**Quick-start guide**

This guide is intended to be a supplement to the full KEB elevator manual. Read KEB document: 00F5LUMK331 thoroughly before powering up the drive.

**Start-up Process**

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

(B) Configure Inputs/Outputs
- PNP/NPN
- Define Inputs
- Define Outputs

(C) Motor Data
- System Units (Imperial/Metric)
- Motor Type (i.e. Induction geared or PM synch gearless)
- Control (i.e. Binary, Serial, Analog)

(D) Encoder Data
- Encoder Units
- Encoder Data
- Encoder Machine Data
- Encoder Speed Profile
- Encoder Time Parameters
- Encoder Control Setting

(E) Machine Data
- Power (inc. resistor/regen)
- Control
- Encoder
- Communication

(F) Speed Profile
- Motor Speed (RPM) - Verify it is rated “slip speed”

(G) Motor Learn (Stationary)
- SPI (stationary)
- Pole Learn (requires movement)
- Encoder Synchronization

(H) Encoder Learn
- Encoder Units
- Encoder Data
- Encoder Machine Data
- Encoder Speed Profile
- Encoder Time Parameters
- Encoder Control Setting

(I) Run the Motor
- Drive is able to run

(J) Advanced Adjustments
- Speed Profile
- Inertia Learn (optional)
- Gains
- Pre-torque (optional)

(K) Special Functions
- Test Function - Overspeed Test - Safety Release

**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.

**Outputs**

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

B2 - Confirm the correct drive outputs are assigned according to the controller drawing.

The output menu is found at the bottom of the programming screen.

**C1** - For 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

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

**C2** - For 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)

**Setting the password**

The password access level can be set here:

- A1 - 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 geared or PM synch gearless)
  - US04 - Control Type (i.e. Binary, Serial, Analog)

- A2 - Load the configuration:
  - US05 - Load Configuration (Write config. to drive)

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

**Setting the Date/Time (password limited)**

The LCD keypad has a real-time clock & date which can be used to time stamp faults.

- The date can be set at (Home > Prog > Setup > date)
  - The date format is mm/dd/yyyy
- The time can be set at (Home > Prog > Setup > time)
  - The time format is 24-hour

**Inputs (password limited)**

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

B1 - Enter/confirm the type of digital input
- LI01 - Type of Input (PNP or NPN logic)

**Encoder Data**

- D1 - Enter the basic encoder parameters:
  - LE02 - Encoder Pulse Number (ppr)
  - LE05 - Encoder Multiplier (EnDat = 8; TTL = 2)

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

- LM02 = \frac{\text{LM04} \times 120}{\text{\# of Motor Poles}}
- LM04 = \frac{\text{LM02} \times \text{\# of Motor Poles}}{120}

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:

\[ \text{lb-ft} = \frac{\text{Nm} \times 5252}{1.355} = \frac{\text{kW} \times 7051}{\text{Rated Motor Speed}} \]
**Machine Data**

E1 – 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)

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

**Speed Profile**

F1 – 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. However, in Analog speed control, the user must enter a High Speed setting which corresponds high speed to +10V.

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

Note: The nomenclature of the speeds above are defined (as default) by KEB. However, the controller manufacturer may assign speeds differently (e.g. the controller manufacturer may use Intermediate Speed 1 for High Speed). If the elevator does not move at the correct speed, verify which speed is selected and it’s corresponding setting (Diag. screen #10). Also, verify whether the command speed and encoder speed match.

F2 – To begin with, use the KEB defaults for the profile adjustments.

The KEB LCD operator 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)

F3 – Alternatively, if a user wants to customize the profile, they can adjust the different speed profiles based on the selected speed:

- Acceleration
- Start Jerk
- Decel Jerk
- Deceleration
- Stop Jerk
- Final Stop
- ETS

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 2 functions available to determine the encoder pole position with PM machines:

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

**Motor Learn**

G1 – 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

Follow the instructions on the LCD screen. The user is instructed to:

1. Disable the brake
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 + enable inputs) until completed

The process should take 2-5 minutes and will emit a high pitched noise while the drive measures various motor parameters.

The drive will confirm a successful motor learn, and LED 1 and 2 will flash if needed, reconnect the brake wire and return the controller command speed.

H1 – 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 H3 (IM only)

H2 – Encoder Learn, PM motors

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

**Encoder Learn**

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:

- LC.30 - Maximum Torque (Default is 150%; Typical values are 200-250%)

Run The Motor (at High Speed)

Now, the elevator should be able to run at high speed with no major issues. At this point, if the user is satisfied then no further adjustments may be needed to increase ride quality.
Advanced Adjustments (Password limited)

J1 - Adjusting Accel/Decel rates - See section F2 for more information.

In general, higher values result in a hard/fast profile, while lower values give softer, slower transitions.

J2 - Inertia Learn (FFTC)
Feed Forward Torque Control (FFTC) reduces the dependence on speed feedback from the motor by predicting what the elevator system will do and providing the required torque. It is recommended for optimal control of dynamic applications.

Process
1. Get the car running at contract speed over multiple floors
2. Balance the car and run on inspection to the middle of the hoistway. Monitor torque (Diag. screen #3) - the motor torque in the up and down direction should be equal but opposite in direction. If this is not the case, adjust the counterweights before proceeding.
3. Run the car at high speed. For buildings with 12 floors or less, run the car from top to bottom. For taller buildings, run between at least 10 floors from the middle of the hoistway (5 above, 5 below). Make sure this measurement is done from the middle of the hoistway to account for rope compensation. Make sure the car reaches high speed. If not, lower the speed such that the car reaches a stable speed for 2 seconds.
4. Begin the process by setting:
   • LL10 - Inertia Learn (“START”)
5. Follow the directions on the keypad. After four runs, the drive will automatically calculate the inertia based on the averages.

J3 - Gain Adjustment (in lieu of Inertia Learn)

Proportional Gain
The proportional gain maintains general control and stability over the entire speed range. In general, it provides the magnitude of response. The proportional gains are split up into the 3 values:
• LC03 - Acceleration and constant speed
• LC04 - Deceleration
• LC05 - Pretorque
Lower values (1000) may result in loose control and overshoot of the command speed as high speed is reached.

High values (10,000) can cause high frequency oscillation resulting in vibration or a buzzing sound in the motor.

Integral Gain
The integral gain is responsible for correcting long-term average error in speed as well as providing increased control and rigidity at lower speeds for starting and stopping. The integral gains are split into 3 values:
• LC08 - Acceleration and constant speed
• LC09 - Deceleration
• LC10 - Pretorque
If the gains are too low, the actual speed will have difficulty tracking the command speed. The drive will not catch the load quickly or will have difficulty overcoming starting friction during takeoff
If the gains are too high there could be torque pulsations during accel, constant speed, or decel.

Integral Gain Offset
The integral offset gain values are effective only at low speeds. Values which are too low will cause the actual speed to lag the command speed. Values too high will cause vibration or steps at the final approach.
• LC11 - KI Offset Acceleration
The offset acceleration gain will assist the motor in catching the load during starting - this setting is especially important for high efficiency geared or gearless applications.

J4 - Pretorque Adjustment
The drive’s internal pretorque is a feature which can be used to minimize the rollback which may occur at brake pick without the need for an external load weighing device. (Pretorque is available when LC01 = Closed Loop FOC or Closed Loop Synthetic Pretorque)

Adjustments
• LT02 (Control Hold Off timer) - Should be set such that it expires briefly before the brake is picked.
• LT03 (Speed Start Delay) - Relates to the pretorque holding period before takeoff.
• LC05 (KP Speed Pretorque) - Gains active during LT03 pretorque period.
• LC10 (KI Speed Pretorque) - See LC05. Adjust higher for tighter control.

(K) Special Functions
• LL15 - Overspeed Test
Allows the drive to run at a higher speed than the programmed contract speed for a single run in order to perform overspeed or governor tests. The speed at which the overspeed test will perform is set in LL16.
• LL17 - Safety Release
The safety release function turns off the acceleration jerk rates and raises the maximum torque limit for one run in order to drive an elevator car off the safeties.
Troubleshooting & Errors - See section 7.0 of drive manual for complete listing

Error Over Voltage
Trip Voltage (460V drive) = 840VDC
Trip Voltage (240V drive) = 400VDC
Braking resistor should shut at:
760V/DC (460V drives)
380V/DC (230V drives)
Check:
Brake resistor connection
Disconnected resistor - measure resistance
Measure DC bus terminals (= 1.41x VAC)
Proper mains grounding

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 Overheat Power Module
The heatsink temperature can be monitored on Diag. screen #7 or DG37.
Typically, the heatsink temperature should be below 65° C. Error trips at 90° 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 Over Current
Can be monitored on Diag. 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 Overload
Time dependent overload - excessive current
See section 2.7 of manual
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

Selected Parameters - See section 8.1 of drive 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
<table>
<thead>
<tr>
<th>Param.</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE01</td>
<td>Encoder 1 Interface</td>
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</tr>
<tr>
<td>LE02</td>
<td>Encoder 1 Pulse Number</td>
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<tr>
<td>LE03</td>
<td>Swap Encoder 1 Channels</td>
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<tr>
<td>LE04</td>
<td>Encoder 1 Sample Rate</td>
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<tr>
<td>LE05</td>
<td>Encoder 1 Pole Position</td>
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LM - Motor Parameters
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<th>Name</th>
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<td>Motor Power</td>
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<td>LM02</td>
<td>Motor Speed</td>
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<tr>
<td>LM03</td>
<td>Motor Current</td>
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<td>LM04</td>
<td>Motor Frequency</td>
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<td>LM05</td>
<td>Motor Voltage</td>
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<tr>
<td>LM06</td>
<td>Motor Power Factor</td>
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<td>LM07</td>
<td>Motor Torque</td>
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<td>LM09</td>
<td>Elec. Motor Protection</td>
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LN - Machine Parameters
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<tr>
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<td>LN02</td>
<td>Gear Reduction Ratio</td>
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<tr>
<td>LN03</td>
<td>Roping Ratio</td>
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LS - Speed Parameters
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<tbody>
<tr>
<td>LS01</td>
<td>Leveling Speed</td>
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<td>LS02</td>
<td>High Speed</td>
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<tr>
<td>LS03</td>
<td>Inspection Speed</td>
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<td>LS04</td>
<td>Correction Speed</td>
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<td>LS05</td>
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<td>LS07</td>
<td>Intermediate Speed 3</td>
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<tr>
<td>LS15</td>
<td>High Speed Profile</td>
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<td>LS16</td>
<td>One Floor Profile</td>
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<td>LS17</td>
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LL - Tune Parameters
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<tr>
<td>LL01</td>
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<td>LL05</td>
<td>SPI</td>
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<td>LL06</td>
<td>Encoder Pole Position Learn</td>
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<td>LL07</td>
<td>Encoder Synch.</td>
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<td>LL10</td>
<td>Inertia Learn</td>
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<td>LL15</td>
<td>Overspeed Test</td>
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<tr>
<td>LL16</td>
<td>Overspeed Test Speed</td>
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LC - Control Settings
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<td>LC01</td>
<td>Control Mode</td>
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<td>LC02</td>
<td>Speed Gain Optimization</td>
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<tr>
<td>LC03</td>
<td>KP Speed Accel</td>
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<tr>
<td>LC04</td>
<td>KP Speed Decel</td>
<td></td>
</tr>
<tr>
<td>LC05</td>
<td>KP Speed Pre-torque</td>
<td></td>
</tr>
<tr>
<td>LC08</td>
<td>Ki Speed Accel</td>
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<tr>
<td>LC09</td>
<td>Ki Speed Decel</td>
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<td>LC10</td>
<td>Ki Speed Pre-torque</td>
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<td>LC11</td>
<td>Ki Speed Offset Accel</td>
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<tr>
<td>LC12</td>
<td>Ki Speed Offset Decel</td>
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<td>LC30</td>
<td>Maximum Torque</td>
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LX - Special Parameters
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<tr>
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<td>LX06</td>
<td>Fan Function Test</td>
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<td>LX08</td>
<td>Phase Current Check</td>
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<td>LX13</td>
<td>Speed Following Error</td>
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<td>LX14</td>
<td>Speed Difference</td>
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CH - Configuration Handling
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<tbody>
<tr>
<td>CH01</td>
<td>Default Parameters</td>
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<tr>
<td>CH02</td>
<td>Save (to flash or SD card) Write to drive</td>
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<tr>
<td>CH03</td>
<td>Restore (from flash or Card)</td>
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LT - Timer Parameters
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<td>LT01</td>
<td>Brake Release Delay</td>
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<td>LT02</td>
<td>Brake Hold Off</td>
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<tr>
<td>LT03</td>
<td>Speed Start Delay</td>
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<tr>
<td>LT10</td>
<td>Brake Drop Delay</td>
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