or service department.
Note the code number for further troubleshooting directions.

ALARM 39, Heatsink sensor
No feedback from the heatsink temperature sensor. The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of digital output terminal 27
Check the load connected to terminal 27 or remove short circuit connection. Check 5-00 Digital I/O Mode and 5-01 Terminal 27 Mode.

WARNING 41, Overload of digital output terminal 29
Check the load connected to terminal 29 or remove short circuit connection. Check 5-00 Digital I/O Mode and 5-02 Terminal 29 Mode.

WARNING 49, Speed limit
When the speed is not within the specified range in *4-11 Motor Speed Low Limit [RPM]* and *4-13 Motor Speed High Limit [RPM]*, the frequency converter shows a warning. When the speed is below the specified limit in *1-86 Trip Speed Low [RPM]* (except when starting or stopping), the frequency converter trips.
ALARM 50, AMA calibration failed
Contact your Danfoss supplier or Danfoss Service Department.

ALARM 51, AMA check Unom and Inom
The settings for motor voltage, motor current and motor power are wrong. Check the settings in parameters 1-20 to 1-25.

ALARM 52, AMA low Inom
The motor current is too low. Check the settings. ALARM 53, AMA motor too big
The motor is too big for the AMA to operate.

ALARM 54, AMA motor too small
The motor is too small for the AMA to operate. ALARM 55, AMA parameter out of range
The parameter values of the motor are outside of the acceptable range. AMA cannot run.

ALARM 56, AMA interrupted by user
The user has interrupted the AMA.

ALARM 57, AMA internal fault
Try to restart AMA again a number of times, until the AMA is carried out.
NOTE:
Repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, however, this is not critical. ALARM 58, AMA Internal fault
Contact your Danfoss supplier.

WARNING 59, Current limit
The current is higher than the value in *4-18 Current Limit*. Ensure that Motor data in parameters 1-20 to 1-25 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit.

WARNING 62, Output frequency at maximum limit
The output frequency is higher than the value set in *4-19 Max Output Frequency*.
ALARM 64, Voltage Limit The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM 65, Control card over temperature
The cut-out temperature of the control card is 80 °C. Troubleshooting

- Check that the ambient operating temperature is within limits
- Check for clogged filters
- Check fan operation
- Check the control card

WARNING 66, Heatsink temperature low
The frequency converter is too cold to operate. This warning is based on the temperature sensor in the IGBT module. Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the frequency converter whenever the motor is stopped by setting *2-00 DC Hold/Preheat Current* at 5% and *1-80 Function at Stop*

Troubleshooting
The heatsink temperature measured as 0° C could indicate that the temperature sensor is defective, causing the fan speed to increase to the maximum. If the sensor wire between the IGBT and the gate drive card is disconnected, this warning would result. Also, check the IGBT thermal sensor.

ALARM 69, Power card temperature
The temperature sensor on the power card is either too hot or too cold.
Troubleshooting
Check the operation of the door fans. Check that the filters for the door fans are not blocked. Check that the gland plate is properly installed on IP21/IP 54 (NEMA 1/12) frequency converters.

ALARM 70, Illegal FC configuration
The control card and power card are incompatible. To check compatibility, contact your supplier with the type code of the unit from the nameplate and the part numbers of the cards.

WARNING 76, Power unit setup
The required number of power units does not match the detected number of active power units.

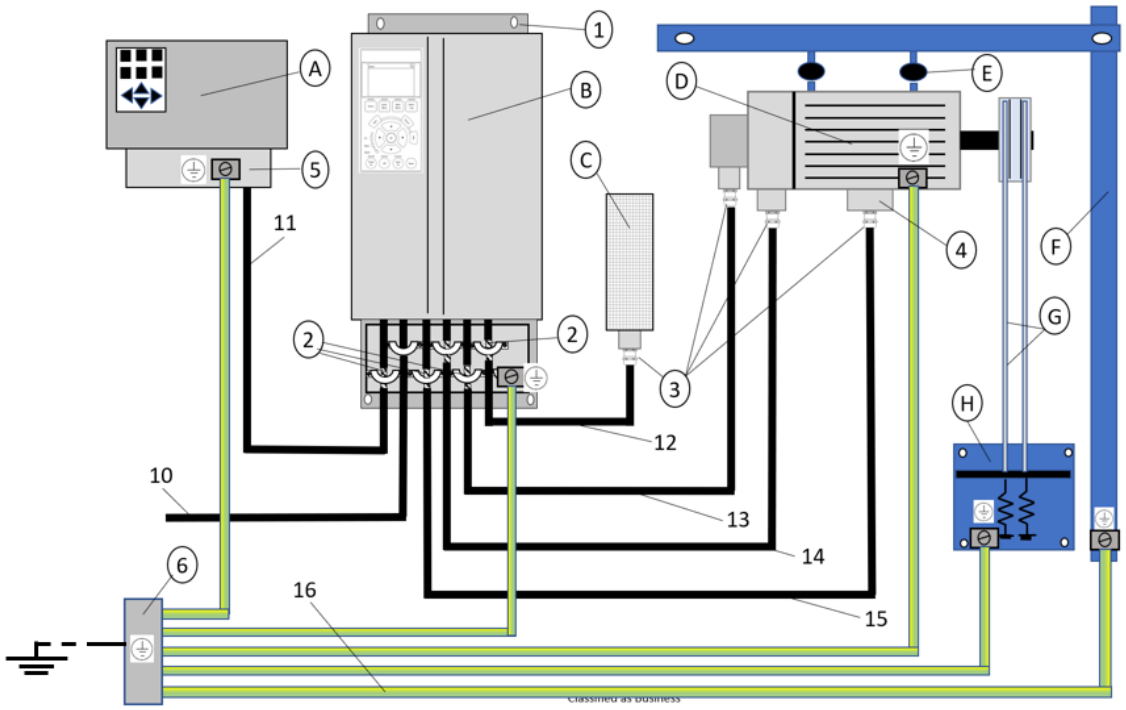
WARNING 77, Reduced power mode
This warning indicates that the frequency converter is operating in reduced power mode (i.e. less than the allowed number of inverter sections). This warning is generated on power cycle when the frequency converter is set to run with fewer inverters and remains on.

ALARM 79, Illegal power section configuration
The scaling card is the incorrect part number or not installed. Also, MK102 connector on the power card could not be installed.

ALARM 80, Drive initialized to default value
Parameter settings are initialized to default settings after a manual reset. To clear the alarm, reset the unit.

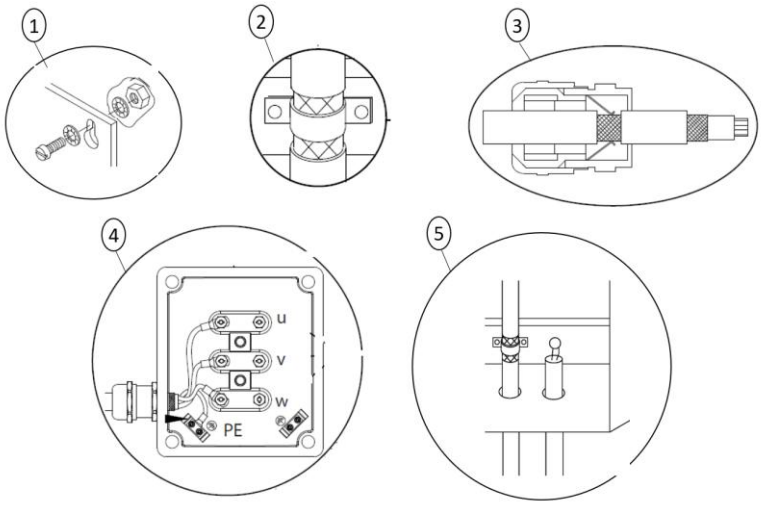
10 EMC complaint installation

Schematic drawing



A	Lift controller	B	Lift Drive LD302	C	Brake resistor
D	Lift Motor	E	Vibration damper	F	mech. elevator construction
G	Elevator rope	H	Rope- tensioning device	1	Mounting
2	Cable clamps	3	EMC cable gland	4	Motor- terminal box
5	Lift controller terminal box	6	Potential compensation rail	10	Main power cable
11	Control cables Lift controller	12	Brake resistor cable	13	Encoder cable
14	Mech. Brake cable	15	Motor cable	16	Earth and ground cable min. 16 mm²

Detailed view:



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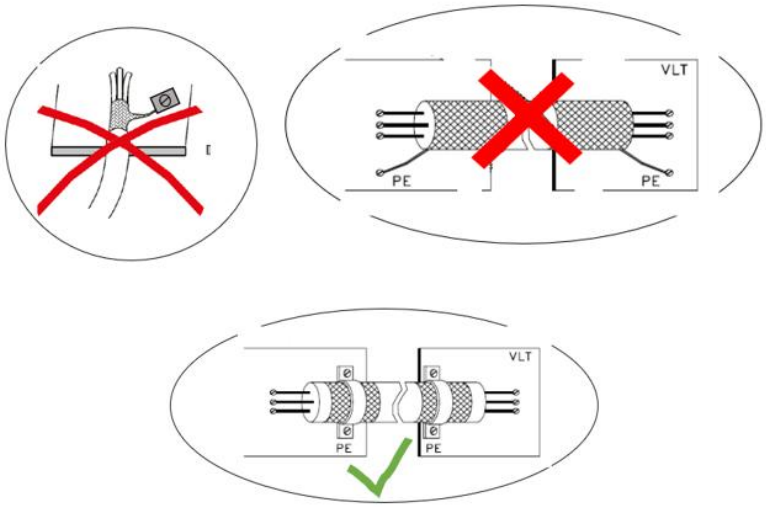

11 Evacuation

Schematic diagram evacuation