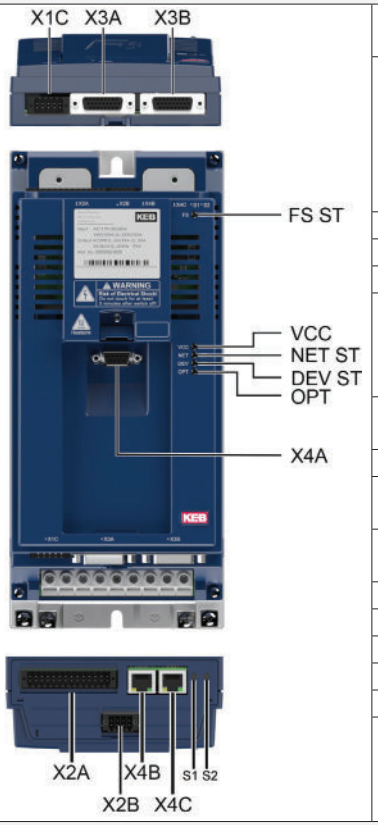
F6 ELEVATOR DRIVE QUICK-START GUIDE

This guide is intended to be a supplement to the KEB F6 Elevator Drive Reference manual (20357526).
Read the F6 Elevator Drive Reference manual thoroughly before powering up the drive.

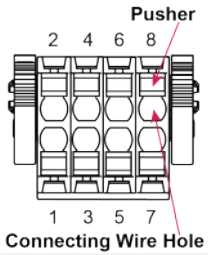
00F6LUZ-K000

Connection and Control Elements



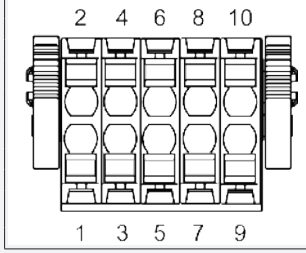
X1C	Temperature monitoring, brake control/ monitoring
X2A	Control terminal block for digital inputs/outputs: • 24V supply • Relay output • Analog inputs and outputs • CAN bus
X2B	Safety module
X3A	Encoder interface channel A
X3B	Encoder interface channel B
X4A	Diagnostic interface with RS232/485 interface according to DIN 66019II protocol; operator slot
X4B	Fieldbus input / port 0 / RS485 potential-free
X4C	Fieldbus output / Port 1
S1	Rotary coding switch 1 (Low-Byte)
S2	Rotary coding switch 2 (High-Byte)
FS ST	LED Safety state
VCC	LED Voltage supply (24V)
NET ST	LED Network / Fieldbus status
DEV ST	LED Inverter / Device status
OPT	LED Operational status

Terminal X2B (Safety Module)



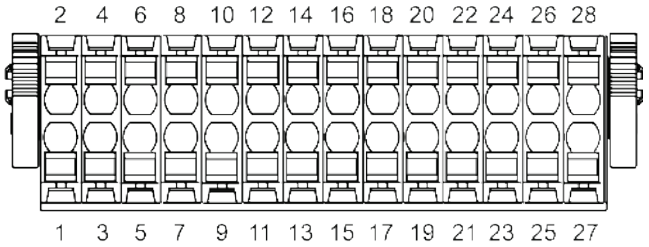
Pin	Name	Function
1	STO1 channel 1	Function1 - Inputs
2	STO1 channel 2	
3	SBC/STO2 channel 1	Function2 - Inputs
4	SBC/STO2 channel 2	
5	No Function	Function3 - Inputs
6	No Function	
7	STO Confirmation	Output 1
8	SBC Confirmation	Output 2

Motor Monitoring X1C (Temperature, Brake)



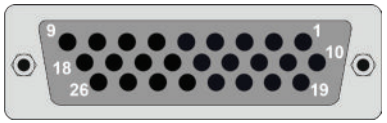
Pin	Name	Function
1	BR	Brake Control / Output +
2	BR-	Brake Control / Output -
3	0V	For supplying the feedback inputs P24Vin - 0.5V / max. 1A (BR+ and 24Vout in total 2A)
4	24Vout	
5	DIBR1	Feedback Input for Brake Control
6	DIBR2	Feedback Input for Brake Control
7/8	Reserved	-
9	TA1	Temperature Detection / Output +
10	TA2	Temperature Detection / Output -

Control Terminal Strip X2A



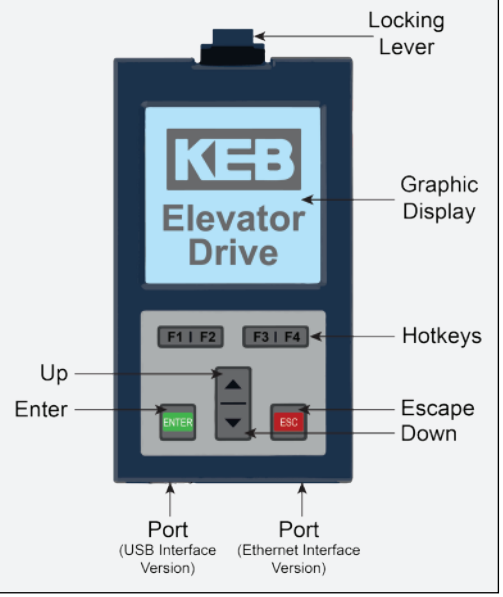
1	DI1	Digital input 1
2	DI2	Digital input 2
3	DI3	Digital input 3
4	DI4	Digital input 4
5	DI5	Digital input 5
6	DI6	Digital input 6
7	DI7	Digital input 7
8	DI8	Digital input 8
9	0V	Reference potential for digital output
10	DO1	Digital output 1
11	0V	Reference potential for digital output
12	DO2	Digital output 2
13	RLB	Relay output / NC contact (no function at variant relay with positively driven contacts)
14	RLA	Relay output / NO contact
15	RLC	Relay output/ switching contact
16	24Vout	DC voltage output 24V (max. 100 mA together with terminal 26) for control the inputs (SELV).
17	AN1-	non-isolated difference input 1
18	AN1+	Non-isolated difference input 1
19	AN2-	non-isolated difference input 2
20	AN2+	Non-isolated difference input 2
21	0V	Reference potential for analog inputs and outputs
22	ANOUT	Analog output DC 0…10 V
23	CAN low	CAN bus ISO High Speed according to ISO/DIN 11896 > Fieldbus interfaces
24	CAN high	CAN bus ISO High Speed according to ISO/DIN 11896 > Fieldbus interfaces
25	CAN COM	CAN ground isolated > Fieldbus interfaces
26	24VoutCtrl	DC voltage output 24V for supply the control board (SELV). DO NOT LINK WITH VOLTAGE SUPPLIES OF OTHER DEVICES!
27	0V	Reference potential for P24Vin at external supply
28	P24Vin	Voltage input DC 24V for supply the control board and the brake output

Encoder Interfaces X3A, X3B

X3A / X3B: Plug-in connector socket	 (Front View Socket)	D-Sub DB-26 (HD), triple row
Counterpart: Plug-in connector		D-Sub DB-26 (HD), triple row, withfix-ing screw

Encoder	Incremental Encoder RS485 and 1Vpp (channel 1 only)	SinCos (absolute)	Sin/Cos- SSI, EnDat (1Vss), BiSS (digital)	Incremental Encoder Emulation
Channel	A / B	A	A	B
PIN				
1	A+	Cos+	Cos+	A+ (out)
2	A-	Cos-	Cos-	A-(out)
3	B+	Sin+	Sin+	B+ (out)
4	B-	Sin-	Sin-	B-(out)
5	N+	N+	Data+	N+ (out)
6	N-	N-	Data-	N-(out)
8, 9	5.25 V (is output, if an encoder type is set)			
10	-	Cos_abs+	Clock-	-
11	-	Cos_abs-	-	-
12	-	Sin_abs+	Clock+	-
13	-	Sin_abs-	-	-
14	-	-	-	-
15	-	-	-	-
7, 16, 17	0V and Inner shields			
18	24 V	24 V	24 V	
19	-	-	-	-
20	-	-	-	-
21	-	-	-	-
22	-	-	-	-
23	-	-	-	-
24	-	-	-	-
25, 26	8 V (depending on parameter LE01)			

Keypad Navigation



LED Indicators

X2B	LED	Description
Off	-	No voltage supply of the safety module
On	Green	Safety module in operation
On	Red	Safety module in error
VCC	**LED**	**Description**
Off	-	Power supply of the control card switched off
On	Green	Control is supplied with 24V
NET ST	**LED**	**Description**
Off	-	Device Off or Booting
Blink Code	Various	Depending on fieldbus interfaces
DEV ST	**LED**	**Description**
Off	-	Device Off or Booting
On	Red	Drive faulted
On	Yellow	No error; power stage switched off
On	Green	No error; ready to run
On	Blue	Configuration mode / Active parameter edit / FTP mode active
OPT	**LED**	**Description**
Off	-	Drive idle state
On	Red	Operational - Torque, current or voltage limit is reached
On	Yellow	Operational - Special function active
On	Green	Operational - Running the motor under normal operation
On	Blue	Operational - Learn mode is active

Setting the Password

UD01: Password
- Basic (Read Only) = 11
- User (Read/Write) = 27
- Adjustor (Read/Write) = 119
- OEM (Read/Write) = Contact OEM

Low access levels will limit the users ability to view and change parameters. Contact the Controller OEM for more information!

Setting the Date/Time (password limited)

US07: Date Time
- MM / DD / YYYY
- 24 Hour Time

Start-up Process

Check Drive Connections
- Power (inc. resistor/regen)
- Control
- Encoder
- Communication

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(1) Basic Set-Up
- Units
- Motor/Control Type
- Load Configuration
- Contract Speed

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(2) Configure Inputs/Outputs
- Define Inputs
- Define Outputs

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(3) Motor Data

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(4) Encoder Data

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(5) Machine Data

↓

(6) Speed Profile

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(7) Motor Learn (Stationary)

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(8) Encoder Learn
- SPI (stationary)

OR
- Pole Learn (requires movement)
- Encoder Synchronization

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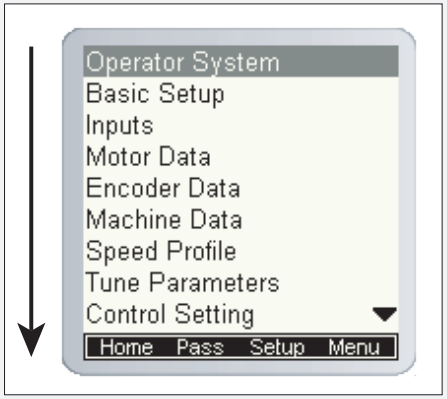
(9) Run the Motor

Programming the drive from default

The drive is programmed via the programming menu (*Home* > *Prog*).

A user should begin at the top of the programming menu and work their way downwards, filling in the required information.



(1) Basic Setup (password limited)

The basic setup might already have been done by the controller mfg.

(1.1) Start at the Basic Setup screen (*Home* > *Prog* > *Basic Setup*) and confirm/enter the following values based on the application/controller:
- US02 - System Units (Imperial/Metric)
- US03 - Motor Type (i.e. Induction or PM synch)
- US04 - Control Type (i.e. Binary, Serial, Analog)

(1.2) Load the configuration:
- US05 - Load Configuration (Write config. to drive)

If loaded successfully, US05 should change from 'Not configured' to 'Configuration OK'.

(1.3) Enter the contract speed of the application:
- US06 - Contract Speed

If the US02 or US04 parameters are changed after a configuration has been loaded, a new configuration must be written to the drive. Writing a new configuration will NOT default all previous settings. If the US03 Motor Type must be changed after a configuration has been loaded, a new configuration must be written to the drive, and writing the new configuration WILL default all previous settings.

(2) Inputs and Outputs

The basic setup might already have been done by the controller mfg.

(2.1) Inputs (password limited)
Confirm the correct drive inputs are assigned according to the controller drawing.

(2.2) Outputs
Confirm the correct drive outputs are assigned according to the controller drawing. The output menu is found at the bottom of the programming screen.

(3) Motor Data

(3.1) Induction Motors
Enter the following parameters from the motor nameplate:
- LM01 - Motor Power (note units)
- LM02 - Motor Speed (RPM) - Verify it is rated "slip speed"
- LM03 - Motor Current
- LM04 - Motor Frequency
- LM05 - Motor Voltage
- LM06 - Motor Power Factor

(3.2) PM Motors
Enter the following parameters from the motor nameplate:
- LM02 - Motor Speed (RPM)
- LM03 - Motor Current
- LM04 - Motor Frequency
- LM05 - Motor Voltage (EMF rms @ rated speed)
- LM07 - Motor Torque (use lb-ft. for english units; Nm for metric units

For permanent magnet motors, it is important that the relationship between the motor speed and rated frequency correlate to the number of poles!

$$\text{Motor Speed (RPM)} = \frac{\text{Rated Motor Frequecy (Hz)} * 120}{\text{\# of Motor Poles}}$$

$$\text{LM02} = \frac{\text{LM04} * 120}{\text{\# of Motor Poles}}$$

$$\text{LM04} = \frac{\text{LM02} * \text{\# of Motor Poles}}{120}$$

$$\text{\# of Motor Poles} = \frac{\text{Rated Motor Frequecy (Hz)} * 120}{\text{Motor Speed (RPM)}}$$

Torque units will change depending on which units are set in US02. For reference, here are the equations to convert between Imperial and Metric units provided different nameplate information:

$$\text{lb-ft} = \frac{\text{Nm}}{1.355} = \frac{\text{HP} * 5252}{\text{Rated Motor Speed}} = \frac{\text{kW} * 7051}{\text{Rated Motor Speed}}$$

(4) Encoder Data

Enter the basic encoder parameters:
- LE01 Encoder 1 Interface
- LE02 Encoder Pulse Number (ppr)
- LE12 Serial Encoder 1 Status (check for 'poisition transfer' when using digital encoders)

(5) Machine Data

Enter the machine data:

- LN01 - Sheave Diameter (use inches for english units; mm. for metric units)
- LN02 - Gear Ratio (x:1); gearless applications > x=1
- LN03 - Roping Ratio (x:1)

i Incorrect setting of the machine data parameters may cause the elevator to run too fast, too slow or may incorrectly calculate the overspeed limit.

(6) Speed Profile

(6.1) Enter the speed control parameters (digital, binary, and positioning control only).
The speed commands in Analog and Serial speed control are dictated by the controller so these speed parameters will have no effect.

Enter the following speed settings if applicable:

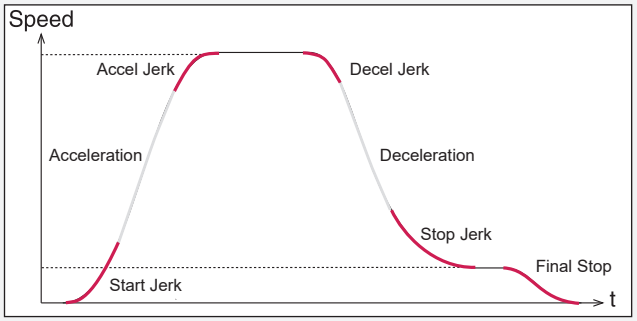
- LS01 - Leveling Speed
- LS02 - High Speed
- LS03 - Inspection Speed
- LS04 - Correction Speed
- LS05 - Intermediate Speed 1
- LS06 - Intermediate Speed 2
- LS07 - Intermediate Speed 3
- LS10 - Battery Operation Speed
- LS43 - Deceleration Emergency
- LS44 - Deceleration Jerk Emergency
- LS45 - Stop Jerk Emergency
- LS48 - ESD/ETS Deceleration
- LS49 - ESD/ETS Jerk

i The nomenclature of the speeds above are defined (as default) by KEB. However, the controller manufacturer may assign speeds differently (e.g. the controller manufacture may use Intermediate Speed 1 for High Speed). If the elevator does not move at the correct speed, verify which speed is selected and its corresponding setting (Home screen). Also, verify whether the command speed and encoder speed match.

(6.2) First, use the KEB defaults for the profile adjustments.
The KEB elevator drive can approximate all relevant profile parameters depending on the desired aggressiveness of the application (i.e. soft, medium, or hard profile). The adjustments can be made with:

- LS15 - High Speed Profile
- LS16 - One Floor Profile (Intermediate Speeds 1, 2)
- LS17 - Emergency Profile (Intermediate Speed 3)

(6.3) Alternatively, to customize the profile, the different speed profiles can be adjusted based on the selected speed:



Speed Profile Parameters

	High Speed	Short Run Int. 1, 2	Emergency Int. 3	Inspection
Acceleration	LS20	LS30	LS40	LS50
Start Jerk	LS21	LS31	LS41	LS51
Accel Jerk	LS22	LS32	LS42	LS52
Deceleration / NTS	LS23	LS33	LS43	LS53
Decel Jerk / NTS	LS24	LS34	LS44	LS54
Stop Jerk / NTS	LS25	LS35	LS45	LS55
Final Stop	LS43-45			
NTS/ETS	LS48-49			

(7) Motor Learn

The Motor Learn function can be found under the Tune Parameters group from the Programming menu (*Home* > *Prog* > *Tune Parameters* > *LL01*).

Begin the procedure by setting:

- LL01 - Motor Tuning = Start

The user must complete the following steps:

1. Disable the brake (Consult w/controller OEM on preferred method).
2. If the speed is generated by the controller (Analog or Serial), then set external speed command to zero.
3. Press and hold inspection (speed + STO inputs) until completed.

The process should take 2-5 minutes and will emit a high pitched noise while the drive measures various motor parameters. If needed, reconnect the brake wire and return the controller command speed.

(8) Encoder Learn

(8.1) Encoder Learn, Induction Motors
In applications with Induction Motors, the Encoder Synchronization function can be used to determine the correct A/B phasing of the encoder channels and whether the direction needs to be inverted for the correct direction of travel.
For Induction motors, the Encoder Synchronization can be adjusted at parameter LL07; proceed to section 8.3 (IM only).

(8.2) Encoder Learn, PM motors

i When using PM motors, the encoder position/pole must be learned.

⚠ **If at any time the physical relation between the motor shaft and encoder changes (i.e. encoder replaced, encoder slippage, etc.), the encoder position must be relearned!**

There are TWO functions available to determine the encoder pole position with PM machines. Only one is required:

1. SPI (Stationary Pole Identification) – This process is preferred and can learn the encoder position without movement (i.e. with ropes + brake set).
2. Encoder Pole Learn – Process requires sheave movement with little friction (i.e. unroped or balanced car), but can accurately determine encoder position and encoder phasing.

1. SPI
To start the SPI Learn, go to LL05 and follow the instructions on the keypad:

- LL05 - SPI (START)

The user will be prompted to:

1. Disable the brake (Consult w/controller OEM on preferred method).
2. If the speed is generated by the controller (Analog or Serial), then set external speed command to zero.
3. Press and hold inspection (speed + STO inputs) until finished.

Upon successful learn, the pole position will be written to parameter LE06, and LED 1 and 2 will flash. Reconnect brake before attempting the Encoder Synchronization, step 8.3; the drive will automatically go to step 8.3 to synchronize the encoder.

2. Encoder Pole Learn

i If SPI fails, check parameters LE11, LE12 and LM27. It may be necessary to change LM27 to other option (0->1 or 1->0) to change the mode of SPI.

This procedure requires relatively frictionless movement (i.e. unroped sheave or balanced load).
To begin the process:

1. Set Encoder Pole Learn to START:
   - LL06 - Encoder Pole Learn (START)
2. The user will be prompted to press and hold the inspection (speed + STO inputs) until finished.
3. When the process is complete, the keypad will prompt the user to release the inspection command. The encoder position and A/B phasing information will be automatically written to parameters LL06 and LL03 respectively.

i The drive will automatically go to step 8.3 to synchronize the encoder.

(8.3) Encoder Synchronization
The Encoder Synchronization function can be used to determine the correct A/B phasing of the encoder channels and whether the direction needs to inverted for the correct direction of travel It should be done for both PM and IM applications. Begin the process by setting:

- LL07 - Encoder Synchronization to START.

Then follow the directions on the keypad. The drive will iteratively run the elevator and swap the phasing and direction of the A/B channels as needed.

i Parameter LO20 must be set to the correct output function.

(9) Run the Motor

At this point, the drive should be set up far enough to run sufficiently on inspection speed. The user should run the elevator in both the up/down directions and monitor the current in the home/diagnostic screen.

- For a balanced car, the current should be sufficiently low.
- For an empty car, the running current should be less than motor rated current in both directions.

If operation on inspection speed shows no issues, the next step is to run the elevator up to high speed. Before this is done, there may be a few parameters which need adjustment:

- LC30 - Maximum Torque (Default is 150%; Typical values are 200-250%)

i Parameter LO20 must be set to the correct output function.

⚠ **Any time the motor data parameters are adjusted, the LC30 Maximum Torque will automatically re-calculate to 150%!**

Run the Motor (at high speed)

The elevator should now be able to run at high speed with no major issues. If the ride quality is satisfactory at this point, then no further adjustments are needed. When you have a running motor, be sure to record parameter values for LE03, LE06 (only for PM motors).

Troubleshooting & Errors

Error Over Voltage

Trip Voltage (460V drive) = 840VDC
Trip Voltage (230V drive) = 400VDC

Braking resistor should shunt at:
- 780VDC (460V drives)
- 380VDC (230V drives)

Check:
- Brake resistor connection
- Disconnect resistor - measure resistance
- Measure DC bus terminals (≈ 1.41x VAC_{IN})
- Proper mains grounding
- Is the brake transistor functioning?

Error Under Voltage

Trip Voltage (460V drive) = 240VDC
Trip Voltage (230V drive) = 216VDC

Check:
- Input voltage and wiring
- Missing input phase
- Imbalanced input phases (not to exceed 2%)
- Proper mains grounding

Error Motor Protection

Excessive RMS motor current - according to LM08 (IM) and LM11 (PM motor).

Causes:
- Excessive Current
- Incorrect motor data
- Incorrect encoder data
- High mechanical load/issues (friction)

Error Over Current

Can be monitored on Diagnostic screen #1 or DG06 or DG31.

If error occurs instantly at the start of each run, the issue may be:
- Ground fault on motor leads
- Damaged or slow closing motor contactor
- Motor Failure
- Shorted output transistor in drive

If error is intermittent, the issue may be:
- Damaged or slow to close motor contactor
- Loose motor connections
- Electrical noise, faulty grounding
- Faulty cabling

Error Overheat Power Module

The heatsink temperature can be monitored on Diag. screen #8 or DG37.

Typically, the heatsink temperature should be below 70° C.

Causes:
- Insufficient cooling or high ambient temp.
  - » Check operation of fans (LX06)
  - » Make sure fans are not clogged
  - » Increase airflow around inverter
- Faulty temperature sensor
  - » Does error happen when drive is cool?

Error Overload

Time dependent overload - excessive current.
➡ Refer to the F6 Power Stage manuals

Causes:
- Excessive current
- Incorrect motor data
- Incorrect encoder data
- High mechanical load/issues (friction)
- Brake is not releasing at start of run

Error Low Speed Overload

Excessive current at low speed (< 3Hz).

Causes:
- Excessive current
- High duty at low speeds
- Incorrect motor data
- Incorrect encoder data
- High mechanical load/issues (friction)
- Brake is not releasing at start of run

Error Low Motor Current

Low current during initial current check.

Causes:
- One or more motor leads not connected
- Motor contactor not closing (or in time)
- Motor contactor contacts are damaged
- Motor windings are damaged

Error Overspeed

The internal overspeed limit is exceeded.

Internal overspeed limit is 110% of contract speed (US06). This cannot be adjusted.

Causes:
- Incorrect machine data settings (LN01-03)
- Lack of motor control
  - » Peak current reached (Diag. screen #1)
  - » Max. torque might be too low (LC30)
  - » Incorrect motor data (i.e. LM02 & LM04)
  - » Incorrect encoder pole position
- Speed gains too high or too low
  - » Unloaded motor might require low gains
- Modulation grade exceeds minimum
  - » Monitor Diag. screen #1
  - » Modulation should not exceed 100%
- Sudden, Excessive movement
  - » Incorrect Motor data
  - » Incorrect encoder data

Speed Following Error

The encoder speed deviates from the command speed by more than the amount set in LX14 (for more than 3 secs.).

Causes:
- Lack of control (torque/current limit)
- Speed gains set too low
- Mechanical issues / High friction
- Modulation grade exceeds maximum

Motor Noise

Vibration
- Increase sample rate of encoder (LE04)
- Reduced speed control gains
- Check if modulation grade is reached
- Increase torque command filter (LC44)

Squealing/Grinding
- Check sample rate of encoder; 4-8ms typ.
- Check encoder multiplier (LE05)
- Verify motor data
- Increase torque command filter (LC44)

"Clunk" at the end of the run.
- Verify the drive STO is not being dropped prematurely while drive is still outputting torque to the motor (i.e. STO is dropped before the speed and direction are dropped)
- Check fault log - Is "Drive STO Dropped" error present?

Torque Limit Being Reached

Causes:
- LC30 is too low
- Incorrect motor data
- Incorrect encoder data
- Incorrect gains
- Modulation grade being reached

Selected Parameters - Refer to *Parameter Descriptions* or *Parameter Reference* chapters of F6 Elevator Drive Reference manual for complete listing

The ability to view/write parameters is dictated by the user access level (*Home* > *Prog* > *Pass (F2)*) - Contact the controller OEM for more information

LE - Encoder Parameters

Param.	Name	Value
LE01	Encoder 1 Interface	
LE02	Encoder 1 Pulse Number	
LE03	Swap Encoder 1 Channels	
LE04	Encoder 1 Sample Rate	
LE06	Encoder 1 Pole Position	

LM - Motor Parameters

Param.	Name	Value
LM01	Motor Power	
LM02	Motor Speed	
LM03	Motor Current	
LM04	Motor Frequency	
LM05	Motor Voltage	
LM06	Motor Power Factor	
LM07	Motor Torque	
LM09	Elec. Motor Protection Current	

LN - Machine Parameters

Param.	Name	Value
LN01	Traction Sheave Diameter	
LN02	Gear Reduction Ratio	
LN03	Roping Ratio	

LS - Speed Parameters

Param.	Name	Value
LS01	Leveling Speed	
LS02	High Speed	
LS03	Inspection Speed	
LS04	Correction Speed	
LS05	Intermediate Speed 1	
LS06	Intermediate Speed 2	
LS07	Intermediate Speed 3	
LS15	High Speed Profile	
LS16	One Floor Profile	
LS17	Emergency Profile	

LL - Tune Parameters

Param.	Name	Value
LL01	Motor Tuning	
LL05	SPI	
LL06	Encoder Pole Learn	
LL07	Encoder Synchronization	
LL10	Inertia Learn	
LL15	Overspeed Test	
LL16	Overspeed Test Speed	
LL17	Safety Release	

LC - Control Settings

Param.	Name	Value
LC01	Control Mode	
LC02	Speed Gain Optimization	
LC03	KP Speed Acceleration	
LC04	KP Speed Deceleration	
LC05	KP Speed Pre-torque	
LC08	KI Speed Acceleration	
LC09	KI Speed Deceleration	
LC10	KI Speed Pre-torque	
LC11	KI Speed Offset Acceleration	
LC12	KI Speed Offset Deceleration	
LC30	Maximum Torque	

LT - Timer Parameters

Param.	Name	Value
LT01	Brake Release Delay	
LT02	Brake Hold Off	
LT03	Speed Start Delay	
LT10	Brake Drop Delay	
LT12	Current Hold Time	
LT13	Current Ramp Down Time	
LT14	Relevel Time	

LX - Special Parameters

Param.	Name	Value
LX02	Switching Frequency	
LX06	Fan Function Test	
LX08	Phase Current Check	
LX13	Speed Following Error	
LX14	Speed Difference	

CH - Configuration Handling

Param.	Name	Value
CH01	Restore Default Parameters • Factory Default (OEM)	
CH02	Save User Parameters	
CH03	Restore User Parameters	

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