Quick-start guide
This guide is intended to be a supplement to the full KEB elevator manual. Read KEB document#: 00F5LUM-K300 thoroughly before powering up the drive.

Keypad Navigation
LED Indicators (CAN only)
- **LED 1**: Inverter running the motor
- **LED 2**: Drive is enabled
- **Blinking**: A limit has been reached (Torque, Current, Voltage)
- **Solid**: Drive is faulted

Setting the password
The password access level can be set here: (Home > Prog > Pass (F2))

- **Off**: No operation (noP) Drive not enabled
- **Inverter running the motor**: Run Mode Drive is able to run
- **Stop Mode**: Drive is being programmed or making calculations

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

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

(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 Type (i.e. Binary, Serial, Analog)

(D) Encoder Data
- SPI (stationary)
- Pole Learn (requires movement)
- Encoder Synchronization

(E) Machine Data
- Motor Power (note units)
- Motor Voltage (EMF rms @ rated speed)
- Motor Frequency
- Motor Current
- Motor Speed (RPM)

(F) Speed Profile
- Motor Torque (use lb-ft. for english units; Nm for metric units)
- Motor Voltage
- Motor Frequency
- Motor Current
- Motor Speed (RPM)

(G) Motor Learn (Stationary)
- # of Motor Poles
- Rated Motor Frequency (Hz)
- Rated Motor Speed (RPM)

(H) Encoder Learn
- Encoder Multiplier (EnDat = 8; TTL = 2)
- Encoder Pulse Number (PPR)

(I) Run the Motor
- OverSpeed Test
- Safety Release

(J) Advanced Adjustments
- Load Configuration
- Inertia Learn (optional)
- Gains
- Pre-torque (optional)

(K) Special Functions
- Test Function
- Encoder Parameters

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.

(A) Basic Setup (password limited)
Note: The basic setup might already have been done by the controller mfg.

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.

A3 - 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.

A4 - Encoder Learn
- SPI (stationary)
- Pole Learn (requires movement)
- Encoder Synchronization

A5 - Motor Learn (Stationary)
- # of Motor Poles
- Rated Motor Frequency (Hz)
- Rated Motor Speed (RPM)

Setting the password
The password access level can be set here: (Home > Prog > Pass (F2))

Higher levels provide access to additional parameters and give the ability to write.

Low access levels will limit the users ability to view and change parameters.

Contact the Controller OEM for more 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.

(C) Motor Data
- LM01 - Motor Power (note units)
- LM02 - Motor Speed (RPM)
- 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!

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 = \( \frac{\text{LM02} \times \text{# of Motor Poles}}{120} \)

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

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:

\[ \text{lb-ft} = \frac{\text{Nm} \times 4258}{1.355} = \frac{\text{HP} \times 7051}{\text{kW}} \]

(D) Encoder Data
- LE02 - Encoder Pulse Number (ppr)
- LE05 - Encoder Multiplier (EnDat = 8; TTL = 2)
### 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 \( \rightarrow x=1 \)
- 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 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 (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: Speed

- **Accel Jerk**
- **Decel Jerk**
- **Stop Jerk**
- **Final Stop**

### 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 the external speed command to zero
3. Press and hold inspection (speed + enable inputs) until completed
4. 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. If needed, reconnect the brake wire and return the controller command speed.

### Encoder Learn

**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.

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 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).
2. Encoder Pole Learn – Process requires sheave movement with little friction (i.e. unroped or balanced car) but can accurately determine encoder phasing.

### Encoder Synchronization

- **LL07 - SPI (“Start”)**

The user will be prompted to:
1. Press and hold the inspection (direction + enable inputs) until finished
2. Run the Motor
3. If further adjustments are needed, see Advanced Adjustments.

The drive should be set up far enough to run reasonably well.

**H3** – 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 be 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.

### Run The Motor

**I1** – Run The Motor

At this point, the drive should be set up far enough to run reasonably well 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 reasonably 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:
- **LC.30 - Maximum Torque** (Default is 150%; Typical values are 200-250%)

**J1** – Advanced Adjustments

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.

If further adjustments are needed, see Advanced Adjustments.
**J1 - Adjusting Accel/Decel rates**

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

**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.

- **LC12 - KI Offset Deceleration**
  - The offset deceleration gain will assist the motor in tracking when coming into the floor.

**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.

**Integral offset Too High (5000)**

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

**Integral offset Too Low (500)**

Lower values (100) may result in loose control and overshoot of the command speed as high speed is reached.

**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 provides a softer lifting of the brake.

**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.

**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)

Adjust the brake spring tension, brake voltage, and brake timing first. Note that it is often advantageous to use a lower spring tension and lower brake pick voltage in order to provide a softer lifting of the brake.
Troubleshooting & Errors - See section 7.0 of drive manual for complete listing

Error Over Voltage
- Trip Voltage (460V drive) = 800VDC
- Trip Voltage (230V drive) = 400VDC

Braking resistor should shut off at:
- 760VDC (460V drives)
- 380VDC (230V drives)

Check:
- Brake resistor connection
- Disconnect resistor - measure resistance
- Measure DC bus terminals (= 1.41x VAC)
- 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 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 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 Load
- 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

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 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 #2
- 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)
- Squeaking/Grinding
- Check sample rate of encoder: 4-8ms typ.
- Check encoder multiplier (LE05)
- Verify motor data

“Clunk” at the end of the run
- Verify the drive enable is not being dropped prematurely while drive is still outputting torque to the motor (i.e. enable is dropped before the speed and direction are dropped)
- Check fault log - Is “Enable Loss Detected” error present?

Torque Limit Being Reached
- Is LED1 red? (CAN version only). If so, torque limit could be reached.

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

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>
<td></td>
</tr>
<tr>
<td>LE06</td>
<td>Encoder 1 Pole Position</td>
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LM - Motor Parameters

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<th>Param.</th>
<th>Name</th>
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<td>Motor Power</td>
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<tr>
<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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<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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<td>Traction Sheave Diameter</td>
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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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<th>Param.</th>
<th>Name</th>
<th>Value</th>
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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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<td>LS03</td>
<td>Injection Speed</td>
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<td>LS04</td>
<td>Correction Speed</td>
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<td>LS05</td>
<td>Intermediate Speed 1</td>
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<tr>
<td>LS06</td>
<td>Intermediate Speed 2</td>
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<td>LS07</td>
<td>Intermediate Speed 3</td>
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<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>
<td>Emergency Profile</td>
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LL - Tune Parameters

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<th>Name</th>
<th>Value</th>
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<tr>
<td>LL01</td>
<td>Motor Tuning</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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<td>LL16</td>
<td>Overspeed Test Speed</td>
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<td>LL17</td>
<td>Safety Release</td>
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LC - Control Settings

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<tr>
<td>LC01</td>
<td>Control Mode</td>
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<td>LC02</td>
<td>Speed Gain Optimization</td>
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<td>LC03</td>
<td>KP Speed Accel</td>
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<td>LC04</td>
<td>KP Speed Decel</td>
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<tr>
<td>LC05</td>
<td>KP Speed Pre-torque</td>
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<tr>
<td>LC08</td>
<td>KI Speed Accel</td>
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<td>LC09</td>
<td>KI Speed Decel</td>
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<tr>
<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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<thead>
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<th>Param.</th>
<th>Name</th>
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<tr>
<td>LX02</td>
<td>Switching Frequency</td>
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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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<tr>
<td>LX14</td>
<td>Speed Difference</td>
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CH - Configuration Handling

<table>
<thead>
<tr>
<th>Param.</th>
<th>Name</th>
<th>Value</th>
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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)</td>
<td>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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<th>Param.</th>
<th>Name</th>
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<td>LT01</td>
<td>Brake Release Delay</td>
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<tr>
<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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